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Comparative Analysis of Assessment Methods Enabled by Learning Management System in Technical Training Institutions in Kenya

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Abstract

Learning Management System (LMS) are software applications designed to manage digital learning content, and their adoption in education has been steadily increasing. However, comprehensive research is needed to assess the effectiveness of LMS in enhancing the instructional process in Kenyan Technical Training Institutions (TTIs). Currently, the utilization of LMS in Kenyan TTIs and its impact on instructional efficiency is unclear, necessitating an in-depth investigation. This study aims to examine and compare the effectiveness of different assessment methods facilitated by LMS in Kenyan TTIs, grounded in Social Constructivism Theory to understand how trainees learn. A mixed-method design was employed, involving qualitative and quantitative approaches, with data collected through questionnaires and interview schedules that were piloted for reliability and validity. The target population included 34 counties with approved TTIs in Kenya, comprising 3400 trainers and 132,000 trainees from 154 institutions. Stratified sampling followed by simple random sampling was used to select respondents. Data was analyzed using descriptive and inferential statistics. Trainers expressed mixed perceptions about LMS competency and time sufficiency, although they generally viewed LMS positively in terms of pedagogy engagement and alignment with learning needs. Challenges identified included technical issues and resistance to change. While traditional assessment methods such as quizzes, exams, and assignments were prevalent, there were suggestions for better alignment with curriculum objectives. Connectivity and technical glitches emerged as significant barriers to effective LMS implementation, highlighting the need for infrastructure investment and comprehensive training. The study found that LMS positively impacts learner engagement, learning, and assessment in TTIs. Regression analysis showed substantial predictive power of LMS variables on policy variance (99.8%), although correlation findings indicated limited direct influence on policy formulation. The study recommends exploring LMS features, addressing technical challenges, integrating technology into curricula through policy, and fostering collaboration between educational institutions and policymakers to develop guidelines addressing infrastructure needs.

Keywords: *Learning Management Systems (LMS), Technical Training Institutions (TTIs), Instructional Process, Digital Learning Content, Assessment Methods, Infrastructure Investment*

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1. Introduction

The integration of Learning Management Systems (LMS) into educational frameworks has revolutionized how digital learning content is managed and delivered. Over the past few decades, LMS adoption has grown globally, driven by the increasing demand for flexible, accessible, and efficient educational tools (Ally, 2004). In Kenya, Technical Training Institutions (TTIs) play a crucial role in equipping students with vocational and technical skills essential for the country's economic development (Nyamongo et al., 2017). However, the implementation and utilization of LMS in enhancing the instructional processes within these TTIs remain underexplored. LMS provide a platform for delivering content, tracking progress, facilitating communication, and administering assessments, which are integral to modern education (Bates, 2015).

Several LMS platforms, including Moodle, Canvas, LearnLinq, Open LMS, and Talent, among others. The Moodle environment engages trainees in activities such as thinking, planning, interacting, formulating ideas, and participating in forums and quizzes (Warheed et al., 2016). Commonly used features of Moodle include communication, assignment, and course delivery modules (Warheed et al., 2016). In Indonesia, LMS is valued

for its application in administration, documentation tracking, reporting, and course delivery (al Frachait et al., 2020; Mohd Zain et al., 2018). The development of suitable LMS products significantly impacts the learning process (Stockless, 2018; Mohd Zain et al., 2018; Wu and Plakhtu, 2021; Zabolotniala et al., 2020). Key elements for LMS development include addressing specific needs and providing ongoing technical support (Fathema and Akanda, 2020; Syaugi et al., 2020).

Canvas LMS facilitates planning, evaluation, and content delivery (Ellis et al., 2009). It supports collaborative learning and effective educational activities (Sanga, 2016; Zain, Fadil, & Hadi, 2018). Canvas LMS has been associated with quality distance education in Nigeria (Zain, Fadil, & Hadi, 2018) and fosters imagination and systematic learning among trainees (Sanga, 2016). LMS platforms, such as Blackboard and Canvas, have transformed teaching and learning, making education accessible and convenient for adult learners worldwide (Findik-Conkuncay et al., 2018; Zain et al., 2018). These platforms encourage engagement and knowledge sharing (Castellano, 2014) and provide intuitive interfaces for classroom management (Marta, 2015). Canvas, in particular, has gained popularity since 2011, especially in community colleges and universities in the USA (Emmons et al., 2017). It offers advanced capabilities meeting customer needs (Romeo et al., 2017). LMS-enabled instruction supports various pedagogical approaches, including blended learning, flipped classrooms, problem-based learning (PBL), peer teaching, and simulations (Graham, 2013; Bergmann & Sams, 2012; Savin-Baden & Major, 2013; Yan, 2014; Wang et al., 2008). These approaches enhance flexibility, interactivity, collaboration, and experiential learning opportunities for trainees.

1.1 Technology Utilization in Kenyan Technical Training Institutions

Kenya has been making strides in the utilization of technology in her education system, aiming to enhance learning outcomes and prepare trainees for the digital age. The Kenyan government's commitment to the use of technology in education is reflected in initiatives such as the Digital Literacy Program (DLP), which aims to provide primary school trainees with access to digital devices and content (UNESCO, 2020). Additionally, the Kenya Institute of Curriculum Development (KICD) has been working to integrate digital resources into the national curriculum (KICD, 2019). While these initiatives mainly target primary and secondary education, the influence of technology is also being felt in technical training institutions. Some technical training institutions have successfully adopted LMS platforms, offering blended learning experiences that combine face-to-face instruction with online resources. These institutions recognize the potential of LMS in enhancing instructional efficiency, engaging trainees, and bridging the gap between theory and practice. The launching of the Open University in Kenya by President William Samoi Ruto in July 2023 also provides potential to revolutionize the teaching and learning processes, offering new avenues for skill development and career readiness in higher learning institutions.

LMS offer numerous advantages for instructional purposes in technical education, including providing a unified platform for storing and managing course materials, enhancing organization and accessibility (Beard et al., 2010). It also enables trainees to access content anytime, anywhere, allowing for self-paced learning and accommodating diverse schedules (Graham, 2006). The platform also offers tools for creating assessments, quizzes, and assignments, and provides real-time data on learner progress (Conole, 2013). Discussion forums, chat features, and multimedia integration foster learner engagement and collaboration (Ally, 2008), allowing instructors to tailor content and activities to individual trainees' needs and preferences (Picciano, 2017). Though the review also noted some challenges and barriers in implementation in technical education, such as technical issues including compatibility, maintenance, and infrastructure, which can impede successful LMS implementation (Wong & Looi, 2011). Trainers also require training to effectively use LMS features for pedagogical purposes (Richter et al., 2016). There is also an element of digital divide due to uneven access to technology and reliable internet, which can limit equitable LMS usage (Selwyn, 2016), and both instructors and trainees may resist adopting new technologies and changing established practices (Ertmer & Ottenbreit-Leftwich, 2010).

1.2 Empirical Review

Background studies such as the ones by Bach, Domingues and Walter (2013) and Zawacki-Richter, Bäcker and Sebastian Vogt (2009) points out that there are gaps in the e-learning literature. In this regard, for the authors, there is a need for studies that guide educational institutions and teachers so they can exploit the resources that only IT can provide and, consequently, improve teaching and management.

Macfadyen and Dawson (2010) complement that significant trainees' information can be extracted from an LMS and may help educators to extract and visualize real-time data on student engagement and probability of success in their courses. Nevertheless, there is a strong concern of researches in e-learning about the technological aspect,

notably the use of Information Technology, and also about an LMS being able to exchange, dialogue, collaboration and joint elaboration (Oliveira, 2012). Although, McGill and Klobas (2009) point out that LMS research is characterized by a diversity of studies conducted in a wide variety of contexts, considering different variables and explanatory models. For them, on that basis, it is difficult, if not impossible, for research results to be generalized in the field. According to a literature review in e-learning, conducted by Berge & Mrozowski (2001), research has tended to emphasize student learning outcomes for individual courses rather than form a total academic program. In the study by Zawacki-Richter, Bäcker and Sebastian Vogt (2009), who conducted a review of 695 papers on distance education published in five of the major scientific journals between 2000 and 2008, the researchers showed that there is a strong imbalance between the three research levels in distance education. For them, research on distance education is dominated by issues that relate to the micro perspective, that is, teaching and learning in distance education, where more than 50% of all papers had focused on interaction and communication in communities of learning, instructional design and student characteristics. The authors indicate that the areas related to the management and organization of distance education, that is, methods of research and distance education knowledge transfer, globalization of education and cultural aspects, innovation and change, and the costs and benefits of distance education deserve more attention from researches.

Learning Management Systems have been adopted in HLIs to enhance the effectiveness and efficiency of the teaching and learning process. The LMS, as with educational technology in general, has evolved quickly along with the development of ICTs (Al-Emran & Shaalan 2015, 2017). HLIs and universities have made a huge investment in information systems (Moodle, Sakai, Blackboard) to help in delivery of blended distance as well as face-to-face courses (Tarhini, Hone & Liu 2013). Use of the LMS in HLIs along with well-connected computers facilitates wide access to electronic educational materials to the trainees through user devices such as desktop and laptop computers, and other digital devices. Studies have been conducted that are focused on student usage of LMS in HLIs (Asiri et al. 2012; Joo, Kim & Kim 2016; Raman, Don, Khalid & Rizuan 2014; Šumak et al. 2011), and the findings indicate different factors that affect LMS usage based on the trainees' perceptions.

Asiri et al. (2012) examined the factors that influenced the LMS usage among faculty members of public universities in Saudi Arabia and found that the attitude towards utilizing the LMS, competence in utilizing the LMS, and beliefs about the LMS - internal factors; and the technological organizational, social barrier and demographic characteristics (training, workshop, gender as well as computer experience) - external factors, were important in influencing the usage of the LMS. 235 trainees at the Faculty of Electrical Engineering and Computer Science in Maribor were studied by Šumak et al. (2011) to identify the factors influencing their perception of LMS use and acceptability. The study findings indicate that behavioral intention determines actual system use, with attitude towards the system use perceived usefulness being the most significant predictors. There are positive impacts of perceived usefulness and satisfaction on predicting the intention to adopt and use mobile-LMS (Joo et al. 2016). The sharing of knowledge and collaboration play a vital role in the intention of the trainees in e-learning systems acceptance and usage (Eid & Al-Jabri 2016; Raman et al. 2014). System quality and service quality were also found to have a positive effect on users' satisfaction with learning systems (Mahmodi 2017; Mtebe & Raisamo 2014a; Mtebe & Raphael 2018). Technical support availability, and service quality are factors affecting usage of the LMS. Many of the studies have been focused on behavioral intention on LMS usage in HLIs among instructors (Alharbi & Drew 2014; Almarashdeh 2016; Cigdem & Topcu 2015; Motaghian et al. 2013). The studies showed that training, personal innovativeness, perceived ease of use, education instructors (Alharbi & Drew 2014; Coleman & Mtshazi 2017). For example, Alharbi & Drew (2014) conducted a study of the behavior intention to use LMS among 59 academics at the Shaqra University in Saudi Arabia, and the findings indicate that perceived usefulness, attitude towards usage and perceived ease of use had a significant relationship with behavioural intention to use the LMS. Moreover, perceived usefulness, system quality, information quality, subject norm, application self-efficacy significantly influenced the intention of instructors to use the LMS (Almarashdeh 2016; Cigdem & Topcu 2015).

Cigdem & Topcu (2015) explored the factors influencing the behavioral Factors affecting Learning Management Systems Usage in HLIs 9 intention to use the LMS among 115 participants at a Turkish vocational college. The findings revealed that perceived ease of use, perceived usefulness, self-efficacy, technological complexity, and subjective norm all had a positive effect on behavioral intention for LMS usage. Perceived usefulness was the most significant for intention and use of the LMS. Similarly, Almarashdeh (2016) investigated the factors that influence instructor's satisfaction among 110 instructors in four universities in Saudi Arabia. The study found that perceived usefulness, service quality, system quality and information quality had a positive significant effect on instructor satisfaction and hence influenced LMS usage. Nevertheless, the findings cannot persuade the researchers that the identified factors are the only factors that influence instructors' usage of the LMS within

higher education institutions.

Despite these advancements, Kenyan TTIs face unique challenges, including limited infrastructure, varying levels of digital literacy among trainers and trainees, and resistance to technological change (Kipyegon et al., 2020). These factors necessitate a comprehensive examination of how LMS can be effectively utilized in this context to improve learning outcomes.

1.3 Theoretical Frameworks

This study was anchored on Social Constructivism Theory, initially proposed by the Post-Revolutionary Russian Psychologist Lev Vygotsky. Social Constructivism highlights the collaborative aspect of learning, emphasizing that knowledge develops through interactions within society. According to Vygotsky, learners rely on others to construct their understanding and learning foundations. The theory posits that learners are active participants in their educational journey, constructing knowledge based on their experiences. As Woolfolk (2023) aptly states, learning is an active mental process rather than a passive reception of instruction. Instructors, therefore, play the role of facilitators, fostering an environment conducive to active engagement rather than directing the learning process.

Constructivist classrooms prioritize student-centered approaches, where learning is tailored to individual interests and inquiries. Trainers facilitate learning through group activities, collaborative dialogue, and interactive experiences, allowing learners to build upon their existing knowledge and construct new understandings. Dialogue and negotiation are pivotal components of successful constructivist learning experiences. In the context of this study, digital learning leverages the internet and Learning Management Systems to facilitate a social constructivist paradigm. The plethora of applications available online offers opportunities for collaborative learning and knowledge construction. Voogt (2018) describes constructivism as a means to transition from teacher-dominated to learner-dominated classrooms, aligning with the goals of interactive teaching. Mascolo and Fischer (2019) emphasize that meaningful learning, a cornerstone of constructivism, occurs through reflection and active mental construction. This perspective is reinforced by Howland, Jonassen, and Marra (2021), who underscore the role of technology in facilitating meaningful learning experiences.

Meaningful learning, characterized by the acquisition of new knowledge based on existing understanding and personal experiences, is integral to constructivism (Jonassen et al., 2020). Instructional technologies play a vital role in realizing the attributes of meaningful learning, as outlined by Howland et al. (2021), who identify technology as a vehicle for meaningful learning in classrooms.

While constructivism promotes critical thinking, engagement, and memory retention, its reliance on trial and error learning can be time-consuming and lacks a highly structured environment. However, it empowers learners by viewing them as active and competent individuals capable of reflection and critical engagement. This theory fosters advanced skills such as critical analysis, evaluation, and creativity, while encouraging learners to reflect on their work and identify areas for further development based on individual needs. In the context of Technical Training Institutions, constructivism offers a framework for developing advanced skills aligned with the demands of the modern world. By utilizing Learning Management Systems and embracing learner-centered instructional approaches, institutions can navigate challenges such as increased enrollment and disruptions like the COVID-19 pandemic, thereby facilitating meaningful and impactful learning experiences.

2. Methodology

Research design serves as a blueprint for addressing research questions and navigating challenges encountered during the research process. Recent works by Creswell and Creswell (2017) and Yin (2018) define research design as the arrangement of conditions for collecting and analyzing data in a manner that balances relevance to the research purpose with procedural efficiency. It provides a systematic approach for researchers to comprehend a research problem and identify appropriate solutions (Bhat, 2021). In this paper, a mixed methods design was adopted to generate both qualitative and quantitative data. Mixed methods research involves integrating elements of qualitative and quantitative approaches to enhance the breadth and depth of understanding (Johnson et al., 2020). This combination enables researchers to strengthen the conclusions of their study by taking advantages of the strengths of both qualitative and quantitative research designs (Schoonenboom & Johnson, 2017). The mixed methods design was found suitable because the study collected both quantitative and qualitative data from the respondents.

The study was conducted in approved Technical Training Institutions (TTI's) in Kenya, which are found in 34

counties across the country. According to the Kenya National Bureau of Statistics (KNBS, 2022), there are 154 approved TTIs in Kenya. It targeted 154 Principals each from the 154 approved TTIs, 3400 trainers, and an estimated 132,000 trainees. Sampling involved the systematic selection of individuals from the population to ensure that the chosen group accurately represents the characteristics of the entire target population (Kombo & Orodho, 2003). In this study, probability sampling techniques were employed to select participants at various levels, enhancing the generalizability of the study results to the target population (Acharya et al., 2013).

The participants were sampled using a combination of methods, including stratified sampling, where respondents were grouped into different strata such as trainers and trainees, followed by simple random sampling. It is worth noting that a sample size ranging from 10% to 30% of the study population is considered sufficient for statistical analysis (He, 2020). In this case, 10% of principals (15) were sampled to ensure an adequate representation of these key stakeholders. The sample sizes for trainees and trainers were obtained using a simplified formula for proportions (Yaname, 1967). Questionnaires and interviews were employed as data collection tools, and the validity and reliability of the instruments were ensured through expert validation and Cronbach's Alpha analysis. After data collection, rigorous data processing and analysis were conducted using SPSS version 26, involving descriptive and inferential analysis techniques to derive meaningful insights from the collected data (Kombo & Tromp, 2019; Silverman, 2016).

3. Findings and Discussion

This section collects and analyzes data on how LMS facilitate various assessment methods to evaluate trainees or trainees learning in online and blended learning environments. It analyses methods including quizzes, assignments, simulations, and peer assessments, among others. Each assessment method is perceived to offer unique advantages and challenges, providing trainers with diverse tools to measure student understanding, skills acquisition, and critical thinking abilities. Table 1 summarizes various assessment method used.

Table 1: Assessment modes within the LMS

Mode of assessment	Frequency	Percent
Conventional	30	16.2
Assignments, Discussion Forums and exams, quizzes, peer assessment, simulations.	155	83.8
Total	**185**	**100.0**

Source: Author (2024)

Table 1 outlines the assessment methods utilized within Learning Management Systems (LMS) in Technical Training Institutions in Kenya, as reported by respondents. Among the 185 individuals surveyed 155(83.8%) indicated the use of quizzes/exams and assignments as assessment methods. A smaller proportion 30(16.2%) indicated that they were still using conventional assessment method at the time of data collection. These findings underscore the diverse approaches to assessment facilitated by LMS, including both traditional methods like quizzes/exams and more interactive methods such as discussion forums, reflecting efforts to promote varied and effective assessment practices in technical training contexts.

The study further collected data from the respondents in order to ascertain whether the assessment is effective as per the curriculum design and implementation assessment goals as in Table 2.

Table 2: Respondents Perception of LMS Assessment Effectiveness

Perception	Frequency	Percent
Not Indicated	34	18.4
Effective	70	37.8
Ineffective	30	16.2
Very Effective	51	27.6
Total	**185**	**100.0**

Source: Author (2024)

Table 2 presents respondents' perceptions of the effectiveness of assessment methods utilized within Learning Management Systems (LMS) in Technical Training Institutions in Kenya. Among the 185 individuals surveyed,

70(37.8%) considered the assessment methods to be effective, while 51(27.6%) described them as very effective. Conversely, 16.2% deemed the assessment methods ineffective, and 34(18.4%) did not provide any response on their perception. These findings suggest a generally positive perception of the effectiveness of assessment methods facilitated by LMS, with a significant proportion of respondents finding them to be either effective or very effective in evaluating student learning within technical training contexts.

The analysis on Table 1 and 2 reveals that TTIs, where competency-based education is emphasized, LMS facilitates various assessment methods that align with the principles of conversation assessment. These methods include quizzes and tests for assessing knowledge retention, assignments and projects for evaluating practical application of skills, and simulations for providing hands-on practice in simulated real-world scenarios. Peer assessments and reviews encourage collaborative learning and critical thinking, akin to the interactive nature of conversation assessment. Additionally, self-assessment prompts trainees to reflect on their progress and engage in metacognitive processes, similar to self-reflection in conversation assessment. Performance-based assessments, such as demonstrations, evaluate practical skills in a manner akin to real-life conversation scenarios. Formative assessments in LMS monitor ongoing progress, while summative assessments measure overall competency attainment, reflecting the comprehensive evaluation approach in conversation assessment. By incorporating these diverse assessment methods facilitated by LMS, TTIs ensure holistic evaluation of trainees' competencies, fostering a learning environment that mirrors the interactive and reflective nature of conversation assessment.

The study further examined various challenges faced by trainees or trainees during assessment time on LMS. These challenges were as in Table 3

Table 3: Challenges Encountered when Utilizing LMS

Challenge	Frequency	Percent
Did not indicate	30	16.2
Connectivity Issues	55	30.7
Difficulty uploading assignments	5	2.7
Limited technical skills/ Technical issues/ Technical glitches	40	21.6
None	20	10.8
Time constraints/ Time management	35	18.0
Total	**185**	**100.0**

Source: Author (2024)

Table 3 outlines the challenges encountered by respondents regarding LMS within TTIs in Kenya. Among surveyed individuals, connectivity problems, including internet connectivity issues, were the most prevalent challenge, mentioned by 55(30.7%) of respondents. Additionally, 40(21.6%) cited limited technical skills or technical glitches, while 35(18.0%) reported time related constraints or difficulties with time management during online assessments. A smaller proportion of respondents mentioned difficulty uploading assignments 5(2.7%), while some indicated experiencing no challenges 20(10.8%). These findings highlight the importance of addressing infrastructure issues, providing technical support, and offering training to enhance users' digital literacy and mitigate challenges associated with LMS utilization in technical training institutions,

Respondents also provided additional comments and recommendations on the challenges and what need to be addressed in order to enable the LMS to give its best as in Table 4.

Table 4: Additional Comments on Challenges Encountered when Utilizing LMS

Challenge	Frequency	Percent
Did not provide response	30	16.2
Technical Support and Guidance	13	7.1
Improve platform and Interface	23	12.4
Improved connectivity needed	3	1.6
More engaging materials needed.	4	2.2
More hands-on activities needed.	5	2.7
More interactive multimedia content desired.	41	24.2
More peer interaction needed	9	3.8
More practice quizzes needed	5	2.7
More real-world examples needed.	5	2.7
More tutorials needed.	10	5.4
Satisfied with the experience/ More tutorials needed.	32	17.3
Simplified instructions required	5	2.7
Total	185	100.0

Source: Author (2024)

Table 4 provides additional comments by respondents encompass various aspects of their experience with the platform. Notably 30(16.2%) of respondents did not provide specific comments. However, a significant proportion highlighted the need for technical support and guidance, with 13(7.1%) emphasizing the importance of addressing user queries and concerns promptly. Additionally, 23(12.4%) of respondents indicated a desire for improvements to the platform and interface, suggesting a need for enhanced usability and navigability. Connectivity issues were identified as a minor concern, with 3(1.6%) of respondents indicating a need for improved network reliability. Moreover 41(24.2%) of respondents expressed a desire for more engaging materials, hands-on activities, and interactive multimedia content to enrich their learning experience. Peer interaction and the availability of practice quizzes and real-world examples were also cited as areas for improvement, each mentioned by 9(3.8%), 5(2.7%), and 5(2.7%) of respondents, respectively. However, 32(17.3%) of respondents expressed satisfaction with their overall experience, while acknowledging the need for additional tutorials and simplified instructions to further enhance their usage of the platform.

The study reveals a predominant use of quizzes/exams and assignments as assessment methods within LMS, reflecting a blend of traditional and interactive assessment practices. This approach aligns with the diverse needs of technical training contexts, catering for both knowledge acquisition and practical skill development (Gikandi et al., 2011). However, the continued use of conventional assessment methods by a small proportion of respondents 30(16.2%) suggests potential resistance to fully embracing innovative assessment practices facilitated by LMS (Rienties et al., 2013).

Through an interview with respondents, findings of the interviews revealed a significant influence of LMS on assessment methods within TTIs. Trainers noted a shift towards more frequent, diverse, and authentic assessments facilitated by LMS platforms. In their responses, many highlighted the integration of self-assessment tools, peer assessments, and project-based assessments to promote a holistic evaluation of student learning. However, some raised concerns regarding the technical expertise required for customization and the complexity of user interfaces of which most of them did not know how to go about it since they have little in information above most used LMS architectural design. Trainers emphasized the importance of user-friendly assessment tools to ensure effective implementation of assessment strategies using LMS.

In response to how LMS have influenced assessment methods in technical training institutions, participants highlighted the diversification of assessment types, including quizzes, assignments, and discussions. They also noted that they can now conduct assessments more frequently and efficiently through the LMS platform, leading to increased effectiveness in tracking student progress. Regarding differences in the effectiveness of assessment methods facilitated by LMS compared to traditional methods, participants emphasized that assessments conducted via LMS are often perceived as more effective. This perception stems from enhanced feedback

mechanisms and the ability to leverage data analytics for deeper insights into student performance. Respondent Principal 1 (PPL1) noted that:

> *"In my view, LMS has significantly influenced the assessment methods used in our institutions. We now have a wider range of assessment types available, including quizzes, assignments, and discussions, all facilitated through the LMS platform. Additionally, the frequency of assessments has increased, and they can be conducted more efficiently, leading to greater effectiveness in tracking student progress."*

When the Respondents were asked if there any notable differences in the effectiveness of assessment methods facilitated by LMS compared to traditional methods PPL2 noted;

> *"We have observed notable differences in the effectiveness of assessment methods facilitated by LMS compared to traditional methods. Assessments conducted through LMS are generally perceived as more effective due to enhanced feedback mechanisms and the ability to leverage data analytics for deeper insights into student performance."*

Respondents generally perceived the assessment methods facilitated by LMS as effective, with over two-thirds considering them effective or very effective. This positive perception underscores the value of LMS in supporting varied and impactful assessment practices in technical training institutions (Alqurashi, 2019). However, a notable proportion of respondents did not indicate their perception of assessment effectiveness (18.4%), suggesting a need for further exploration of user experiences and satisfaction with LMS assessment practices.

The diverse assessment methods facilitated by LMS align with the principles of competency-based education, emphasizing comprehensive evaluation of trainees' competencies (Miller, 2010). Methods such as assignments, simulations, and peer assessments support the assessment of practical skills, critical thinking, and collaborative abilities, reflecting the holistic approach advocated in competency-based education frameworks (Shah & Foster, 2015).

Connectivity issues emerged as the most prevalent challenge, highlighting the critical role of reliable internet access in facilitating seamless online assessment experiences (Alzahrani et al., 2020). Technical glitches and limited technical skills were also cited as significant challenges, underscoring the importance of technical support and digital literacy training to enhance users' confidence and competence in utilizing LMS for assessment purposes (Nguyen et al., 2015).

Time constraints and difficulties with time management further emphasize the need for flexible assessment design and support mechanisms to accommodate diverse learner needs and circumstances (Dennen et al., 2007).

Respondents' suggestions for improving LMS assessment practices highlight the importance of technical support, platform usability enhancements, and the availability of engaging, interactive content (Bhuasiri et al., 2012). The desire for more hands-on activities, real-world examples, and peer interaction reflects a growing emphasis on active, experiential learning approaches within digital learning environments (Bower, 2016). Additionally, the need for simplified instructions and additional tutorials underscores the importance of user-friendly design and comprehensive support resources are required to facilitate optimal usage of LMS assessment features (Alzahrani et al., 2020).

The findings regarding the effectiveness of assessment methods within LMS align with previous research highlighting the benefits of technology-enhanced assessment practices in promoting student engagement and learning outcomes (Gikandi et al., 2011; Alqurashi, 2019). Challenges related to connectivity issues, technical glitches, and time constraints resonate with broader literature on the implementation of digital technologies in educational settings, emphasizing the importance of infrastructure support and user training (Nguyen et al., 2015; Dennen et al., 2007). User recommendations for improving LMS assessment practices reflect emerging trends in educational technology research, emphasizing the importance of user-centered design, interactive content development, and comprehensive support mechanisms (Bhuasiri et al., 2012; Bower, 2016).

3.1 Regression Analysis on LMS utilization and Educational Policy

This section provides analysis on the descriptive statistics, offering deeper insights into the characteristics of the study's main variables. It indicates moderate levels of agreement with the constructs under consideration. Moreover, variability in responses is observed, with differences in standard deviations across LMS utilization, LMS effectiveness, and pedagogy. Skewness and kurtosis values shedding light on the distributional characteristics of the data. Additionally, the model summary for Government & Institutional Policy on LMS Utilization is presented. The regression coefficients of LMS utilization, LMS effectiveness, and pedagogy, as

well as instructional process in predicting Government & Institutional Policy, are analyzed. Furthermore, correlation analyses explore the associations among LMS utilization, LMS effectiveness, pedagogy variation, and instructional process.

3.1.1 Variable Characteristics

This analysis examines the descriptive statistics of key variables, including LMS utilization, effectiveness, and Pedagogy and Instructional Process. Mean values suggest a moderate to slightly high level of agreement with the constructs, while differences in variability are observed across variables. Skewness and kurtosis values indicate relatively symmetrical distributions with minimal extreme values or outliers, contributing to the dataset's stability. Table 5summarizes the findings.

Table 5: Variable Characteristics

	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
LMS utilization	3.4735	.52668	.277	.398	.183	-.401	.364
LMS effectiveness	3.5920	.69885	.488	-.023	.183	-.975	.364
Pedagogy and Instructional Process	3.9341	.64372	.414	-.309	.183	-.919	.364

Table 5 provides analysis on the characteristics of the study's main variables. The mean values reveal that respondents, on average, rated LMS utilization which include the types of LMS being used, engagement levels, learning experiences at (3.4735), LMS effectiveness at (3.5920), and Pedagogy and instructional process at (3.9341). These scores indicate a moderate to slightly high level of agreement with the constructs in the study. However, a closer look at the standard deviations unveils differences in variability. While LMS utilization and effectiveness demonstrate relatively low variability with standard deviations of (0.52668) and (0.69885) respectively, pedagogy and instructional process exhibits higher variability with a standard deviation of (0.64372). This suggests a greater diversity in responses concerning pedagogical approaches and instructional process.

Analysis and examination on skewness and kurtosis values on the distributional characteristics of the data reveal the skewness values of (0.398) for LMS utilization, (-0.023) for LMS effectiveness, and (-0.309) for Pedagogy and instructional process which indicate slight right skewness for LMS utilization and slight left skewness for Pedagogy instructional process. This implies that responses for these variables tend to cluster around their means with relatively symmetrical distributions. However, the kurtosis values of (-0.401) for LMS utilization, (-0.975) for LMS effectiveness, and (-0.919) for Pedagogy and instructional process suggest that the distributions are relatively flat compared to a normal distribution. This indicates a lack of extreme values or outliers, contributing to the stability of the dataset.

31..2 Government & Institutional Policy on LMS Utilization

The model summary provides crucial statistics derived from a regression analysis focusing on the relationship between Government & Institutional Policy and LMS Utilization. It features the R-squared value, which indicates how well the independent variables (pedagogy & instructional process, LMS utilization, and LMS effectiveness) collectively explain the variance in Government & Institutional Policy. Additionally, the significant F-statistic underscores the overall significance of these independent variables in influencing Government & Institutional Policy. This analysis was performed in order to understand the extent to which LMS utilization, effectiveness, and pedagogy contribute to shaping institutional policies in education. The finding is as in table 6.

Table 6: Regression Coefficients on Government & Institutional Policy on LMS Utilization

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	-.494	.031		-15.868	.000			
	LMS Utilization	-.060	.012	-.044	-5.033	.000	.898	-.358	-.019
	LMS Effectiveness	1.174	.036	1.157	32.271	.000	.999	.926	.120
	Pedagogy & instructional process	-.131	.038	-.119	-3.443	.001	.991	-.254	-.013

a. Dependent Variable: Government & Institutional Policy

Table 6 reveals a constant term of (-0.494), indicating that when all other variables are held constant, the dependent variable (Government & Institutional Policy) is expected to be (-0.494) units. The coefficient for LMS utilization is (-0.060), indicating that for every one-unit increase in LMS utilization, the dependent variable (Government & Institutional Policy) is expected to decrease by (0.060) units. The coefficient for LMS effectiveness is (1.174), indicating that for every one-unit increase in LMS effectiveness, the dependent variable (Government & Institutional Policy) is expected to increase by (1.174) units. The coefficient for pedagogy and instructional process is (-0.131), indicating that for every one-unit increase in pedagogy and instructional process, the dependent variable (Government & Institutional Policy) is expected to decrease by (0.131) units.

The coefficients table provides information on the regression coefficients, standard errors, t-values, and significance levels for the independent variables (LMS utilization, LMS effectiveness, and pedagogy & instructional process) in predicting the dependent variable (Government & Institutional Policy). Additionally, correlations between the independent variables and various types of correlations (zero-order, partial, and part) are also presented. LMS effectiveness has the highest standardized coefficient (Beta = 1.157), indicating its strongest influence on the dependent variable. All independent variables show statistically significant relationships with the dependent and moderating variable ($p < 0.001$), as indicated by their low p-values.

The coefficient for LMS effectiveness suggests that it has the most substantial impact on Government & Institutional Policy compared to LMS utilization and pedagogy and instructional process. Institutions should prioritize strategies that enhance the effectiveness of their LMS platforms to positively influence policy decisions. While pedagogy has a relatively smaller coefficient compared to LMS effectiveness, its significance indicates its relevance in shaping policies. Collaboration between policymakers, educators, and researchers is crucial to ensure policies align with the evolving needs of the education sector.

3.1.3 LMS Utilization, LMS Effectiveness and Pedagogy and instructional process Variation

This section examines the relationships among LMS utilization, LMS effectiveness, and pedagogy and instructional process variation. It explores how these factors interact and influence one another in educational settings in TTIs. It provides an understanding on how TTIs can optimize the use of learning management systems and instructional methods to enhance trainees learning outcomes and institutional policies. Table 7 gives a summary of the findings.

Table 7: Correlations among LMS Utilization, LMS Effectiveness, and Pedagogy Variation

Control Variables			LMS Utilization	LMS effectiveness	Pedagogy & Instructional Process
Government & Institutional Policy	LMS utilization	Correlation	1.000	.435	.164
		Significance (2-tailed)	.	.000	.030
		Df	0	173	173
	LMS effectiveness	Correlation	.435	1.000	.594
		Significance (2-tailed)	.000	.	.000
		Df	173	0	173
	Pedagogy & instructional Process	Correlation	.164	.594	1.000
		Significance (2-tailed)	.030	.000	.
		Df	173	173	0

Table 4.31 reveals that there is a moderate positive correlation (0.435) between LMS utilization (which includes types of LMS used, trainees' engagement levels and role of LMS in facilitating learning experiences) and LMS effectiveness. This finding suggests that higher utilization of the LMS is associated with increased effectiveness in facilitating learning. The correlation is statistically significant ($p < 0.001$) indicates that the observed relationship is highly unlikely to be random, reinforcing the validity of the association.

The analysis also reveals a weak positive correlation (0.164) between LMS utilization and pedagogy & instructional process variation. This suggests that as the utilization of the LMS increases, there may be some tendency for variation in pedagogical approaches & instructional process. The correlation, though weaker compared to LMS effectiveness, is still statistically significant ($p = 0.030$), indicating a meaningful relationship. $P=0.030 < 0.05$.

The findings further reveal a moderate positive correlation of (0.594) between LMS effectiveness and pedagogy & instructional process variation. This implies that as the effectiveness of the LMS increases, there tends to be more variation in pedagogical approaches. Similar to the previous correlations, this relationship is statistically significant ($p < 0.001$). Implying that TTIs should focus on increasing the utilization of their LMS platforms, as it positively relates to the effectiveness of the system in facilitating learning.

Training programs or initiatives that encourage educators to make more comprehensive use of LMS features is likely benefit. The correlation between LMS effectiveness and pedagogy variation, aiming to foster diverse teaching approaches. Encouraging educators to explore different pedagogical methods within the LMS framework could lead to more engaging and effective learning experiences for students. Government and institutional policies should support initiatives that promote LMS utilization and effective pedagogical practices. Resources allocated towards professional development, technological infrastructure, and research into innovative teaching methodologies is likely to contribute to these objectives.

3.2 Challenges

During the interviews, several challenges associated with LMS implementation in TTIs were identified and shared. Technical issues, limited technical support, resistance to change, scalability issues, and resource constraints emerged as significant barriers to successful implementation. Most trainers emphasized on the need for comprehensive training and support services in order to address these challenges effectively. PPL10 and PPL11 noted that; since technology its likely to be the order of life, institutions need to invest in IT infrastructure (such networking and connectivity), exploring open-source alternatives, and simplifying interface design to enhance the usability and effectiveness of LMS in TTIs. PPL3 noted that:

> *"…We encountered technical issues, had limited technical support, and faced resistance to change, which prevented us from configuring some settings due to connectivity problems.*
>
> *Furthermore, I suggested that institutions should invest in IT infrastructure, explore open-source*

alternatives, and simplify interface design to enhance the usability and effectiveness of LMS in TTIs."

PPL4 noted that:

"We have encountered several challenges in implementing LMS in technical training institutions. These include technical issues such as compatibility with existing systems, limited technical support, and scalability concerns. Additionally, resistance to change among staff and trainees has posed challenges to adoption. To address these challenges, we have invested in comprehensive training programs for staff and trainees, improved technical support services, and conducted regular evaluations to identify and resolve technical issues promptly."

Some respondents (PPL5, PPL 6 and PPL7) noted that;

".... believe that the role of LMS in technical training institutions is instrumental in enhancing teaching and learning processes. However, it requires ongoing commitment and investment from stakeholders to overcome challenges and maximize its potential benefits. We remain optimistic about the future of LMS in our institutions and are dedicated to continuously improving its utilization to support the learning needs of our students."

As a form of recommendation, the respondents pointed out the following:

"... we recommend several best practices for the effective utilization of LMS in technical training institutions. Firstly, institutions should prioritize investing in robust IT infrastructure to support the implementation and operation of LMS. Secondly, comprehensive training programs should be provided to both staff and students to ensure they are proficient in using the LMS platform. Additionally, regular communication and support mechanisms should be established to address technical issues and provide assistance when needed. Lastly, institutions should continuously evaluate and update their LMS implementation strategies to align with evolving technological advancements and educational needs."

The analysis identifies some challenges related to LMS utilization, such as complex navigation interfaces and time constraints (Gikandi et al., 2011). However, it could delve deeper into the specific barriers encountered by both trainees and trainers (Naidu, 2006). There is need to explore challenges such as digital literacy gaps, infrastructure limitations, and resistance to change for a more comprehensive understanding of the obstacles hindering effective LMS utilization within TTIs (Al-Azawei et al., 2017). Moreover, there is need to explore opportunities for addressing these challenges through targeted interventions, professional development initiatives, and institutional support structures (Vaughan, 2007).

These thematic analyses revealed diverse perceptions of LMS implementation, encompassing preferences, challenges, and benefits associated with different platforms. Additionally, it also points out LMS integration and how it is significantly impacting teaching methods, student engagement, and learning outcomes and its influence to the adoption of new assessment methods, changes in assessment strategies, and perceived effects on assessment validity and reliability.

4. Conclusion

The study examines the use and effectiveness of LMS in TTIs in Kenya, focusing on diverse assessment methods and associated challenges. LMS facilitates a variety of assessment techniques, including quizzes, assignments, simulations, and peer assessments, which are perceived as effective by a majority of respondents. However, connectivity issues, technical glitches, and time constraints pose significant challenges. The analysis has also revealed a moderate positive correlation between LMS utilization and effectiveness, highlighting the need for enhanced technical support, user-friendly interfaces, and comprehensive training. Respondents recommend investing in robust IT infrastructure, continuous evaluation of LMS strategies, and providing more engaging and interactive content. The findings underscore the importance of LMS in promoting varied and impactful assessment practices while addressing the technical and logistical barriers to optimize its potential benefits in technical education.

5. Recommendation

Based on the findings, TTIs in Kenya should prioritize investing in robust IT infrastructure to enhance internet connectivity and ensure seamless online assessments. Providing comprehensive training programs for staff and trainees in order to boost digital literacy and confidence in using LMS, supported by responsive technical

assistance. Simplifying LMS interfaces to make them more user-friendly and intuitive in order to reduce technical barriers and improve engagement. Additionally, incorporating diverse and engaging content, such as interactive multimedia and real-world examples, to enrich learning experiences and maintain student interest. Promoting collaborative learning through peer assessments and discussions aligns with competency-based education principles, fostering critical thinking. Regularly evaluating and updating LMS strategies to keep pace with evolving educational needs and technological advancements is essential. Designing flexible assessments that accommodate diverse learner needs and addressing time management challenges ensures inclusivity. Lastly, encouraging collaboration between policymakers, educators, and IT professionals to align LMS policies and practices with educational objectives and technical capabilities, creating a more supportive and efficient digital learning and assessment environment.

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