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Designing for Engagement: The Influence of LMS Features on Online Formative Assessment in Tanzania Higher Learning Institutions

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ABSTRACT

This study examined student engagement in Online Formative Assessment (OFA) across six higher education institutions in Tanzania, and how LMS design features specifically assignment clarity, feedback quality, usability, and mobile accessibility which relate to student perceptions and engagement levels. A quantitative cross-sectional design was employed, involving 214 students from six (6) higher institutions in Tanzania. Data were collected using structured questionnaires and analyzed through descriptive statistics and multiple regression techniques. Overall engagement with OFA tools was high, with students reporting strong agreement on the importance of clear assignment guidelines (82.7%), timely feedback (81.7%), and intuitive LMS interfaces (79.2%). Regression analysis revealed significant positive associations for feedback quality ($\beta = 0.41$, $p < .001$), LMS usability ($\beta = 0.38$, $p < .001$), and assignment clarity ($\beta = 0.35$, $p < .001$). Mobile accessibility showed a moderate but meaningful effect ($\beta = 0.24$, $p = .002$), highlighting its emerging role in inclusive digital learning. The adjusted R^2 value of 0.42 indicated that 42% of the variance in student engagement was explained by the combined predictors. Participants cited challenges such as inconsistent mobile optimization, limited digital literacy, and delayed feedback. The study recommends standardizing LMS design templates, investing in mobile-first development, and strengthening instructor training to improve OFA effectiveness. It also calls for further research on mobile learning strategies and longitudinal impacts of LMS design improvements in bandwidth-constrained environments.

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1. Introduction

Online Formative Assessment (OFA) has become a vital component of contemporary higher education worldwide, enabling continuous monitoring of student progress and providing meaningful feedback to guide learning. In the era of digital learning, OFA, facilitated through Learning Management Systems (LMS), has emerged as a dynamic tool that allows instructors to design and deliver assessments in real-time. LMSs such as Moodle, Blackboard and Google

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Classroom offer platforms through which quizzes, assignments and discussions can be conducted in an interactive and timely manner.

In Tanzanian higher learning institutions, LMS platforms have been widely adopted, particularly after the disruptions caused by the COVID-19 pandemic, which necessitated rapid transitions to online learning. Institutions such as the University of Dodoma (UDOM), Open University of Tanzania (OUT) and others have increasingly relied on LMS platforms to facilitate not only course delivery but also assessment. OFA via LMS has been appreciated for its flexibility, immediate feedback, and potential to promote student-centered learning. However, its implementation is often met with several challenges, including poor internet connectivity, limited digital literacy among users, lack of standard design structures and issues related to LMS usability.

Research has shown that the design of LMS-based OFA tools greatly influences student engagement. Well-structured assessments that are easy to navigate, clearly articulated and accompanied by timely feedback can improve student motivation and learning outcomes. Nicol and Macfarlane-Dick (2006) noted that feedback, when timely and constructive, is a central component of formative assessment that fosters learner autonomy and reflection. Usability, on the other hand, determines the ease with which students can interact with LMS tools, directly impacting their willingness to participate in OFA activities. Recent studies emphasize that Learning Management Systems (LMS) are not merely platforms for content delivery but pedagogical environments that actively shape learner engagement, feedback processes, and self-regulated learning behaviors. Well-designed LMS environments support continuous assessment, formative feedback loops, and learner autonomy, all of which are central to effective online formative assessment (OFA) (Martin et al. (2023). In post-pandemic higher education contexts, particularly in Sub-Saharan Africa, LMS platforms have become critical infrastructures for sustaining instructional continuity and enhancing student participation in digital learning environments (Rajan et al., 2023)

Beyond convenience and flexibility, LMS platforms foster student engagement through pedagogically meaningful features such as interactive quizzes, formative feedback mechanisms, peer discussion tools, and progress-tracking dashboards. These features promote cognitive engagement by encouraging reflection, behavioral engagement through regular participation, and emotional engagement by supporting learner motivation and confidence (Géraldine Heilporn et al., 2024; Aldabbas et al., 2025). When effectively designed, LMS-supported OFA enables active learning, timely intervention, and personalized feedback, thereby transforming assessment into a continuous learning process rather than a summative endpoint (Meyer et al., 2024).

Moreover, in the Tanzanian context, many students access LMS platforms via mobile phones. As such, mobile compatibility becomes a critical factor in the design of effective OFA tools. Okai-Ugbaje et al. (2022) assert that mobile optimization enhances accessibility, especially in resource-constrained environments. Despite these known factors, empirical studies on OFA in Tanzanian universities remain limited. This study, therefore, aims to fill the gap by examining the design features that promote or hinder student engagement in OFA.

The global shift towards digital education underscores a crucial pedagogical evolution that moving beyond content delivery to fostering dynamic, feedback driven learning environments (Røe et al., 2022; McCarthy et al., 2023). This transition emphasizes the critical role of digital literacy for both learners and instructors, empowering them to effectively navigate and leverage the functionalities of LMS for enhanced learning outcomes (Narongrit Sukonthasing & Nalinpat Bhumpenpein, 2024). In this evolving landscape, understanding the intricate interplay between technological design, user perception and pedagogical effectiveness becomes dominant, especially in contexts with emerging digital infrastructures like Tanzania.

A critical yet underexplored dimension in this landscape is mobile access. In Tanzania, mobile phones serve as the primary digital device for many students, especially those in rural or low-income settings. Despite this, many LMS platforms remain poorly optimized for mobile use, leading to accessibility barriers that undermine the inclusivity and effectiveness of OFA. Mobile compatibility, therefore, is not merely a technical feature but a determinant of equity in digital learning environments (Okai-Ugbaje et al., 2022).

Addressing the intersecting challenges addressed in the paragaphs above, ranging from usability and feedback quality to mobile accessibility—is essential for designing OFA tools that are both pedagogically sound and contextually responsive. Based on this context, the study sought to respond to the following research objectives:

i. To assess how LMS design features influence student engagement in Online Formative Assessment.
ii. To examine the role of LMS usability and mobile access in enhancing OFA effectiveness

2. Literature Review

This section explores key concepts aligned with the research objectives, including Online Formative Assessment, LMS Design Features, Student Engagement, Feedback Quality, Usability and Mobile Accessibility.

2.1 Online Formative Assessment (OFA)

OFA refers to digital assessments aimed at monitoring and improving student learning through constructive feedback (Gikandi et al., 2011). Unlike summative assessments, OFA emphasizes learning as a process, allowing students to reflect, adapt and improve their ability. Beyond its role in continuous monitoring, OFA actively promotes metacognition and self-regulated learning among students (Fleur et al., 2021; Braad et al., 2022; Geng & Su, 2024). By providing immediate or near-immediate feedback, OFA allows learners to reflect on their performance, identify misconceptions and adjust their learning strategies in real time. This iterative process of assessment and reflection is crucial for developing deeper understanding and fostering learner independence. While Gikandi et al. (2011) frame OFA as a feedback-driven process, Braad et al. (2022) and Geng & Su (2024) extend this by emphasizing its role in fostering metacognition and learner autonomy. Together, these perspectives suggest that OFA is not only evaluative but developmental, shaping how students reflect and adapt their learning strategies

2.2 Learning Management System Design Features

LMS platforms serve as the digital environment where OFA takes place. The effectiveness of these systems largely depends on their design. Features such as clarity of instructions, integration of multimedia and interface simplicity are essential for fostering a conducive learning environment (Maluleke & Maake, 2025). Effective LMS design extends beyond basic clarity to include intuitive navigation, interactive elements and strong communication tools that facilitate seamless interaction with diverse learning materials and assessment types (Abdoli et al., 2025). Furthermore, modern LMS platforms often incorporate analytics features that can provide instructors with valuable insights into student engagement patterns and performance, enabling them to tailor their pedagogical approaches more effectively (Martínez-Mireles et al., 2025; Maluleke & Maake, 2025) highlight clarity and simplicity as foundational design elements, whereas Abdoli et al. (2025) advocate for interactive features and analytics. This contrast reflects a shift from static usability to dynamic engagement, underscoring the evolving expectations of LMS platforms.

Despite growing global scholarship on LMS-supported formative assessment, empirical studies focusing on Tanzanian higher education remain limited. Existing studies in Sub-Saharan Africa often emphasize access and adoption while giving less attention to design quality, feedback effectiveness, and mobile usability in formative assessment contexts (Bervell & Umar, 2017; Emnet Tadesse Woldegiorgis, 2025). Furthermore, many studies rely on institutional case analyses rather than cross-institutional evidence, limiting the generalizability of findings. This gap underscores the need for context-sensitive investigations that examine how LMS design features influence student engagement within resource-constrained educational environments such as Tanzania.

2.3 Student Engagement

Student engagement in OFA is reflected through their participation, interaction with content and use of feedback. Active engagement has been linked to improved academic performance and satisfaction (Hu & Xiao, 2024; Mgeni et al., 2024). Student engagement is a complex construct about behavioral, emotional and cognitive dimensions

(Fredricks & McColskey, 2012). In the context of OFA, behavioral engagement might involve timely submission of tasks, emotional engagement relates to feelings of interest and motivation, while cognitive engagement refers to the mental effort students invest in understanding and processing content (McCarthy et al., 2023). Fredricks and McColskey (2012) offer a multidimensional view of engagement which associates behavioral, emotional, and cognitive while McCarthy et al. (2023) focuses on cognitive effort in digital contexts. Synthesizing these views reveals that LMS design must cater to all three dimensions to foster holistic engagement.

2.4 Feedback Quality

Timely and specific feedback is crucial for effective OFA. Winstone (2019) argues that constructive feedback encourages self-assessment and improves academic outcomes. The quality of feedback in a digital environment is paramount for its effectiveness, extending beyond mere correctness to include specificity, timeliness and actionable advice (Hattie & Timperley, 2007). Effective digital feedback guides students towards understanding their errors, improving their performance and ultimately developing self-correction abilities. This can involve a combination of automated feedback for immediate verification and personalized human feedback for deeper conceptual understanding and skill development (Winstone, 2019; Er et al., 2024).

2.5 Usability and Mobile Accessibility

Usability refers to how easily users can navigate an LMS. Poor usability can lead to disengagement, while intuitive platforms support learning Almusharraf (2024). Additionally, mobile accessibility is vital in Tanzania where many students rely on smartphones (Garzón et al., 2025). The implications of usability and mobile accessibility are far-reaching, directly impacting equity of access and learner retention, particularly in regions where internet infrastructure and device ownership vary (McCarthy et al., 2023). An intuitive and mobile-optimized LMS can significantly bridge the digital gap, ensuring that all students, regardless of their device or location, can participate effectively in OFA. This highlights the need for instructional designers and institutions to prioritize mobile-first approaches in their digital learning strategies to promote inclusive online education (Ed.D, 2024).

Despite global research on OFA and LMS, there is limited literature focusing on Tanzanian institutions. For instance, Nicol and Macfarlane-Dick (2006) and Hattie & Timperley (2007) both emphasize feedback's centrality, yet differ in scope: the former stress formative feedback for autonomy, while the latter focus on its impact on performance. This duality suggests that effective OFA feedback must balance immediacy with depth. Further, recent research shows that system usability and mobile-optimized platforms play a critical role in how students engage with and use learning management systems; more intuitive interfaces and better mobile accessibility contribute to higher participation and engagement, while poorly designed systems limit effective use of LMS features (Simon et al., 2025; Ahmed et al., 2025). These findings underscore the need for both technical refinement and institutional support in particular mobile-first strategies to bridge access gaps and promote inclusive participation in online formative assessment across diverse higher education settings.

This study addresses the gaps by offering insights into local experiences and suggesting practical improvements.
The literature review provides a detailed overview of existing research directly related to the topic. It situates the current study within the context of previous work and highlights how it will contribute to the field.

3. Method

3.1 Research Design

This study employed a quantitative cross-sectional survey design to investigate the relationship between Learning Management System (LMS) design features and student engagement in Online Formative Assessment (OFA) within Tanzanian higher education institutions. The cross-sectional approach allowed for the collection of numerical data at a single point in time, enabling the analysis of associations between variables while providing a broad, generalizable snapshot of students' experiences across multiple institutions (Creswell & Creswell, 2018). Alternative designs, such

as longitudinal or mixed methods, were considered but deemed less feasible due to variations in academic calendars and resource constraints in Tanzanian institutions. Cross-sectional surveys remain a well-established design in educational technology research, where the goal is to examine relationships rather than track change over time (Schoonenboom, 2019).

3.2 Study Area and Population

The study was conducted across six higher education institutions in Tanzania: University of Dodoma (UDOM), Open University of Tanzania (OUT), Institute of Finance Management (IFM), Institute of Accountancy Arusha (IAA), Mbeya University of Science and Technology (MUST), and Agency for Development of Education Management (ADEM). These institutions were purposively selected to capture diversity in size (large public universities vs. specialized institutes), geographical location (urban vs. semi-urban), and levels of LMS adoption (Moodle, Blackboard and institutionally developed systems). These platforms were selected for this study due to their widespread adoption across Tanzanian higher education institutions and their comprehensive support for online formative assessment tools. Moodle and in-house developed systems commonly used in public universities due to their open-source flexibility and cost-effectiveness. These platforms offer comparable formative assessment features, including quizzes, assignment submission, feedback tools, and mobile access, making them appropriate for comparative analysis of LMS design features and student engagement (Abdoli et al., 2025). This diversity provided a representative overview of LMS-based OFA practices in Tanzanian higher education.

The target population consisted of undergraduate and postgraduate students enrolled in programs actively using LMS for formative assessments. Demographic characteristics such as gender, age, academic discipline, and year of study were considered to contextualize findings, as previous studies highlight how these factors can influence technology adoption and engagement (Al-Samarraie & Saeed, 2018).

3.3 Sampling Techniques and Population

A stratified random sampling technique was employed to ensure adequate representation of students across different strata, including institution, academic discipline, and year of study. Within each stratum, students were randomly selected using the RAND function in Microsoft Excel to minimize selection bias.
The sample size of 214 students was determined using Yamane's (1967) formula, based on an estimated student population of 10,000 across the six institutions, with a 95% confidence level and a 5% margin of error. The purposive selection of institutions ensured inclusion of contexts where LMS-based OFA is actively implemented, thus enhancing the study's relevance and generalizability (Etikan & Bala, 2017).

3.4 Data Collection Methods and Tools

Data were collected through a structured questionnaire comprising 35 items distributed across four subscales: student engagement (10 items), LMS usability (8 items), feedback quality (7 items), and mobile accessibility (10 items). The questionnaire was guided by theoretical frameworks such as the Technology Acceptance Model (Davis, 1989) and Nicol and Macfarlane-Dick's (2006) principles of formative feedback. Items were adapted from validated scales (e.g., Fredricks & McColskey, 2012; Teo, 2019) and contextualized for Tanzanian higher education settings.
The instrument was administered both online (via Google Forms) and in paper-based format. To avoid mode bias, identical formats and instructions were used across both platforms, and all responses were anonymized. Administering questionnaires in dual modes improved accessibility and reduced exclusion of students with limited internet access.

3.5 Data Analysis

Data analysis was conducted using SPSS version 25. Descriptive statistics (means, frequencies, standard deviations) summarized key characteristics of the data. Correlation analysis examined relationships between LMS design features and student engagement. Multiple regression analysis was conducted to assess the predictive influence of LMS design features which include: usability, feedback quality, mobile accessibility, and assignment clarity, on

student engagement. Standardized beta coefficients (β) were calculated to determine the relative strength of each predictor, and 95% confidence intervals (CI) were reported to assess the precision and reliability of the estimates. The selection of predictor variables which are usability, feedback quality, mobile accessibility, and assignment clarit was informed by TAM and UTAUT constructs. Usability aligns with perceived ease of use, feedback quality with performance expectancy, and mobile accessibility with facilitating conditions, enabling a theoretically grounded analysis of student engagement.

Model assumptions of normality, linearity, homoscedasticity and multicollinearity were tested. The Shapiro-Wilk test and histograms confirmed normality, scatterplots tested linearity and Variance Inflation Factors (VIF < 5) confirmed absence of multicollinearity. Control variables such as gender and year of study were included to account for potential confounding factors. Effect sizes (adjusted R^2) were reported to indicate the explanatory power of the regression model (Hair et al., 2021).

4. Results and Discussion

This section presents key findings regarding students' perceptions of LMS design features, usability and their impact on engagement in OFA. Furthermore, it presents the key design factors identified from students' responses concerning LMS tools for OFA. The data, derived from a quantitative survey, are organized to first detail descriptive statistics, illustrating student perceptions and engagement levels, followed by inferential analyses that establish relationships between key variables. These results collectively provide empirical evidence supporting the hypothesized relationship between OFA tool design and student interaction within Tanzanian higher learning institutions.

4.1 Students' Perception of LMS Design Features in OFA

Descriptive results indicate that students highly value core LMS design features that directly support clarity, feedback, and usability in online formative assessment (OFA). As shown in Table 1, clear assessment instructions were rated most favorably, with 82.7 % of respondents agreeing or strongly agreeing on their importance. Similarly, timely feedback provision (81.7 %) and easy navigation interfaces (79.2 %) received strong positive responses, underscoring their central role in shaping positive online assessment experiences. These findings are consistent with research showing that usability, particularly in terms of perceived ease of use and intuitive interface, is strongly associated with user satisfaction and engagement in LMS environments (Ahmed et al., 2024). Evidence indicates that platforms with clearer navigation and higher usability are linked to greater student satisfaction and interaction with course content, whereas poorly usable systems tend to reduce effective engagement.

Although multimedia integration (63 %) and mobile phone accessibility (65.2 %) were rated positively, their comparatively lower scores suggest that these features, while beneficial, are seen as supplementary to foundational design elements. A comprehensive systematic review on mobile learning highlights that mobile access generally enhances learning outcomes, engagement, and motivation by enabling students to interact with educational content anytime and anywhere, especially when integrated meaningfully into pedagogy and designed for usability on diverse devices (Pedraja-Rejas et al., 2024; Garzón et al., 2025).

Table 1: Perceptions of LMS Design Features in OFA

Design Feature	Strongly Agree (%)	Agree (%)	Total Agree (%)
Clear assessment instructions	46.7	36	82.7
Easy navigation interface	41.1	38.1	79.2
Timely feedback provision	43.5	38.2	81.7
Multimedia integration	30.3	32.7	63

Mobile phone accessibility	35	30.2	65.2

4.2 Key LMS Design Features for OFA and Their Implications for Engagement

Table 2 further illustrates how specific LMS design features contribute to student engagement in online formative assessment (OFA). Clear assignment guidelines (82.7%), quality feedback (81.7%), and overall LMS usability (79.2%) recorded the highest combined positive ratings, indicating strong consensus among students regarding their importance. These features play a critical role in reducing cognitive load, supporting students' understanding of assessment expectations, and enabling them to focus on learning tasks rather than system navigation challenges (Sweller et al., 2011; Gunesekera et al., 2019). High-quality feedback is particularly important in fostering self-regulated learning, as it helps learners monitor their progress, reflect on performance, and make informed improvements (Nicol & Macfarlane-Dick, 2006; Broadbent & Poon, 2015). In addition, well-designed online quizzes and peer collaboration tools received favorable ratings, highlighting their contribution to active participation and social learning. Prior research indicates that interactive assessments and peer-supported learning environments enhance engagement by promoting dialogue, reflection, and sustained involvement in learning activities (Garrison et al., 2000; Martin et al., 2020). Overall, the strong positive perception of these LMS design features suggests that when platforms align with students' functional and pedagogical expectations, learners are more likely to engage consistently and meaningfully with OFA activities.

Table 2: Student Ratings of Key LMS Design Features for OFA and Their Implications for Engagement

Design Factor Identified of LMS tools for OFA	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Combined Positive (%)	Implication
Clear assignment guidelines	48.6	34.1	10.7	4.7	1.9	**82.70%**	Enhances clarity and reduces confusion during assessment
Quality of feedback	45.3	36.4	11.2	5.1	2	**81.70%**	Promotes self-regulated learning and academic improvement
Well-designed online quizzes	42.1	37.8	12.6	5	2.5	**79.90%**	Encourages active participation and deeper content engagement
Peer collaboration tools	39.8	35.4	14.3	6.2	4.3	**75.20%**	Supports social learning and peer feedback exchange
Overall LMS usability	41.2	38	11	6	3.8	**79.20%**	Facilitates seamless navigation and sustained platform us

4.3 Predictive Effects of LMS Design Features on Student Engagement

Regression analysis provides deeper insight into the relationship between LMS design features and student engagement. Feedback quality (β = 0.41, 95% CI [0.32, 0.50]) and LMS usability (β = 0.38, 95% CI [0.29, 0.47]) emerged as the strongest predictors of engagement, followed by clear assignment guidelines (β = 0.35, 95% CI [0.26, 0.44]). Mobile accessibility demonstrated a moderate but statistically meaningful influence (β = 0.24, 95% CI [0.15, 0.33]). These results indicate that students' ability to clearly understand assessment requirements and receive timely, constructive feedback is fundamental to sustained engagement in LMS-supported OFA, enabling learners to focus on the learning task rather than on navigating the platform. This interpretation aligns with empirical evidence showing that intuitive LMS design, clear navigation, and effective communication tools enhance student engagement (Al-Fraihat et al., 2020; Nasir et al., 2021).

The adjusted R^2 value of 0.42 shows that 42% of the variance in student engagement is explained by the combined LMS design features, demonstrating substantial explanatory power. This finding is consistent with recent studies highlighting LMS usability and feedback mechanisms as dominant predictors of engagement in online learning environments (Almusharraf, 2024). While interactive and mobile-friendly features contribute meaningfully to engagement, the results suggest that foundational elements such as clarity of instructions and high-quality feedback remain the most influential drivers of student participation and persistence.

Further, the findings of this study underscore the crucial role of thoughtful LMS design in supporting student engagement within Tanzanian higher learning institutions. Learners favored platforms that offered clear instructions, interactive features, and mobile compatibility, reflecting global trends in digital learning. These results are consistent with prior research emphasizing that usability, interactivity, and effective communication mechanisms are central to sustained engagement in LMS-mediated learning (Martin et al., 2020).

4.4 Interpretation Through TAM and UTAUT

The strong predictive effect of LMS usability (β = 0.38) supports TAM's construct of perceived ease of use, indicating that students are more likely to engage with OFA when the platform is intuitive. Similarly, feedback quality (β = 0.41) reflects performance expectancy from UTAUT, suggesting that students value LMS features that enhance learning outcomes. These findings demonstrate how TAM and UTAUT manifest in the Tanzanian context. Students' emphasis on usability and feedback quality confirms that perceived ease of use and performance expectancy are critical drivers of engagement. Mobile accessibility, though moderate in effect, aligns with UTAUT's facilitating conditions, highlighting the infrastructural and contextual factors that shape technology adoption. The high adjusted R^2 value (0.42) further validates the relevance of these theoretical models, showing that LMS features grounded in TAM and UTAUT constructs explain a substantial proportion of engagement variance. The findings highlight a clear mandate for instructional designers and educators to actively integrate research-backed design principles into their OFA strategies. Beyond the technical functionality of the LMS, the way instructors design and implement assessments, provide feedback and foster collaborative learning directly impacts student engagement and outcomes (Clark & Mayer, 2016; Martin et al., 2020). Instructors play a pivotal role in translating LMS design into meaningful learning experiences. Training programs should emphasize how to structure assessments with clear instructions, provide actionable feedback, and leverage peer collaboration tools to foster engagement. These findings confirm that TAM and UTAUT provide robust explanatory lenses for understanding student engagement in LMS-supported OFA within the Tanzanian context. Recent studies further validate the applicability of these models in developing-country and mobile-dependent learning environments (Almusharraf, 2024; Nasir et al., 2021).

4.5 Mobile Accessibility and Emerging Design Priorities

Given the moderate yet significant effect of mobile accessibility (β = 0.24), institutions must ensure that LMS platforms are mobile-optimized. This includes responsive design, low-bandwidth compatibility, and simplified interfaces to accommodate students accessing content via smartphones. Although mobile accessibility exerted a moderate effect, its importance should not be underestimated. In Tanzania, smartphones often serve as the primary digital access point for students, particularly in rural or low-income settings. The moderate influence observed may reflect persistent challenges such as limited mobile optimization, high data costs, and reduced LMS functionality on

mobile devices. These findings reinforce calls for mobile-first LMS development, including responsive design, low-bandwidth optimization, and simplified interfaces to enhance inclusive access (Ed.D, 2024; Mtebe & Kondoro, 2023).

Therefore, ongoing professional development focusing on pedagogical best practices for online assessment, coupled with robust technical support, is crucial for maximizing the potential of LMS platforms in Tanzanian higher learning and ensuring that the technology genuinely serves learning rather than simply delivering content. At the institutional level, these results support the development of LMS design standards that embed usability, feedback quality, and mobile compatibility as core principles. Investment in digital infrastructure and ongoing support for both students and faculty is essential to sustain OFA effectiveness.

4.6 Synthesis with Global Trends and Research Contributions

Overall, the findings align closely with global trends in online and blended learning, where feedback quality and system usability consistently emerge as central determinants of student engagement. International evidence indicates that intuitive LMS interfaces and timely, actionable feedback enhance motivation and learning outcomes across diverse educational contexts, suggesting that effective LMS-supported OFA principles are largely universal (Bond et al., 2020; Martin et al., 2020; Nasir et al., 2021).

Theoretically, the study extends the application of the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) by empirically demonstrating how LMS design features—specifically usability, feedback quality, assignment clarity, and mobile accessibility—collectively explain student engagement in OFA within a developing-country context. While prior studies have validated these models in technologically advanced environments, this research confirms their relevance and explanatory power in resource-constrained settings, thereby contributing context-sensitive evidence to educational technology theory (Davis, 1989; Venkatesh et al., 2003; Almusharraf, 2024).

Practically, the findings provide actionable guidance for higher education institutions, instructional designers, and policymakers. The study highlights the need to prioritize clear assessment guidelines, timely feedback mechanisms, and intuitive LMS interfaces as immediate strategies to enhance student engagement (Clark & Mayer, 2016; Martínez-Mireles et al., 2025). Furthermore, the moderate but significant role of mobile accessibility underscores the importance of mobile-first LMS development to promote inclusive access. These insights support institutional decision-making related to LMS procurement, instructor training, and digital infrastructure investment, offering a practical roadmap for improving OFA effectiveness in Tanzanian higher education institutions.

5. Conclusion

This study demonstrates that the effectiveness of Online Formative Assessment (OFA) in Tanzanian higher education is strongly influenced by the design and usability of Learning Management System (LMS) platforms. Evidence from six institutions shows that clear assignment guidelines, high-quality and timely feedback, and intuitive LMS interfaces are the most significant drivers of student engagement, while mobile accessibility plays an important emerging role in promoting equitable participation for students who rely on smartphones in bandwidth-constrained environments. These findings align with the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), confirming the relevance of perceived ease of use, performance expectancy, and facilitating conditions in shaping student engagement within LMS-supported OFA contexts.

To operationalize these findings, institutions should adopt a phased approach to improvement. In the short term, standardizing LMS design templates, strengthening automated and instructor-led feedback mechanisms, conducting regular usability audits, and providing targeted training for both instructors and students can significantly enhance OFA effectiveness. Over the longer term, prioritizing mobile-first LMS development, investing in digital infrastructure, and establishing institutional policies on OFA design and feedback standards are essential for sustainable impact. Continuous professional development in digital pedagogy and instructional design will further enable educators to

maximize the pedagogical potential of LMS platforms, fostering inclusive, student-centered digital learning environments aligned with Tanzania's higher education transformation goals (Mtebe & Kondoro, 2023).

6. Limitations and Future Research

This study has several limitations that should be acknowledged. The cross-sectional design provided a useful snapshot of student engagement with LMS-supported Online Formative Assessment (OFA) but did not allow for observation of changes over time. In addition, reliance on self-reported data may have introduced response bias, although anonymity and clear instructions were used to mitigate this risk. Future studies could address these limitations by adopting longitudinal or mixed-methods approaches that integrate qualitative data, such as interviews or focus groups, to generate deeper contextual insights into LMS-based OFA practices (Creswell & Plano Clark, 2017).

Future research should also extend beyond engagement to examine how LMS-facilitated OFA supports knowledge construction, learning gains, and long-term academic outcomes such as retention and learner autonomy. Comparative studies across institutions or countries would help identify context-specific and scalable best practices, particularly in resource-constrained environments. Additionally, investigating the integration of emerging technologie such as artificial intelligence, learning analytics, personalized feedback, and adaptive learning systems can provide evidence-based guidance on enhancing OFA effectiveness. Further inquiry into instructor-related challenges, including digital competence, workload, and institutional support, is also essential for informing targeted interventions that strengthen teaching quality and advance inclusive digital assessment practices..

Declarations

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Competing Interests

None.

Ethical Approval

This study was granted ethical clearance approvals by relevant authorities in Tanzania.

Author's Contribution

Author[1]: Conceptualization, Data curation, Formal analysis, Writing – original draft
Author[2]: Supervision, Investigation
Author[3]: Supervision, Investigation, Writing – review and editing

Data availability (if available)

None

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