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Comparative Analysis of Student Performance Using Learning Management Systems (LMS) and Traditional Teaching Methods in Academic Tasks: A Case Study of the University of Cape Coast (UCC)

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Abstract

This study aimed to evaluate the impact of Learning Management System (LMS) integration on student performance and engagement at the University of Cape Coast (UCC) while comparing its effectiveness to traditional teaching methods. The study also sought to identify the challenges associated with LMS adoption and to propose evidence-based recommendations for enhancing its utilization. A total of 3799 students, selected through stratified random sampling, participated in the study. Their performance data were collected from the Directorate of Academic Affairs, and engagement levels were measured using the Utrecht Work Engagement Scale. The study employed quantitative methods, including the Mann-Whitney U test and Moses Test, to assess differences between LMS and traditional methods, while qualitative insights were gathered from focus group discussions and interviews with faculty and students. Key findings revealed that while student performance did not differ significantly between LMS and traditional methods, engagement levels were slightly higher in traditional approaches due to interpersonal interactions and immediate feedback. However, LMS proved advantageous for flexibility, scalability, and personalized learning. Challenges such as digital literacy gaps, infrastructural deficits, and resistance to change emerged as significant barriers to LMS adoption. Based on these findings, the study recommends a hybrid teaching approach that combines LMS with traditional methods to optimize learn-

ing outcomes. The study emphasizes the need for institutional investments in training, infrastructure, and policies to support technology-enhanced learning and foster student and faculty readiness for a digital academic environment.

Keywords

Learning Management System (LMS), Hybrid Learning, Student Engagement, Academic Performance, Traditional Teaching Methods, Technology Adoption, Blended Learning, Innovative Education Models

1. Background of the Study

The methods used to facilitate student learning have always been critical in shaping academic success. Traditional teaching methods like face-to-face interactions and printed materials have dominated educational systems for decades. However, the rapid advancement of technology has introduced innovative tools like Learning Management Systems (LMS) that have transformed the educational landscape (Bonsu et al., 2021). These tools are increasingly recognized for their ability to enhance student engagement and streamline academic processes. Learning methods significantly impact student engagement and academic outcomes by shaping how students interact with course materials and instructors. Traditional approaches foster direct interpersonal interactions, which can promote trust and immediate feedback (Mwangi et al., 2020). However, these methods are often constrained by time and location, potentially limiting access for students in flexible learning environments. Conversely, hybrid models integrating traditional and digital approaches have shown improved student cohesion, especially in fostering peer-to-peer collaborations (Amadi et al., 2022).

Institutional cohesion is another critical aspect influenced by learning methods. Studies have shown that universities using consistent teaching methodologies report higher levels of academic integration and student satisfaction (Tandwa & Chikandiwa, 2021). In such environments, students tend to build stronger relationships with faculty and peers, contributing to better retention and overall performance. Thus, for UCC, understanding how different learning methods align with its academic goals is vital to improving institutional outcomes. This makes digital tools like LMS to become indispensable in modern education, providing platforms for collaborative learning and improved productivity. Also, LMS platforms like Moodle and Canvas allow for centralized access to educational resources, fostering self-paced learning while enabling instructors to track student progress (Bonsu et al., 2021). These systems support asynchronous and synchronous learning, making education more flexible and inclusive.

Furthermore, research has shown that LMS enhances the learning experience by encouraging active student participation in online discussions, quizzes, and group projects. For instance, Komba and Ngowi (2023) revealed that institutions

integrating LMS observe a 30% increase in student engagement compared to traditional methods. This suggests that digital tools not only improve academic performance but also cultivate essential skills like time management and digital literacy among students. The integration of LMS into academic tasks plays a pivotal role in determining its impact. According to Agyemang and Yeboah (2020), when properly implemented, LMS systems streamline course delivery, automate administrative tasks, and create opportunities for adaptive learning. Other studies highlights have shown that universities with fully integrated LMS frameworks report improved student performance and satisfaction (Agyemang & Yeboah, 2020; Komba & Ngowi, 2023).

On the other hand, some researchers have argued that the absence of such systems often leads to inconsistencies in course delivery and diminished student experiences. For instance, a comparative study in South Africa by Mbatha et al. (2021) demonstrated that students in LMS-supported programs performed 25% better in assessments than their peers using only traditional methods. The study attributed this to the accessibility of learning resources and the immediate feedback mechanisms inherent in LMS. The study further argued that despite these benefits, partial integration or technical challenges can hinder the full realization of LMS potential. In contexts like UCC, where digital tools are increasingly adopted, the role of LMS in addressing long-standing challenges like large class sizes and resource constraints cannot be overemphasized. The rationale is that effective LMS utilization ensures that students receive equitable access to educational materials and timely support (Mbatha et al., 2021).

Constructivist Theory, which emphasizes active collaborative learning underscores the value of LMS in creating learner-centered environments (Vygotsky, 1978). The theory posits that LMS platforms facilitate constructivist practices by providing tools for discussion, problem-solving, and collaborative projects, making them more effective than teacher-centered traditional methods. Similarly, Self-Regulated Learning (SRL) Theory also aligns with LMS usage by promoting autonomy in learning. According to Zimmerman (2020), students who use LMS can set goals, monitor progress, and reflect on outcomes, leading to improved academic achievement. The role of technology in supporting SRL is especially significant in large universities like UCC, where personalized attention may be limited. Finally, the Technology Acceptance Model (TAM) further explains how perceived usefulness and ease of use drive the adoption of LMS (Davis, 1989).

Empirical studies like Boateng et al. (2023) confirm that students and instructors at African universities are more likely to embrace LMS when the systems are user-friendly and demonstrate clear benefits over traditional methods. Globally, universities have embraced LMS to enhance academic delivery. In the United States, Harvard University uses Canvas to provide seamless learning experiences, reporting improved student outcomes (Smith et al., 2020). Similarly, the University of Johannesburg in South Africa adopted Moodle, leading to a significant increase in course completion rates (Ntuli & Phiri, 2022). In Ghana, Kwame Nkru-

mah University of Science and Technology (KNUST) has implemented Sakai LMS, which has transformed how students and lecturers interact. Besides, Agyemang and Yeboah (2020) found that students at KNUST experienced a 20% improvement in academic performance when using Sakai compared to traditional methods. These successes illustrate the transformative potential of LMS when effectively adopted.

At UCC, LMS platforms like Moodle are increasingly used to complement traditional teaching methods. Preliminary evaluations indicate that students find LMS beneficial for accessing lecture notes, participating in discussions, and submitting assignments (Adomako et al., 2021). However, gaps remain in the consistent adoption of these tools across faculties, leading to mixed outcomes. Despite the potential benefits, UCC faces challenges in fully adopting LMS. Issues like inadequate digital infrastructure, limited training for faculty, and resistance to change hinder the seamless integration of LMS into academic processes. Understanding these challenges is critical to developing strategies for optimizing LMS use at UCC.

1.1. Problem Statement

The use of Learning Management Systems (LMS) has become a vital component in higher education, revolutionizing traditional methods of teaching and learning. Different LMS platforms offer different digital tools to enhance collaborative learning, accessibility, and student engagement (Mbatha, Ndhlovu, & Sithole, 2021). However, the extent to which these platforms contribute to academic success is still contested in specific contexts like the University of Cape Coast (UCC), where the integration of LMS in academic tasks has faced notable challenges. Studies indicate that, despite LMS adoption in many Ghanaian universities, especially UCC, its utilization remains inconsistent, leading to disparities in student performance (Agyemang & Yeboah, 2020).

The magnitude of the problem is evident in the uneven academic outcomes reported across faculties and departments at UCC. A study by Bonsu, Boateng, and Mensah (2021) revealed that only 45% of students fully utilized LMS tools for their academic tasks, leading to a 25% gap in performance compared to peers who engaged actively with these platforms. Additionally, a survey conducted by Adjei and Amankwah (2022) showed that over 40% of students faced technical and infrastructural challenges that hindered effective LMS use. Such statistics demonstrate the critical need to evaluate the efficacy of LMS compared to traditional methods in improving student outcomes. Several factors contribute to this problem. These include inadequate digital literacy among students and faculty, limited technical support, and inconsistent internet access (Komba & Ngowi, 2023). Furthermore, the lack of comprehensive training programs for faculty members exacerbates the ineffective utilization of LMS in academic settings (Mbatha et al., 2021).

Efforts have been made to address these issues, including investments in ICT

infrastructure and workshops on LMS usage at UCC (Adjei & Amankwah, 2022). While these initiatives have improved awareness, their impact on actual usage and student performance remains minimal due to inconsistent follow-up and monitoring mechanisms. This creates a significant research gap, as there is limited evidence comparing the effectiveness of LMS with traditional teaching methods in enhancing student outcomes. Addressing this research gap is crucial. This study will contribute to understanding the comparative efficacy of LMS and traditional methods in shaping academic performance at UCC. It will identify specific challenges and propose evidence-based recommendations to enhance LMS integration. This can help bridge the gap in performance disparities and ensure equitable access to educational resources.

To address the problem effectively, this study proposes a comprehensive analysis of student performance using LMS compared to traditional methods. By assessing how these approaches influence engagement, satisfaction, and academic outcomes, the study aims to provide actionable insights to improve the implementation and usage of LMS at UCC.

1.2. Purpose of the Study

The purpose of this study is to compare the effectiveness of Learning Management Systems (LMS) and traditional teaching methods in enhancing student performance at the University of Cape Coast (UCC). By addressing the existing research gap, the study aims to provide evidence-based recommendations for improving the integration and use of LMS at UCC to foster a more effective learning environment. The study will specifically seek:

1) To evaluate the academic performance of students using LMS in comparison to those using traditional methods.

2) To assess student engagement levels with LMS compared to traditional teaching methods.

3) To identify challenges and barriers faced by students and faculty in utilizing LMS at UCC.

Hypotheses

1) H_0: There is no significant difference in the academic performance of students using LMS compared to those using traditional methods at UCC.

2) H_1: Students who use LMS for academic tasks have higher engagement levels than those using traditional methods.

3) H_2: There are significant challenges in the adoption and utilization of LMS among students and faculty at UCC.

4) H_3: Improving the integration of LMS at UCC will lead to increased academic performance and student satisfaction.

1.3. Significance of the Study

This study will contribute valuable insights into the role of LMS in enhancing academic performance at UCC. By identifying key factors influencing LMS usage

and comparing them with traditional methods, the research will guide future educational strategies at the university. Additionally, it will inform university policy on ICT integration, helping to address barriers that prevent optimal use of LMS. The findings from this study will benefit both students and faculty by highlighting areas where LMS can be better utilized to support academic achievement. Moreover, the study's recommendations will assist in developing targeted training and support programs that improve the overall learning experience. The results can also serve as a reference for other universities in Ghana and beyond that are looking to optimize their use of digital learning tools.

1.4. Scope of the Study

This study will focus on the University of Cape Coast (UCC), specifically evaluating students from various academic departments who engage in both LMS and traditional learning methods. The study will analyze data from both undergraduate and postgraduate students to provide a comprehensive understanding of how LMS impacts different levels of learners. The research will also gather input from faculty members who use LMS to deliver course content and assess student performance.

The research will examine both quantitative and qualitative aspects of LMS usage, including academic performance data and surveys or interviews with students and faculty. The scope will be limited to UCC due to logistical considerations, but the findings may have broader implications for other higher education institutions in Ghana and similar contexts.

2. Literature Review

2.1. Role of Different Teaching Methods in Influencing Academic Outcomes

Teaching methods play a critical role in shaping academic performance, with both traditional and digital approaches presenting distinct advantages and challenges. Traditional teaching, which relies on face-to-face interaction, allows for immediate feedback and personalized guidance, often fostering deeper comprehension through direct communication. However, studies have shown that this method can be less effective in addressing diverse learning styles and large student populations (Adeoye & Adanikin, 2020). Digital teaching methods, such as those facilitated by Learning Management Systems (LMS), provide flexibility and scalability, enabling learners to access materials at their convenience. According to Owusu-Agyeman and Larbi-Siaw (2020), digital tools enhance engagement through interactive content and analytics, leading to better academic outcomes compared to traditional methods. A comparative study by Adekola et al. (2021) in Nigerian universities revealed that students using LMS had higher grades in continuous assessments than those in traditional lecture-only classes. These findings highlight the potential of digital methods to transform education, though challenges like internet access and digital literacy persist.

The effectiveness of teaching methods is deeply rooted in educational theories. The Constructivist Theory posits that students learn best through active engagement and interaction, which aligns well with LMS features that support collaborative learning (Kim & Reeves, 2019). Similarly, the Self-Regulated Learning (SRL) Theory emphasizes student autonomy and the ability to set goals, monitor progress, and reflect on outcomes, and processes facilitated by digital platforms (Zimmerman & Schunk, 2021). On the other hand, the Technology Acceptance Model (TAM) provides insight into how perceived usefulness and ease of use influence the adoption of digital tools in education. Research by Kintu and Zhu (2019) demonstrated that constructivist approaches in digital learning environments led to improved critical thinking and problem-solving skills among students. Meanwhile, a study by Ansong and Boateng (2022) showed that students' positive attitudes toward LMS, guided by TAM principles, resulted in higher engagement levels and academic achievement. These theories collectively underscore the importance of aligning teaching strategies with the psychological and technological needs of learners.

Empirical evidence comparing traditional and digital methods has produced mixed results, reflecting diverse educational contexts and implementation challenges. A study by Adeoye and Adanikin (2020) in sub-Saharan Africa found that traditional methods remained dominant due to limited digital infrastructure, but significant academic improvements in hybrid setups combined with both approaches were noted. Similarly, Obilor and Onuoha (2021) observed that students in a fully digital learning environment scored better on analytical tasks than their peers in traditional classrooms. However, these studies also revealed disparities in access to digital tools, with rural students often lagging behind their urban counterparts. Addressing these gaps, innovative solutions like blended learning—integrating traditional and digital methods—have emerged as a promising approach. This model was validated by Gyamfi et al. (2022), who reported enhanced engagement and performance among Ghanaian university students when blended learning was employed.

Despite the growing popularity of digital methods, critics argue that over-reliance on technology could lead to decreased interpersonal skills and overemphasis on self-directed learning, which may disadvantage less motivated students. Empirical studies have proposed alternatives to address these issues. For instance, Tadesse and Gillies (2021) emphasized the importance of balancing traditional and digital approaches to maintain interpersonal connections while leveraging technology's benefits. Similarly, Eshun and Ankrah (2020) advocated for capacity-building programs to enhance educators' digital competence, ensuring the effective integration of LMS in pedagogical practices. These perspectives highlight the need for a context-specific approach to teaching methods, considering institutional resources and student demographics.

This literature highlights the nuanced impacts of traditional and digital teaching methods on academic performance, emphasizing the need for context-sensi-

tive strategies. For the University of Cape Coast, understanding these dynamics is crucial for optimizing LMS use. The study seeks to fill gaps identified in the literature, particularly the limited research on the comparative effectiveness of traditional and digital methods within Ghanaian higher education. By exploring these teaching methods, the study will provide actionable insights into improving academic outcomes, aligning with both institutional goals and global educational trends.

2.2. Evolution and Adoption Trends of LMS Globally, in Africa, and within Ghana

The adoption of Learning Management Systems (LMS) in higher education has transformed teaching and learning globally. Initially developed in the 1990s to support distance education, LMS platforms have evolved into comprehensive tools that integrate multiple educational functions. Globally, the adoption of LMS is driven by advancements in technology and the demand for flexible learning. According to Lim et al. (2020a), approximately 80% of universities in developed countries have integrated LMS into their core operations. In Africa, the adoption rate has been slower due to infrastructure limitations and financial constraints. However, studies by Tadesse and Gillies (2021) show increasing uptake, with 45% of African universities adopting LMS post-COVID-19. Ghana has witnessed a similar trend, particularly in public universities like the University of Cape Coast, where platforms like Moodle have been utilized to enhance academic delivery (Ansong & Boateng, 2022). These adoption trends illustrate the growing recognition of LMS as a tool for modernizing higher education, although challenges remain.

The LMS platforms offer a range of features that facilitate effective academic engagement. Accessibility is a critical advantage, enabling students to access course materials anytime and anywhere, thereby promoting self-paced learning. Additionally, collaborative tools like discussion forums, live chats, and group project spaces foster interaction among students and instructors. Tracking progress is another vital feature, allowing educators to monitor student performance and provide timely feedback. According to Gyamfi et al. (2022), these features contribute significantly to improving student outcomes by ensuring timely access to resources and fostering active participation. Similarly, Adeoye and Adanikin (2020) highlighted that features like automated grading and analytics reduce educators' workload while providing insights into student performance. The versatility of LMS platforms underscores their potential to bridge educational gaps, particularly in resource-constrained environments.

Despite its potential, the adoption of LMS faces several barriers, particularly in Africa. Infrastructure deficits, such as unreliable internet and electricity, remain a significant challenge, limiting the functionality of LMS in rural areas. Additionally, digital literacy among both educators and students often hampers effective utilization. Eshun and Ankrah (2020) reported that over 60% of university staff in

Ghana required training to effectively use LMS platforms. Financial constraints also pose a barrier, as subscription fees and the cost of acquiring compatible devices are prohibitive for many institutions and students. Moreover, cultural resistance to digital tools persists, with some educators and learners preferring traditional methods due to familiarity. Obilor and Onuoha (2021) emphasized that addressing these barriers requires coordinated efforts, including government funding, training programs, and infrastructure development.

While barriers exist, several solutions have been proposed to enhance LMS adoption. Blended learning, which combines traditional and digital methods, has been recommended as a transitional approach. Gyamfi et al. (2022) found that blended learning reduced resistance to LMS by allowing gradual adaptation while retaining familiar teaching methods. Capacity-building initiatives, such as digital skills training for educators, have also proven effective. Ansong and Boateng (2022) highlighted the success of workshops in Ghana that improved LMS proficiency among university staff, resulting in increased adoption rates. Furthermore, government and institutional investments in digital infrastructure can mitigate financial and connectivity challenges. Tadesse and Gillies (2021) suggested public-private partnerships to fund LMS deployment in underserved regions. These alternative approaches demonstrate the importance of tailored strategies to overcome adoption barriers.

The literature underscores the transformative potential of LMS in higher education while highlighting the persistent barriers to its adoption and utilization. For the University of Cape Coast, understanding these dynamics is critical for optimizing LMS to improve academic delivery. This study seeks to explore these issues within the Ghanaian context, addressing gaps in existing research on adoption trends, key features, and barriers. The findings will provide actionable insights for policymakers and educators, contributing to strategies that enhance LMS integration and support effective teaching and learning.

2.3. Influence of LMS on Student Engagement, Collaboration, and Time Management

Learning Management Systems (LMS) have demonstrated significant potential in enhancing student engagement, collaboration, and time management in higher education. Through features like interactive discussion boards, group projects, and real-time communication tools, LMS fosters active participation and collaboration among students and instructors. For instance, Al-Adwan et al. (2021) found that students using LMS reported higher levels of peer engagement and a better understanding of course materials. Time management is another area where LMS excels, providing students with structured schedules, reminders, and access to course materials at their convenience. Gyamfi et al. (2022) revealed that LMS users spent 20% less time searching for resources compared to their counterparts using traditional methods. These benefits highlight the capacity of LMS to create a more organized and interactive learning environment, particularly in institutions seeking to enhance academic productivity.

Empirical comparisons of engagement metrics between LMS users and students relying on traditional methods further underscore the effectiveness of digital platforms. Research by Adeoye and Adanikin (2020) demonstrated that students using LMS participated in course-related discussions 35% more frequently than those in traditional settings. The study also found that LMS users were more likely to submit assignments on time due to automated notifications and centralized submission portals. In a similar study, Ansong and Boateng (2022) noted that institutions with fully integrated LMS frameworks reported a 28% increase in classroom interaction, particularly during blended learning sessions. These comparative metrics suggest that LMS not only improves academic engagement but also bridges gaps in communication and resource access, making it a critical tool in modern education.

Several studies have reported enhanced productivity and academic performance through the adoption of LMS. Tadesse and Gillies (2021) observed that Ethiopian universities using LMS recorded a 15% improvement in student performance, attributing this to the system's ability to provide tailored feedback and support self-paced learning. Another study by Obilor and Onuoha (2021) in Nigeria found that students utilizing LMS achieved higher grades in assessments compared to those in traditional classrooms. The researchers credited this improvement to features like immediate feedback on quizzes and access to diverse learning materials. These findings align with global trends, as highlighted by Lim et al. (2020a), who noted that LMS fosters a sense of accountability and active participation among students. The ability of LMS to enhance both engagement and academic outcomes underscores its growing relevance in higher education.

Despite its advantages, some studies argue that LMS can lead to disengagement if not implemented effectively. Overreliance on digital tools may reduce face-to-face interactions, which are crucial for developing interpersonal skills. Gyamfi et al. (2022) recommended a blended approach, combining LMS with traditional methods to mitigate this risk. Furthermore, challenges such as technical issues and lack of motivation to use LMS have been documented. Adeoye and Adanikin (2020) emphasized the need for comprehensive training and support systems to address these issues. These alternative views highlight the importance of strategic implementation and continuous improvement of LMS to ensure its effectiveness in fostering engagement and productivity.

The review demonstrates that LMS significantly enhances student engagement, collaboration, and productivity while addressing traditional challenges such as resource accessibility and time management. However, the barriers and limitations identified indicate the need for contextualized strategies to optimize LMS usage. This study seeks to explore the impact of LMS on academic engagement and productivity at the University of Cape Coast, focusing on its effectiveness in a Ghanaian higher education context. The findings will provide actionable recommendations for improving LMS implementation and fostering academic success.

2.4. Institutional and Social Challenges in Transitioning to LMS

The transition to Learning Management Systems (LMS) often faces significant institutional and social challenges. Resistance to change is one of the most common issues, as faculty and students accustomed to traditional teaching methods may be hesitant to adopt new digital platforms. Technical issues, such as server downtime and software incompatibility, further complicate the process. Gyamfi et al. (2022) found that approximately 40% of instructors in Ghanaian universities expressed difficulty in integrating LMS into their teaching routines due to inadequate training and support. Additionally, inequitable access to technology remains a pressing concern, with students in remote areas struggling to participate fully due to unreliable internet connectivity and the high cost of devices. These challenges highlight the need for institutions to address both human and technical barriers to ensure successful LMS adoption.

Several case studies have documented the difficulties universities face when implementing LMS. In a study by Adeoye and Adanikin (2020), a Nigerian university experienced significant setbacks due to inadequate ICT infrastructure and poor digital literacy among students and faculty. The study revealed that only 25% of faculty members had received formal training on LMS usage, leading to low adoption rates and dissatisfaction among students. Similarly, Ansong and Boateng (2022) explored the experiences of a Ghanaian university transitioning to LMS during the COVID-19 pandemic. Their findings showed that frequent system crashes and limited technical support discouraged faculty from using the platform effectively. These case studies emphasize the importance of addressing systemic challenges, such as infrastructure deficits and insufficient training, to optimize LMS usage.

Developing regions, including Ghana, face unique challenges in transitioning to LMS. Limited resources often hinder the establishment of robust ICT infrastructure necessary for LMS functionality. For instance, Gyamfi et al. (2022) noted that only 35% of Ghanaian universities have the bandwidth required to support large-scale online learning activities. Moreover, cultural factors, such as the preference for face-to-face interactions, contribute to slow adoption rates. Financial constraints are another critical issue, with many universities unable to afford premium LMS platforms or provide subsidized internet access for students. Adeoye and Adanikin (2020) highlighted how these factors disproportionately affect rural institutions, further widening the digital divide in education. These region-specific challenges necessitate targeted interventions to support LMS adoption in developing countries.

Despite these challenges, alternative perspectives suggest that gradual implementation and blended learning models could ease the transition to LMS. A study by Tadesse and Gillies (2021) recommended phased LMS adoption, starting with basic functionalities like resource sharing before scaling up to interactive features. Furthermore, partnerships with telecommunications companies to provide affordable internet packages for students have been suggested as a practical solution.

Ansong and Boateng (2022) also proposed localized training programs to build digital literacy among faculty and students. These strategies highlight the importance of context-specific approaches to overcome barriers to LMS implementation.

The review demonstrates that transitioning to LMS in developing regions like Ghana involves navigating institutional, technical, and social challenges. While resistance to change and infrastructural deficits are common hurdles, targeted strategies such as blended learning and capacity-building initiatives can mitigate these issues. This study seeks to explore these challenges at the University of Cape Coast, providing actionable insights for improving LMS adoption. By addressing these barriers, the findings aim to contribute to the broader discourse on enhancing digital learning in developing regions.

2.5. Comparative Benefits and Limitations of Traditional and LMS Approaches

Traditional teaching methods have long been celebrated for their benefits, particularly the emphasis on face-to-face interaction and immediate feedback. These methods allow instructors to gauge students' comprehension in real-time, fostering a dynamic and engaging classroom environment. Gyamfi and Opoku (2021) emphasized that physical classrooms enable better rapport between instructors and students, improving the overall learning experience. Immediate feedback from teachers during in-person sessions often clarifies doubts and reinforces understanding. However, traditional methods are not without their drawbacks, including limited scalability and difficulty accommodating diverse learning paces. These limitations highlight the need for alternative approaches that address these shortcomings.

In contrast, Learning Management Systems (LMS) offer flexibility, scalability, and personalized learning experiences. LMS platforms like Moodle and Blackboard allow students to access course materials anytime and anywhere, making learning more adaptable to individual schedules. Moreover, the scalability of LMS enables institutions to accommodate large numbers of students without overburdening resources. Tadesse and Gillies (2021) noted that LMS features, such as automated assessments and progress tracking, empower students to take control of their learning pace, promoting self-regulated learning. However, the lack of direct interpersonal interaction in LMS environments can hinder the development of critical thinking and problem-solving skills, which are often nurtured through classroom discussions.

Empirical evidence underscores the comparative outcomes of these two methods. Ansong and Boateng (2022) conducted a study in Ghana, comparing academic performance between students relying solely on traditional teaching and those using LMS. The study found that LMS users demonstrated a 15% improvement in their final grades, attributed to enhanced access to resources and self-paced learning. Similarly, Adeoye and Adanikin (2020) highlighted that students

using LMS reported higher satisfaction levels due to the convenience of accessing materials and interactive tools like discussion forums. These studies illustrate that while traditional methods excel in fostering interpersonal skills, LMS provides a more flexible and resource-rich environment for academic growth.

Despite the evident benefits of LMS, some educators advocate for a blended learning approach, combining the strengths of both traditional and digital methods. Tadesse and Gillies (2021) argued that hybrid models allow students to benefit from face-to-face interactions while leveraging the flexibility and resources of LMS. Additionally, concerns about the lack of interpersonal interaction in LMS environments could be mitigated by incorporating virtual classroom features and collaborative tools. Gyamfi and Opoku (2021) suggested that integrating synchronous and asynchronous components within LMS platforms can create a balanced learning experience, retaining the immediacy of traditional feedback while offering the advantages of digital learning.

The comparative analysis of traditional and LMS approaches reveals that both methods have unique strengths and limitations. While traditional methods excel in fostering interpersonal communication and real-time feedback, LMS offers unparalleled flexibility and accessibility. This study aims to explore how these dynamics manifest at the University of Cape Coast, examining the comparative benefits and challenges of both approaches. By identifying best practices and potential integration strategies, the findings will contribute to enhancing the effectiveness of teaching methods in higher education.

2.6. The Role of Institutional Support in LMS Success

Institutional support is critical to the successful adoption and utilization of Learning Management Systems (LMS) in higher education. Policies that prioritize digital transformation, adequate training for faculty and students, and investments in technological infrastructure significantly influence the effectiveness of LMS. Without such support, the transition to digital learning platforms often encounters significant barriers, including user resistance and technical challenges. As noted by Marfo and Ofori-Danso (2020), universities with clear, well-implemented LMS policies tend to experience smoother adoption processes and higher user satisfaction. These policies often include guidelines for course integration, monitoring, and evaluation, ensuring a structured approach to LMS deployment.

Training programs also play an essential role in institutional support for LMS success. Providing faculty with technical skills and pedagogical strategies for digital teaching ensures they can effectively utilize LMS features to enhance learning. Students, too, require orientation to maximize the benefits of these platforms. Ansong and Boateng (2022) highlighted that training programs in Ghanaian universities improved LMS usage rates by 30%, as both instructors and students gained confidence in navigating the system. Such training bridges the digital literacy gap, addressing a common challenge in developing regions.

Investment in infrastructure is another pivotal aspect of institutional support.

Reliable internet connectivity, functional computer labs, and regular system upgrades are necessary to sustain LMS operations. Tadesse and Gillies (2021) found that universities with robust infrastructure were more likely to report positive outcomes in LMS adoption, as technical issues were minimized. For instance, institutions in Ethiopia with well-equipped ICT centers experienced 25% fewer system downtimes than those lacking such resources. This highlights how infrastructure investments directly impact the usability and effectiveness of LMS.

Several universities have demonstrated the value of institutional support in facilitating LMS success. For example, the University of Johannesburg in South Africa implemented a comprehensive training program for staff and students during its transition to Blackboard, resulting in a 40% increase in course enrollment on the platform (Adeoye & Adanikin, 2020). Similarly, the University of Nairobi in Kenya invested in upgrading its ICT infrastructure, enabling seamless adoption of Moodle across its departments (Tadesse & Gillies, 2021). These examples underscore the importance of a multi-faceted approach to institutional support, combining policies, training, and infrastructure development.

The examination of institutional support underscores its importance in shaping the success of LMS adoption. For the University of Cape Coast, understanding the role of policies, training programs, and infrastructure investments provides a framework for assessing the challenges and opportunities associated with its LMS. The findings of this study will contribute to developing tailored recommendations for enhancing institutional support, ultimately improving LMS effectiveness and student outcomes

2.7. Research Gaps in LMS Effectiveness and Adoption

Despite the growing body of research on Learning Management Systems (LMS), significant gaps persist, particularly in the Ghanaian context. While numerous studies explore LMS adoption globally, relatively few examine the comparative effectiveness of LMS and traditional methods in Ghanaian universities. This gap limits the understanding of how these learning methods influence student engagement, academic outcomes, and institutional success within the unique socio-cultural and infrastructural framework of Ghana. As highlighted by Ansong and Boateng (2022), most existing studies focus on technological readiness rather than pedagogical effectiveness, leaving a critical void in comparative research that evaluates these methods in real-world educational settings.

Moreover, there is limited emphasis on user satisfaction and its role in determining the long-term impact of LMS adoption on academic performance. Existing studies often prioritize technical efficiency and accessibility, overlooking students' and instructors' experiences with LMS platforms. Akoto and Owusu (2021) observed that while Moodle has been widely adopted in Ghana, there is inadequate feedback on its usability and effectiveness from the primary users—students and faculty. This gap is significant because user satisfaction influences continued usage and determines the overall success of LMS integration in higher

education.

Another critical gap in the literature is the limited focus on the long-term impacts of LMS adoption on academic performance. Studies conducted by Tadesse and Gillies (2021) primarily assess short-term metrics, such as increased participation and submission rates, without delving into how sustained LMS use affects critical indicators like graduation rates, retention, and job readiness. The lack of longitudinal studies in the Ghanaian context hinders the ability to draw robust conclusions about the transformative potential of LMS in enhancing academic productivity over time.

These gaps present an opportunity for this study to address the comparative effectiveness of LMS and traditional teaching methods at the University of Cape Coast. By focusing on user satisfaction and evaluating the long-term academic impacts of LMS, this research will contribute valuable insights to the literature. Additionally, it will provide a context-specific analysis that informs policy decisions and practices in Ghanaian universities, bridging the current gaps and advancing digital education strategies.

3. Research Method

3.1. Research Design

The study employed a comparative research design, which effectively aligned with the study objectives by enabling a systematic comparison of student performance, engagement, and satisfaction between Learning Management Systems (LMS) and traditional teaching methods. This design facilitated a thorough evaluation of quantitative differences in academic outcomes while incorporating qualitative insights to understand experiences and challenges associated with both methods. By combining these elements, the design ensured a holistic analysis of the effectiveness of LMS in the academic context at UCC. Additionally, the research design supported the triangulation of data by integrating multiple data collection tools like surveys, focus group discussions, and academic performance records. This approach enhanced the depth and reliability of the findings, allowing the study to achieve its purpose of evaluating the influence of LMS adoption on student outcomes compared to traditional methods.

3.2. Study Area

The research was conducted at the University of Cape Coast (UCC), located in the Central Region of Ghana. The UCC is renowned for its diverse student body and strong emphasis on academic excellence, making it an ideal setting to study the impact of LMS. The university operates a well-established digital learning infrastructure, including a Learning Management System that serves as the primary platform for delivering academic content to students. The selection of UCC as the study area was based on its progressive implementation of LMS and the co-existence of traditional teaching methods, providing a natural platform for comparison. Furthermore, UCC's student population includes a broad mix of undergrad-

uate and postgraduate learners, ensuring diverse perspectives in the data collection process.

3.3. Study Population

The study targeted students and faculty at UCC. The student population on the main campus exceeds 20,000, while the faculty comprises over 500 academic staff members. The target population was chosen because it represents the primary users of LMS and traditional methods in academic activities. Table 1 provides an overview of the study population.

Table 1. Study population.

Group	Population Size	Justification
Undergraduate students	15,000	Represent the majority of LMS users at UCC
Postgraduate students	5000	Include learners with advanced perspectives on LMS usage
Faculty members	500	Deliver course content using LMS and traditional methods

3.4. Sample and Sampling Techniques

The sample for the study was derived using Krejcie and Morgan's sampling formula, which requires a minimum sample size of 384 for a population exceeding 20,000. To ensure proportional representation, stratified random sampling was employed to select participants from the undergraduate and postgraduate student populations and faculty. The steps for calculating the sample size are illustrated below:

$$n = \frac{N * Z^2 * p * (1-p)}{e^2 * (N-1) + Z^2 * p * (1-p)}$$

where:

- n = Sample size
- N = Population size (20,000 students)
- Z = Z-score (1.96 for 95% confidence level)
- P = Proportion (0.5, assuming maximum variability)
- e = Margin of error (0.05)

Using this formula, the sample size was approximately 384 students. Additional participants were recruited to account for non-responses. Table 2 outlines the derived sample distribution.

Table 2. Sample distribution.

Category	Population Size	Sample Size	Sampling Technique
Undergraduate students	15,000	300	Stratified random sampling
Postgraduate students	5000	75	Stratified random sampling
Faculty members	50	9	Purposive sampling

3.5. Data Collection Instrument

Data were collected using secondary data, a structured questionnaire and semi-structured interview guides. The Utrecht Work Engagement Scale (UWES) was adapted to measure student engagement in this study, focusing on its three core dimensions: vigor, dedication, and absorption. Vigor assessed students' energy levels and willingness to persist with academic tasks, while dedication evaluated their sense of purpose, enthusiasm, and involvement in their studies. Absorption examined the degree to which students became deeply engrossed in their academic activities, both in traditional and LMS-based settings. The 17-item version of UWES was tailored to suit the context of learning environments, with questions modified to reflect academic experiences. Responses were recorded on a Likert scale ranging from 1 ("never") to 7 ("always"), allowing for a comprehensive assessment of engagement levels.

Data collection involved administering the UWES through an online survey to students who had experience with both traditional learning and LMS platforms. This ensured comparability across the two methods. Statistical analyses like reliability testing using Cronbach's alpha were performed to confirm the internal consistency of the scale within the academic context. The results from the UWES provided quantitative measures of engagement, which were later correlated with academic performance to determine whether higher engagement levels were associated with improved outcomes in LMS-based learning compared to traditional methods.

Concerning the students' performance, the data on students' academic performance were retrieved from the Records Section of the Directorate of Academic Affairs at the University of Cape Coast. This included grades from traditional in-person examinations and assessments conducted through the LMS. The dataset spanned the last three academic years to ensure sufficient variability and robustness. Performance metrics, such as grade point averages (GPA) and scores on specific assignments, were collected for courses where LMS had been fully integrated alongside courses that utilized traditional teaching and assessment methods.

A comparative analysis was conducted to evaluate differences in performance between the two instructional methods. For consistency, only courses with similar credit weightings and evaluation criteria were included in the analysis. The data were anonymized to protect student confidentiality, and ethical clearance was obtained to access these records. By integrating performance data with engagement measures from the UWES, the study sought to uncover patterns linking engagement levels with academic outcomes under different learning approaches, providing insights into the efficacy of LMS in enhancing academic success.

The interview guide complemented the quantitative data by exploring faculty and student experiences with LMS and traditional methods in depth. Both instruments were pilot-tested with 20 participants to ensure clarity, reliability, and validity before full deployment. Respondents were invited through official university communication channels, including emails and announcements via the LMS plat-

form. Students and faculty received detailed information about the study, including its purpose, confidentiality assurances, and voluntary nature of participation.

3.6. Data Analysis

The normality test was conducted on the students' performance and engagement data to assess the distribution of these variables, which is a crucial step in determining the appropriate statistical analysis method. According to statistical theory, parametric tests which rely on certain assumptions about the data, including normality, provide more powerful and reliable results when the data follows a normal distribution. In contrast, non-parametric tests are typically used when the data violates normality assumptions (Field, 2018). To assess this assumption, the Kolmogorov-Smirnov (K-S) test was selected as it is a non-parametric test commonly used to determine whether a sample follows a normal distribution. The K-S test compares the sample's cumulative distribution with a reference distribution, and a significant result indicates a deviation from normality (Mauchly et al., 2017).

The Kolmogorov-Smirnov test was chosen for this study because it is particularly effective for small to medium-sized samples and can handle multiple distributions (Ghasemi & Zahediasl, 2012). If the test indicated that the data followed a normal distribution, a parametric test like ANOVA would be employed to examine relationships and differences between student performance in traditional versus LMS-based learning environments. These tests assume that the underlying data are normally distributed and homogeneously spread, which allows them to provide more precise estimates and inferences. Conversely, if the Kolmogorov-Smirnov test showed that the data significantly deviated from normality, non-parametric alternatives like the Mann-Whitney U test or Kruskal-Wallis test would be chosen, as they do not require the normality assumption (Pallant, 2020).

Parametric tests like t-tests and analysis of variance (ANOVA) are typically used when the following conditions are met: (a) the data are interval or ratio level, (b) the data are approximately normally distributed, (c) there is homogeneity of variance (i.e., similar spread of data points across groups), and (d) the observations are independent (Field, 2018). These conditions ensure the validity of the results obtained from parametric tests. If the normality assumption is violated, using parametric tests can lead to misleading conclusions, especially in small sample sizes where deviations from normality are more pronounced.

On the other hand, non-parametric tests, such as the Mann-Whitney U test or Kruskal-Wallis test, are used when the assumptions for parametric tests are not met. These tests do not require the data to be normally distributed and are appropriate for ordinal data or when sample sizes are small. Non-parametric methods are more flexible and robust in the presence of skewed distributions or outliers (Pallant, 2020). By performing the Kolmogorov-Smirnov normality test, this study ensured that the chosen analytical method—whether parametric or non-parametric—was appropriate for the data characteristics, thereby increasing the accuracy and reliability of the findings.

3.7. Results of the Normality Test

The results in Table 3 indicate that both the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) tests were performed to assess the normality of the data for students' performance and engagement. The *p*-values associated with these tests provide critical information for determining whether the data follows a normal distribution. For students' performance, the K-S test yielded a statistic of 0.108 and a *p*-value of 0.000, while the S-W test produced a statistic of 0.849 and a *p*-value of 0.000. Similarly, for students' engagement, the K-S test resulted in a statistic of 0.118 and a *p*-value of 0.000, with the S-W test producing a statistic of 0.523 and a *p*-value of 0.000. In both cases, the *p*-values are less than the conventional significance threshold of 0.05, indicating that the null hypothesis of normality is rejected. This implies that the data for both students' performance and engagement significantly deviate from a normal distribution.

Given the results of the normality tests, non-parametric analysis techniques are more appropriate for this study. Non-parametric methods do not require the assumption of normality and are robust for analysing data that is skewed, has outliers, or is not normally distributed (Ghasemi & Zahediasl, 2012). For this study, using non-parametric tests ensures that the findings are reliable and unbiased, given the data's non-normal distribution. Since the study aimed to compare groups involving performance and engagement, the Mann-Whitney U test is a suitable alternative to their parametric counterparts like t-tests or Pearson's correlation. These non-parametric tests are effective for ordinal data or interval data that do not meet normality assumptions, which aligns with the current findings. The non-normality of both performance and engagement data justifies the use of non-parametric methods for statistical analysis. This approach ensures that the study's results are valid and reliable, adhering to the principles of sound statistical practice.

Table 3. Tests of normality.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Performance	0.108	3799	0.000	0.849	3799	0.000
Engagement	0.118	3799	0.000	0.523	3799	0.000

4. Results and Discussion

4.1. Descriptive Analysis

The descriptive statistics for students' performance and engagement in Table 4 provide insights into the central tendency, variability, and distribution of the data:

- **Performance**: The mean score is 63.58, with a standard deviation of 17.264. This indicates a moderate level of variability, suggesting that while most students performed around the mean, there was some spread in their scores. The minimum score is 0, and the maximum is 98, suggesting a wide range of per-

formance levels among students. The 25th percentile is 57.00, the median (50th percentile) is 66.00, and the 75th percentile is 75.00. This implies that 50% of students scored between 57 and 75, with the median representing a central tendency that aligns closely with the mean.

- **Engagement**: The mean engagement score is 55.03, with a higher standard deviation of 18.932 compared to performance. This suggests greater variability in engagement levels among students. Engagement scores range from 0 to an outlier at 899, indicating the presence of extreme values that might distort the results. The percentiles (25th = 47.00, median = 55.00, 75th = 63.00) reveal that 50% of students' engagement levels fall between 47 and 63, with a median aligning with the mean, discounting the impact of outliers.
- **Mode of Exams (Mode_Exams)**: This variable has a mean of 1.54 and a standard deviation of 0.499, indicating that most students predominantly used one of two modes for examinations (coded as 1 and 2). Percentiles show that the majority of students utilized the second mode, as the median (50th percentile) and 75th percentile both align with 2.

Table 4. Descriptive test.

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Performance	3799	63.58	17.264	0	98	57.00	66.00	75.00
Engagement	3799	55.03	18.932	0	899	47.00	55.00	63.00
Mode Exams	3799	1.54	0.499	1	2	1.00	2.00	2.00

The descriptive statistics reveal variability in both performance and engagement. However, the large range and the presence of extreme values in engagement (maximum = 899) suggest the need for further investigation, such as whether these outliers represent data entry errors or legitimate but rare occurrences. Given the rejection of normality in the Kolmogorov-Smirnov and Shapiro-Wilk tests (as discussed earlier), the Mann-Whitney U test is appropriate for analyzing differences between groups in performance and engagement. This non-parametric test is robust against non-normal distributions and is well-suited to datasets with outliers or skewed distributions.

The findings align with the literature on the variability of performance and engagement among students using different modes of learning. Studies, such as those by Lim et al. (2020b), have demonstrated that students in digital learning environments often exhibit a wide range of engagement levels due to disparities in digital literacy, access to resources, and intrinsic motivation. Similarly, Geng et al. (2021) found that performance scores in blended learning settings show moderate variability, influenced by both teaching methods and individual student factors. The wide range of scores in performance and engagement aligns with challenges identified in the literature, such as differences in self-regulated learning and

the effectiveness of digital tools. The descriptive statistics suggest that while many students benefit from the flexibility of LMS-based methods, others may struggle due to inadequate support or unfamiliarity with the platform.

These findings emphasize the importance of institutional support in bridging engagement gaps and optimizing performance outcomes, as noted by Garrison & Vaughan (2019). The descriptive findings set a foundation for the Mann-Whitney U test, which will examine differences in performance and engagement based on groups such as those using LMS versus traditional methods. Since the data does not meet normality assumptions, this test will provide a robust comparison and help identify whether engagement or performance outcomes are significantly different across teaching modes.

4.2. Comparative Analysis

The results in Table 5 provide insights into the comparison of students' performance and engagement between traditional and LMS-based modes of examination. Regarding the students' performance, the mean rank for students using traditional methods is 1903.74, while for LMS users, it is 1896.79. This slight difference suggests minimal variation in performance outcomes between the two groups. Also, The Mann-Whitney U value is 1,786,759.500, and the corresponding Z-value is −0.195, with an asymptotic significance (2-tailed) of 0.846. Since the *p*-value is greater than 0.05, there is no statistically significant difference in performance between students using traditional methods and those using LMS.

Table 5. Mann-Whitney U test.

	Mode Exams		N	Mean Rank	Sum of Ranks
Mann-Whitney Test	Performance	Traditional	1753	1903.74	3337259.50
		LMS	2046	1896.79	3880840.50
		Total	3799		
	Engagement	Traditional	1753	1966.73	3447673.00
		LMS	2046	1842.83	3770427.00
		Total	3799		

		Performance	Engagement
Test Statistics	Mann-Whitney U	1786759.500	1676346.000
	Wilcoxon W	3880840.500	3770427.000
	Z	−0.195	−3.472
	Asymp. Sig. (2-tailed)	0.846	0.001

Concerning student engagement, the mean rank for traditional users is 1966.73, while for LMS users, it is 1842.83. This difference suggests that students using traditional methods reported slightly higher engagement levels. The Mann-Whitney U value is 1,676,346.000, and the Z-value is −3.472, with an asymptotic sig-

nificance (2-tailed) of 0.001. Since the *p*-value is less than 0.05, the difference in engagement levels between the two groups is statistically significant, with students using traditional methods showing greater engagement.

4.3. Implications for Study Objectives

These findings have implications for the study's objectives to compare performance and engagement across LMS and traditional methods; the lack of a significant difference in performance suggests that both methods are equally effective in supporting academic outcomes. This aligns with the objective of evaluating whether LMS provides comparable results to traditional methods in student performance. The significant difference in engagement indicates that traditional methods might better foster student interaction and focus, a key element to consider when transitioning fully to LMS-based learning systems.

4.4. Discussion of Findings in Relation to Literature

The findings on performance align with studies like Lim et al. (2020a) and Garrison & Vaughan (2019), which report no significant differences in academic outcomes between LMS-based and traditional teaching methods, provided that both approaches are well-implemented. These studies suggest that performance is more influenced by content quality and delivery than the mode of teaching. However, the results on engagement contrast with research by Geng et al. (2021), which found higher engagement levels among LMS users due to the flexibility and interactive tools available. The lower engagement scores for LMS in this study could reflect challenges such as limited digital literacy, inadequate infrastructure, or resistance to technology adoption, which are common in developing regions like Ghana (Asare et al., 2022). Alternative perspectives argue that LMS systems require robust institutional support to maximize engagement (Morris et al., 2020).

Institutions that invest in digital training, better LMS interfaces, and active monitoring report higher engagement, which might not have been the case for the LMS users in this context. The results indicate that while LMS and traditional methods perform similarly in supporting academic performance, traditional methods currently foster better engagement among students. This suggests that LMS adoption in higher education settings like Ghana should prioritize addressing barriers to engagement, such as usability and infrastructure support. Institutions may need to combine the strengths of both methods to achieve optimal outcomes.

4.5. Confirmatory Test

Regarding the student's performance, for the Observed Control Group Span, the span for traditional (control) mode is 3722, with a significance value (1-tailed) of 0.000. This indicates that there is a statistically significant difference in the variability of performance between the control and experimental groups. After trimming outliers from both ends, the span decreases to 3371, with a 1-tailed signifi-

cance value of 0.010. Although the significance has decreased, it still suggests that the variability in performance between the two modes (traditional and LMS) remains statistically significant, even when accounting for extreme values. A total of 87 outliers were trimmed from each end, indicating some extreme performance scores that could affect variability.

Regarding student engagement, the observed span for the traditional (control) mode is 3780, with a significance value (1-tailed) of 0.000. This suggests a statistically significant difference in the variability of engagement between the control and experimental groups. After outliers are removed, the trimmed span is 3486, and the 1-tailed significance value becomes 1.000. This indicates that once outliers are accounted for, there is no longer a significant difference in engagement variability between traditional and LMS users. Similar to performance, 87 outliers were trimmed from each end.

4.6. Comparison of Performance and Engagement

Concerning the performance, the significant differences in variability across both observed and trimmed spans suggest that the traditional (control) method exhibits more consistency in students' performance compared to the LMS (experimental) group. This may imply that LMS usage introduces greater variation in performance outcomes, possibly due to disparities in digital literacy or access to LMS resources among students. For engagement, the initial significant difference in variability disappears when outliers are removed. This implies that any observed difference in engagement variability was driven by extreme cases, suggesting that LMS and traditional methods might have comparable engagement levels when extreme values are excluded.

4.7. Discussion

The observed greater variability in LMS performance is consistent with studies like Geng et al. (2021) and Asare et al. (2022), which highlight how factors like digital access and individual readiness can create disparities in LMS outcomes. However, it contrasts with the findings by Lim et al. (2020b), who report similar performance consistency across LMS and traditional methods in regions with adequate LMS infrastructure. The disappearance of significant differences in engagement variability post-outlier trimming aligns with studies like Morris et al. (2020), which argue that engagement variability is often a product of infrastructure gaps and resistance to LMS adoption. Yet, it disagrees with the results by Garrison & Vaughan (2019), who report consistently higher engagement with LMS due to interactive and flexible tools.

The Moses Test results indicate that variability in performance is significantly higher with LMS, suggesting a need for targeted interventions to address disparities in digital access and preparedness. For engagement, the results underscore the importance of addressing outliers (e.g., students with exceptionally low or high engagement levels) to ensure equitable outcomes. These findings emphasize the

necessity of institutional support to optimize the benefits of LMS while minimizing variability and enhancing student engagement. (Table 6)

Table 6. Moses test.

		Mode Exams	N	
Frequencies	Performance	Traditional (Control)	1753	
		LMS (Experimental)	2046	
		Total	3799	
	Engagement	Traditional (Control)	1753	
		LMS (Experimental)	2046	
		Total	3799	
			Performance	Engagement
Test Statistics	Observed Control Group Span		3722	3780
		Sig. (1-tailed)	0.00	0.000
	Trimmed Control Group Span		3371	3486
		Sig. (1-tailed)	0.010	1.000
	Outliers Trimmed from each End		87	87

5. Summary

The study's findings reveal nuanced insights into the impact of LMS and traditional methods on student performance and engagement. While there is no significant difference in the average performance of students using LMS compared to traditional methods, the variability in performance outcomes is significantly higher in LMS users, even after controlling for outliers. For engagement, initial significant differences in variability were nullified after trimming outliers, suggesting that both LMS and traditional methods are comparable in promoting overall student engagement. These results emphasize that while LMS offers innovative opportunities, its adoption is accompanied by challenges related to performance disparities. The study contributes to the ongoing discourse on the effectiveness of LMS in academia. It aligns with prior studies that highlight the flexibility and scalability of LMS for modern education (Garrison & Vaughan, 2019) but also underscores concerns about disparities in performance linked to digital preparedness and equitable access (Geng et al., 2021). The findings reinforce the need for careful contextualization of LMS adoption in resource-constrained environments, like Ghana, where infrastructural and cultural readiness play pivotal roles.

The study underscores the potential of LMS to transform academia by fostering personalized and flexible learning environments. However, the higher variability in performance among LMS users suggests that the integration of LMS requires complementary interventions to address disparities. These may include tailored training programs, improved technical support, and equitable access to digital de-

vices and internet connectivity. Without such measures, the benefits of LMS might disproportionately favuor students who are already digitally literate, leaving others behind. The findings provide critical data points for university administrators to make evidence-based decisions regarding technology integration. While LMS holds great promise for enhancing learning outcomes and engagement, its adoption cannot fully replace traditional methods at this stage. Instead, management must recognize the value of a blended approach, leveraging the strengths of both LMS and traditional methods. This approach will cater to the diverse needs of the student population, mitigating disparities while maximizing academic outcomes.

Recommendations for UCC

1) Adopt a Blended Learning Model: UCC should maintain and integrate both LMS and traditional methods into its academic activities. A blended learning model combines the flexibility and scalability of LMS with the interpersonal interaction and structure of traditional methods. This approach is particularly effective for addressing the diverse needs and challenges identified in the study.

2) Invest in Digital Readiness Programs: Management should implement targeted training programs for both students and faculty to improve digital literacy and maximize LMS utilization. This would help reduce the performance variability observed among LMS users.

3) Address Infrastructure Gaps: The university must invest in equitable access to resources such as stable internet connectivity, user-friendly devices, and technical support systems to ensure that all students can effectively engage with LMS.

4) Conduct Regular Evaluations: UCC should periodically evaluate the effectiveness of LMS and its impact on student outcomes. These evaluations should inform adjustments in policy and practice to optimize the integration of technology in academia.

Based on the findings, UCC should not completely transition to LMS nor rely solely on traditional methods. Instead, a hybrid approach that combines both systems is ideal. By doing so, the university can leverage the advantages of each method while minimizing their limitations, ensuring that all students have access to a high-quality, inclusive learning experience. This approach aligns with global best practices in higher education and positions UCC as a leader in innovative and equitable academic delivery.

6. Outcomes of Interviews and Focus Group Discussions on LMS Challenges

The interviews and focus group discussions revealed that digital literacy, infrastructure, resistance to change, cost of access, technical issues, and institutional support are critical barriers to LMS adoption. Participants unanimously emphasized the need for targeted interventions, such as training programs, infrastructural investments, and institutional support, to address these challenges and maximize the benefits of LMS in academia.

Lack of Digital Literacy

Interview Outcome: Faculty members and students repeatedly expressed frustration with navigating LMS platforms. A lecturer mentioned, "*I find it difficult to create quizzes or upload lecture notes. Sometimes, I don't even know where to start.*" Similarly, a student noted, "*We were not trained on how to use the LMS, so I struggle to submit assignments.*"

Focus Group Discussion Outcome: Students highlighted that many peers' resort to trial and error to figure out the platform. Some suggested implementing hands-on workshops to improve proficiency. Faculty participants emphasized the need for regular technical training to keep up with the system's updates and functionalities.

Inadequate Infrastructure

Interview Outcome: Both faculty and students identified poor internet connectivity as a significant obstacle. One student shared, "*I live in a rural area, and the internet there is so bad that I often miss submission deadlines.*" Faculty also expressed concerns about the lack of reliable electricity, with one lecturer stating, "*Sometimes I can't conduct online classes because of power outages.*"

Focus Group Discussion Outcome: Students in rural communities pointed out that limited access to computers or smartphones compounded the problem. Faculty added that some lecture halls lack the infrastructure to fully support LMS integration, such as projectors or Wi-Fi. Participants proposed that the institution should collaborate with telecommunications providers to improve connectivity and subsidize devices for students in need.

Resistance to Change

Interview Outcome: Faculty members were hesitant to move away from traditional teaching methods. One lecturer remarked, "*I've been teaching for 20 years, and I'm comfortable with face-to-face teaching. The LMS feels impersonal and less effective.*" On the student side, a participant said, "*It's hard to stay motivated when there's no in-person interaction with classmates and lecturers.*"

Focus Group Discussion Outcome: Both groups acknowledged a lack of awareness about the potential benefits of LMS. Faculty suggested that showcasing successful LMS adoption stories could help reduce resistance, while students recommended integrating LMS with traditional methods to ease the transition.

Cost of Access

Interview Outcome: Students from low-income households emphasized the financial strain of accessing LMS resources. One student mentioned, "*Buying data every week just to download lecture slides and attend Zoom sessions is expensive.*" Faculty also observed that some students missed online assignments due to their inability to afford consistent internet access.

Focus Group Discussion Outcome: Students recommended providing subsidized data bundles or free access to educational platforms, as practiced in some universities. Faculty suggested lobbying for government support or grants to provide devices and internet access for underprivileged students.

Technical Issues and Platform Usability

Interview Outcome: Faculty and students frequently encountered glitches and usability issues. A lecturer shared, "*Sometimes the LMS crashes when too many students try to access it during exams.*" A student added, "*The interface is confusing. It takes me forever to find my course materials.*"

Focus Group Discussion Outcome: Participants noted the need for more user-friendly designs and improved technical support. Students suggested incorporating a chatbot or helpline for real-time assistance, while faculty proposed hiring more IT staff to promptly address issues.

Lack of Institutional Support

Interview Outcome: Both groups highlighted insufficient institutional support as a key barrier. One faculty member remarked, "*We don't get enough training or encouragement to use the LMS. It's like we're expected to figure it out on our own.*" Students also expressed frustration, with one saying, "*We need someone to guide us when we face problems, but support is hard to find.*"

Focus Group Discussion Outcome: Faculty called for comprehensive onboarding programs, including mandatory LMS training for all new hires and students. Students recommended creating a dedicated LMS support team to handle user issues and conduct periodic feedback sessions to improve the system.

7. Summary of Observations

Engagement Lower in LMS Environments Despite Interactive Tools: Engagement in LMS environments was observed to be lower despite the availability of interactive tools due to several factors highlighted in the qualitative discussions. First, many students reported struggling with digital literacy, which limited their ability to maximize the interactive features of the LMS. Second, some students expressed a preference for face-to-face interaction with instructors and peers, which they felt fostered stronger interpersonal connections and accountability. Additionally, technical issues like unstable internet connectivity and delayed feedback from instructors hindered real-time collaboration, reducing the overall engagement. This aligns with findings from Adarkwah (2022), which indicate that effective engagement with LMS tools requires both technical support and digital readiness.

Short-Term Steps for Implementing a Hybrid Learning Model: Training and capacity-building initiatives should be prioritized, with mandatory workshops for students and faculty to enhance digital literacy and ensure familiarity with LMS features. Infrastructure must also be upgraded to provide stable internet connectivity and reliable power supply, both on campus and in remote areas, to support seamless access to online tools. A pilot phase is recommended, where a select number of courses are delivered in the hybrid format, allowing for feedback collection and iterative adjustments before scaling up the model. Additionally, the development of clear institutional policies and guidelines is crucial. These should outline standards for course design, workload distribution, and assessment strategies to ensure consistency and fairness in implementation. Establishing a robust

feedback mechanism is also vital for addressing user concerns and continuously refining the hybrid learning approach. Together, these steps provide a strong foundation for the successful adoption of a hybrid learning model that balances the benefits of traditional and digital methods.

Addressing the Discrepancy in Engagement Findings: The study found engagement to be slightly higher in traditional methods due to factors like immediate feedback and stronger interpersonal interactions, which were emphasized by participants. This contrasts with the findings of Geng et al. (2021) and Ansong & Boateng (2022), which highlighted the potential of LMS tools to enhance engagement. The discrepancy can be attributed to the specific context of UCC, where digital literacy gaps, resistance to change, and technical challenges hindered the effective use of LMS tools. Moreover, the effectiveness of LMS tools in enhancing engagement largely depends on how well they are utilized, which was suboptimal in this study's context. These findings suggest that while LMS tools have the potential to boost engagement, their success depends on addressing contextual barriers.

Potential Bias from Stratified Random Sampling: Stratified random sampling was used to ensure representation from different student groups, including undergraduate and graduate students across various colleges. While this method reduces selection bias by ensuring proportional representation, it may have introduced potential biases due to differences in access to LMS resources or varying levels of digital readiness among subgroups. Future studies should conduct subgroup analyses to examine whether such differences influenced the overall results.

Controlling Differences in Course Content or Instructor Teaching Styles: To control for variations in course content and instructor teaching styles, the study selected courses with similar syllabi and comparable grading systems across both LMS and traditional methods. Additionally, instructors involved in the study were required to use uniform teaching strategies and assessment criteria, regardless of the mode of delivery. While these measures minimized variability, some uncontrolled factors like instructor enthusiasm and student motivation may have contributed to performance differences. Future research could employ experimental designs to better control such variables.

Emphasis on Resistance to Change and Digital Literacy over Infrastructural Challenges: While infrastructural challenges like internet reliability and power outages were acknowledged, resistance to change and digital literacy emerged as more significant barriers in this study. Participants frequently cited these factors as hindering their willingness and ability to use LMS tools effectively. For instance, many students and faculty expressed discomfort with transitioning from traditional methods to digital platforms, and some lacked basic digital skills. These findings underscore the importance of addressing user readiness as a prerequisite for overcoming infrastructural challenges. This perspective aligns with Kumi-Yeboah et al. (2020), who argue that user adaptation is critical to the successful adop-

tion of educational technologies. However, future studies could explore the interplay between these factors to provide a more comprehensive understanding.

8. General Conclusion

The study comprehensively explored the integration of a Learning Management System (LMS) into academic activities at the University of Cape Coast, comparing its effectiveness with traditional teaching methods. The findings reveal nuanced insights into the performance and engagement of students under the two modes of instruction. While the LMS demonstrated significant potential in fostering flexibility, accessibility, and personalized learning, certain challenges, like digital literacy gaps, technical issues, and infrastructure limitations, hindered its full adoption and effectiveness. Conversely, traditional methods retained their advantage in fostering interpersonal interaction, immediate feedback, and inclusivity for students with limited technological access. Statistical analyses indicated no significant differences in student performance between the two modes, suggesting that LMS is equally effective in facilitating learning outcomes. However, student engagement was slightly higher in traditional methods, likely due to the personalized interactions and immediacy inherent in face-to-face learning. This finding underscores the importance of complementing LMS with strategies that enhance active participation and motivation.

The study aligns with existing literature highlighting the transformative potential of LMS in academia while corroborating the persistence of challenges specific to developing contexts, such as limited internet access, high costs, and resistance to change. Importantly, the findings suggest that while LMS is a promising tool for modernizing education, its success depends heavily on addressing these challenges through targeted institutional support, infrastructure investments, and capacity-building initiatives. In conclusion, the study recommends that the University of Cape Coast adopt a hybrid approach, blending LMS with traditional teaching methods to leverage the strengths of both systems. This strategy ensures inclusivity while capitalizing on the technological advancements of LMS to meet the dynamic needs of students and faculty in a rapidly evolving academic landscape. The findings provide a foundation for evidence-based decision-making by university management, underscoring the critical role of institutional commitment and strategic investments in the successful integration of innovative educational technologies.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Adarkwah, M. A. (2022). Revisiting the Adoption of Learning Management Systems in Africa: The Case of Ghana. *Heliyon, 8,* e09129.

Adekola, G., Ajiboye, O., & Arike, M. (2021). Enhancing Student Performance through

LMS Integration: A Nigerian Perspective. *Journal of Educational Research and Development, 12,* 134-145.

Adeoye, B. F., & Adanikin, A. F. (2020). Comparative Analysis of Learning Methods in Sub-Saharan Africa: Bridging the Gap between Traditional and Digital Approaches. *International Journal of Education and Development using ICT, 16,* 45-58.

Adjei, S., & Amankwah, P. (2022). Challenges and Prospects of LMS Adoption in Ghanaian Universities: A Case Study of UCC. *International Journal of Educational Technology, 19,* 56-72.

Adomako, S., Frimpong, K., & Danso, A. (2021). Digital Tools for Pedagogical Practices: Insights from Ghanaian Universities. *Journal of Educational Technology & Society, 24,* 77-89. https://www.j-ets.net

Agyemang, S., & Yeboah, D. (2020). The Impact of LMS Integration on Student Academic Performance in Ghanaian Universities. *Journal of Digital Education, 15,* 45-61.

Akoto, A., & Owusu, F. (2021). User Perceptions of LMS Platforms in Ghanaian Higher Education: A Case Study of Moodle. *International Journal of Education and Development using ICT, 17,* 25-38.

Al-Adwan, A. S., Albelbisi, N. A., & Hujran, O. (2021). The Influence of LMS on Students' Learning Engagement in Higher Education: A Systematic Review. *Journal of Educational Technology Research and Development, 69,* 181-202.

Amadi, K., Nwogu, L., & Eze, J. (2022). Hybrid Learning Models and Student Cohesion: Evidence from African Universities. *African Journal of Education, 10,* 89-103.

Ansong, E., & Boateng, P. (2022). Technology Acceptance in Higher Education: Examining LMS Adoption in Ghanaian Universities. *Computers & Education, 181,* Article 104478.

Asare, R., Mensah, S. E., & Boateng, K. O. (2022). Barriers to LMS Adoption in Developing Countries: The Case of Ghana. *Journal of Educational Technology & Society, 25,* 50-61.

Boateng, K., Osei, Y., & Appiah, R. (2023). Exploring E-Learning Adoption in Ghanaian Universities: Opportunities and Challenges. *Journal of Educational Technology Research, 19,* 145-160.

Bonsu, E. K., Boateng, F. O., & Mensah, A. (2021). Exploring the Potential of LMS in Ghanaian Tertiary Institutions. *Educational Technology Research, 18,* 123-145.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13,* 319-340. https://doi.org/10.2307/249008

Eshun, E., & Ankrah, R. (2020). Enhancing Digital Pedagogy Skills: The Role of Training Programs in Ghana. *African Journal of Educational Studies, 13,* 89-101.

Field, A. (2018). *Discovering Statistics Using SPSS* (5th ed.). Sage Publications.

Garrison, D. R., & Vaughan, N. D. (2019). *Blended Learning in Higher Education: Framework, Principles, and Guidelines*. Jossey-Bass.

Geng, S., Law, K. M. Y., & Niu, B. (2021). Investigating Self-Regulated Learning and Student Engagement in Higher Education Blended Learning Environments. *Education and Information Technologies, 26,* 795-817.

Ghasemi, A., & Zahediasl, S. (2012). Normality Tests for Statistical Analysis: A Guide for Non-Statisticians. *International Journal of Endocrinology and Metabolism, 10,* 486-489. https://doi.org/10.5812/ijem.3505

Gyamfi, S., & Opoku, F. (2021). Exploring the Impact of Teaching Methods on Student Engagement and Performance in Ghanaian Universities. *Journal of Educational Technology Research, 19,* 233-248.

Gyamfi, S., Opoku, F., & Mensah, P. (2022). The Impact of Blended Learning on Academic

Performance in Ghanaian Universities. *Higher Education Research & Development, 41,* 789-803.

Kim, S., & Reeves, T. C. (2019). Reimagining Learning Environments: Applying Constructivist Principles in Online Education. *Educational Technology Research and Development, 67,* 601-625

Kintu, M. J., & Zhu, C. (2019). Constructivist Perspectives in E-Learning Environments: A Case Study in Uganda. *Educational Technology Research and Development, 67,* 157-176.

Komba, M., & Ngowi, M. (2023). Enhancing Academic Performance through LMS: Evidence from African Universities. *African Journal of Digital Learning, 12,* 87-105.

Kumi-Yeboah, A., Kim, Y., & Jones, S. E. (2020). Culturally Responsive Online Learning for Underrepresented Student Groups in Higher Education. *Online Learning Journal, 24,* 68-91.

Lim, C. P., Wang, T., & Graham, C. R. (2020a). Exploring the Global Trends in LMS Adoption: A Critical Review. *Educational Technology Research and Development, 68,* 1589-1610.

Lim, J., Morris, M. L., & Kupritz, V. W. (2020b). Online vs. Face-to-Face Learning: A Comprehensive Review of Comparative Studies. *Computers & Education, 159,* Article 104025.

Marfo, J., & Ofori-Danso, P. (2020). Digital Transformation in Ghanaian Universities: Exploring Institutional Frameworks for LMS Implementation. *African Journal of Education and Technology, 9,* 123-138.

Mauchly, J. W., Griego, O. V., & Gloeckner, G. W. (2017). *SPSS for Windows: An Introduction to Statistical Analysis* (5th ed.). Psychology Press.

Mbatha, B., Ndhlovu, T., & Sithole, P. (2021). E-Learning Adoption in South African Universities: Challenges and Opportunities. *Journal of African Digital Education, 7,* 32-48.

Morris, M. L., Lim, J., & Kupritz, V. W. (2020). Institutional Support and Engagement in Digital Learning Environments. *International Journal of Educational Research, 98,* Article 101921.

Mwangi, E. N., Chen, F., & Njoroge, D. M. (2020). Agricultural Imports, Agriculture Productivity and Economic Growth in Sub-Saharan Africa. *Journal of African Trade, 7,* Article 4. https://doi.org/10.2991/jat.k.200902.001

Ntuli, Z., & Phiri, T. (2022). Enhancing Student Outcomes through Moodle: A Case Study from the University of Johannesburg. *International Journal of Digital Learning, 9,* 56-67.

Obilor, N., & Onuoha, J. (2021). Academic Performance in Traditional versus Digital Classrooms: A Nigerian Study. *International Journal of Educational Technology, 18,* 112-125.

Owusu-Agyeman, Y., & Larbi-Siaw, O. (2020). Examining LMS Effectiveness in Ghanaian Higher Education. *Education and Information Technologies, 25,* 2349-2363.

Pallant, J. (2020). *SPSS Survival Manual: A Step-by-Step Guide to Data Analysis Using IBM SPSS* (7th ed.). McGraw-Hill Education.

Smith, J., Thompson, R., & White, E. (2020). LMS and Student Outcomes: Insights from Harvard University. *Journal of Educational Tools, 22,* 12-20.

Tadesse, T., & Gillies, R. M. (2021). Balancing Technology and Human Interaction in Teaching: Lessons from Ethiopia. *Journal of Education and Learning, 10,* 53-64.

Tandwa, E., & Chikandiwa, C. T. (2021). Integrating Blended Learning for Student Engagement in Higher Education: Lessons from the COVID-19 Pandemic. *International Journal of Educational Development, 81,* Article 102370.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Zimmerman, B. J. (2020). Self-Regulated Learning and Academic Achievement. *Educational Psychology Review, 32,* 321-335.

Zimmerman, B. J., & Schunk, D. H. (2021). Advances in Self-Regulated Learning: Implications for Digital Education. *Journal of Learning Analytics, 8,* 67-81.