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EDITORIAL

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Advancing Digital Transformation in Higher Education: Reflections on a Decade of the Sakai Learning Management System at the University of Ghana

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The rapid advancement of digital technologies has transformed higher education globally, reshaping how teaching, learning, assessment, and academic collaboration are conceived and delivered. Learning Management Systems (LMSs), once regarded primarily as repositories for instructional materials, have evolved into strategic infrastructures that support educational continuity, pedagogical innovation, and institutional resilience. Within many African universities, however, the pursuit of meaningful digital transformation has been accompanied by infrastructural constraints, uneven technological capacity, policy deficiencies, and socio-cultural resistance. Against this backdrop, the University of Ghana's experience with the Sakai Learning Management System over the past decade offers a compelling example of how an open-source platform can transition from a supplementary technological tool to a central pillar of institutional development.

This special issue brings together five interconnected studies that collectively examine, document, and critically reflect on different dimensions of the Sakai journey at the University of Ghana. Collectively, the contributions move beyond technical discussions of Learning Management Systems (LMSs) adoption to explore the organisational, pedagogical, and socio-cultural factors shaping digital transformation in higher education. The studies highlight that

successful LMS implementation depends not only on technology but also on effective leadership, strategic policy alignment, capacity building, and sustained institutional investment.

The opening article *From Kakai to Lifeline: Unpacking the Transformational Role of Sakai LMS for Seamless Academic Continuity During and Post-COVID*, chronicles the transformation of Sakai from what many users initially described as “kakai”, a colloquial expression used to characterise a complex or intimidating technology, into a vital mechanism for academic continuity during and after the COVID-19 pandemic. The study illustrates how an unprecedented period of disruption accelerated digital adoption, reshaped attitudes towards online learning, and facilitated the integration of Sakai into the University’s teaching and learning practices. In doing so, it highlights the capacity of crisis situations to stimulate institutional innovation and foster digital resilience.

Assessment, a critical component of digital education, forms the focus of the second article: *Exploring Language Learners’ Experiences and Perceptions of Sakai Online Exams at the University of Ghana*. The study highlights learners' experiences with Sakai-based assessments and offers valuable evidence regarding user acceptance of online examinations. Through an exploration of language learners’ experiences with Sakai-based online examinations, the study demonstrates generally positive student perceptions of digital assessment while also drawing attention to practical challenges, including the provision of special language characters and the need for enhanced technical support. By addressing these concerns, the study contributes valuable insights for institutions seeking to improve the accessibility, inclusiveness, and effectiveness of online assessment practices.

The third contribution *Leveraging Open-Source Learning Management Systems (LMS) for Resilient and Inclusive Higher Education in Ghana: Lessons from the Sakai LMS Journey* argues that open-source platforms offer significant opportunities for educational resilience, technological autonomy, and contextual adaptability. The study expands the discussion beyond a single institution by positioning open-source Learning Management Systems (LMSs) as strategic assets for higher education resilience. Rather than viewing LMS platforms simply as instructional technologies, the authors argue that open-source systems such as Sakai enable institutional adaptability, pedagogical flexibility, and technological autonomy. Their analysis reinforces the value of investing in governance, faculty development, and sustainable policy frameworks to maximize the long-term benefits of digital learning ecosystems.

Looking ahead, the fourth manuscript, *Rethinking Roles of Open-Source Platforms in Equipping Ghanaian Graduates for the Future of Work* shifts attention from educational delivery to graduate employability. It argues that open-source platforms possess enormous potential for developing collaboration, digital literacy, and lifelong learning competencies required in the future workforce. However, realizing this potential requires universities to move beyond using digital platforms merely for content distribution toward intentionally embedding them within curricula as tools for authentic skill development. The paper thus positions digital learning platforms not merely as delivery mechanisms but as environments for cultivating the competencies required in evolving labor markets. This perspective broadens the discourse on

digital transformation by connecting educational technology directly to national workforce development and economic competitiveness.

Completing the collection, the fifth article is a systematic review on, Factors Influencing Perceptions of Learning Management System Effectiveness in Ghanaian Universities provides a valuable synthesis of the evidence base underpinning LMS adoption and effectiveness. By identifying technological, institutional, human, and socio-cultural determinants of LMS perceptions, the review highlights findings that confirm that ease of use, digital self-efficacy, institutional support, and technical infrastructure remain essential determinants of successful LMS adoption. Equally important, the review identifies persistent gaps in understanding socio-cultural factors despite their significance in shaping user experiences and adoption behaviors. Thus, highlighting the need for context-sensitive research that reflects the realities of African higher education institutions.

Taken together, the studies presented in this special issue highlight several important lessons. First, digital transformation is fundamentally a human and organisational process rather than merely a technological endeavour. Institutional culture, leadership commitment, faculty engagement, student preparedness, and organisational learning significantly influence the success of technological innovations. Second, technology adoption succeeds when accompanied by investments in human capacity, leadership, and supportive policy environments. Third, open-source technologies provide valuable opportunities for universities in resource-constrained settings to build sustainable and locally responsive digital ecosystems. Finally, digital learning should not only improve access to education but also prepare graduates with the competencies required for increasing digital economies.

Beyond chronicling the development of Sakai at the University of Ghana, this collection makes a significant contribution to the expanding body of scholarship on digital transformation in African higher education. The studies challenge prevailing narratives that portray African universities merely as recipients of technological innovations by highlighting their ability to adapt, innovate, and generate contextually relevant knowledge that enriches global conversations on educational technology. Overall, the articles offer valuable theoretical, methodological, and practical insights for researchers, policymakers, institutional leaders, instructional designers, and educational technologists seeking to create more inclusive, resilient, and sustainable digital learning environments.

The findings demonstrate that when technology is strategically implemented and supported through inclusive policies, ongoing capacity development, and strong institutional commitment, it becomes much more than a technological tool. It serves as a catalyst for resilience, innovation, and meaningful educational transformation. As higher education continues to respond to technological developments, evolving learner needs, and emerging global challenges, the studies presented in this special issue underscore that digital transformation is neither a one-time achievement nor a finished process. Rather, it is a continuous institutional journey that demands vision, collaboration, adaptability, and long-term commitment. It is hoped that the contributions in this special issue will encourage further scholarly inquiry, support evidence-informed policy and practice, and motivate institutions across Africa and beyond to leverage

open-source learning technologies in ways that broaden access, improve educational quality, and strengthen the future of higher education.

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From Quiet Pilot to Campus Backbone: A Critical Reflection on a Decade of the Sakai Learning Management System Journey at the University of Ghana

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Abstract

In the 2014/2015 academic year, the University of Ghana replaced the Knowledge Environment for Web-based Learning (KEWL) with the Sakai Learning Management System (LMS), an open-source platform sustained under the Apereo Foundation. Over a decade, what began as a modest pilot within the distance education programme of the School of Continuing and Distance Education (SCDE) evolved into the digital backbone of teaching, learning, assessment, and academic continuity across the entire University. This lead article, written by the co-chairs of the Sakai@10 Anniversary Conference held at the University of Ghana on 19–20 August 2025, frames this special edition of the Multidisciplinary Journal of Distance Education Studies (MJDES) but it does so with critical scrutiny rather than celebration.

The article examines the decade (2014/2015-2025) through three analytical lenses: adoption versus institutionalization, the equity paradox of digital transformation, and governance's persistent lag behind technology. It traces the shift from KEWL to Sakai, assesses the platform's effects on

curriculum, pedagogy, and assessment, and weighs these developments against evidence of limited tool use, declining post-pandemic engagement, and infrastructural constraints. It also revisits the COVID-19 "lifeline" narrative by distinguishing emergency remote teaching from designed online learning. The article then confronts the defining development of the platform's second decade: the generative Artificial Intelligence (GenAI) turn. Drawing on a recent PRISMA-guided systematic review of 246 studies on the ethical integration of GenAI in higher education (Yarboi, et al; 2026), the article argues that Ghanaian higher education risks repeating the KEWL-to-Sakai pattern, whereby adoption outpaces governance, training, and equity. It therefore calls for the early development of ethical integration strategies, context-sensitive governance mechanisms, and African-centred frameworks. The article concludes by briefly assessing the University's *Policy on the Use of Artificial Intelligence* (April 2026) in relation to these priorities.

Keywords: *Sakai LMS; digital learning; distance education; open-source platforms; higher education; emergency remote teaching; generative artificial intelligence; ethical integration; AI policy; governance; Ghana*

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Introduction

Universities rarely go digital overnight, and they almost never go digital smoothly. Like many institutions of higher education, the University of Ghana arrived at its present state of digital maturity in stages: through pilot projects, pockets of experimentation within its distance and continuing education programmes, formal adoption for blended learning, and then a sudden, institution-wide reliance during a global health crisis that exposed both the strengths of its chosen platform and the limits of its digital infrastructure. At the centre of that journey stands the Sakai Learning Management System (LMS), an open-source platform that has grown, over ten years, from a quiet pilot into the backbone of the University's teaching and learning fabric.

This special edition of the *Multidisciplinary Journal of Distance Education Studies* (MJDES) is dedicated to that decade-long journey. It emerges directly from the Sakai@10 Anniversary

Conference, a two-day blended international conference hosted by the School of Continuing and Distance Education (SCDE) of the College of Education, University of Ghana, at the Cedi Conference Centre on 19–20 August 2025, under the theme ‘Digital Learning: Reflecting on a Decade of the Sakai LMS Journey at the University of Ghana.’ The conference brought together faculty, students, instructional technologists, administrators, and international partners, including the Keynote Speaker, Dr. Wilma Hodges, the Sakai Community Manager who led the technical team that installed the platform in April 2014, to assess what a decade of Sakai has meant and where the next decade should lead.

Anniversaries invite celebration, and there is much to celebrate. But an anniversary that produces only celebration squanders its scholarly value. As co-chairs of the conference and guest editors of this edition, we have therefore chosen to read the decade through three analytical lenses that recur, sometimes uncomfortably, across the evidence assembled here. The first is the gap between adoption and institutionalisation: acquiring and deploying a platform is not the same as embedding it in pedagogy, policy, and organisational routine, and much of the evidence in this edition suggests that at the University of Ghana the breadth of adoption has outpaced the depth of integration. The second is the equity paradox of digital transformation: technologies introduced to democratise access can simultaneously stratify it, by bandwidth, device, data cost, digital literacy, language, and disability, unless equity is treated as a design principle rather than an afterthought. The third is the governance lag: at every stage of this narrative, from KEWL through Sakai to the present generative Artificial Intelligence (GenAI) moment, technology has moved faster than the institutional frameworks meant to govern it, and the costs of that lag have been borne unevenly. These analytical lenses provide the framework for the discussion that follows.

The article proceeds in three movements. First, we chronicle the institutional history from KEWL to Sakai, reading it not merely as a success story but as a case study in the conditions under which technology adoption succeeds or fails in African higher education. Second, we assess the platform’s pedagogical and institutional impact including its decisive role during COVID-19 against the countervailing evidence of uneven use, post-crisis declines, and infrastructural constraint that the conference itself surfaced. Third, we turn to the question that will define the next decade: the ethical integration of generative AI. Here we draw on a recent systematic review of 246 studies (Yarboi et al., 2026), asking what a decade of LMS experience teaches about how, and how not to absorb the next wave of educational technology, and briefly appraising the University’s newly adopted Policy on the Use of Artificial Intelligence (University of Ghana, 2026) in that light.

The Genesis: From KEWL to Sakai

The University of Ghana's first experiment with technology-mediated distance learning dates to 1997, using the African Virtual University infrastructure on a small scale. A more deliberate turn came in 2004, when the late Professor Mumuni Dakubu, then Head of ICT Services, introduced KEWL, a web-based learning management system developed at the University of the Western Cape, South Africa, and released under an open-source (GNU) license. KEWL's subsequent failure to take root deserves more analytical attention than it usually receives, because it contained the seeds of many of the challenges that followed. The platform's content creation, communication, and assessment tools offered limited scope for instructor creativity and student interaction; but the deeper problems were institutional, not technical. Patronage of KEWL remained poor because of deficient ICT infrastructure, inadequate training for lecturers, and the absence of a support ecosystem findings corroborated empirically by Dadzie (2009), whose study of teaching staff found low adoption driven by infrastructural deficiency, lack of training, and poor integration of e-library services. The lesson, visible already in 2009, was that educational technology fails not primarily because of its feature set but because of the institutional conditions around it. That lesson would have to be relearned, on a scale, more than once.

A significant turning point occurred in August 2011 at the Distance Education and Teacher Education in Africa (DETA) Conference hosted by Eduardo Mondlane University in Maputo, Mozambique. There, during a workshop on Open Educational Resources, Professor Martin Dwomoh-Tweneboah of Linfield University, Oregon, USA introduced the first author to Sakai, highlighting its robustness, flexibility, and long-term sustainability as an open-source platform. What followed and what distinguished the Sakai adoption from the KEWL episode was a disciplined, evidence-driven pilot. Using a TrySakai account hosted by Longsight, Inc., demonstration and customised course sites were run at the Institute of Continuing and Distance Education (ICDE) between 2011 and 2013, including blended delivery of a core postgraduate course, *Contemporary Issues in Adult Education*, with favourable evaluation by students, staff, and faculty.

It is worth being candid, however, about how contingent the eventual adoption was. Three conditions converged. First, a policy entrepreneur: a senior academic with prior Blackboard experience and instructional design training from California State University, positioned as Director of ICDE, who could carry the case through the University's decision structures. Second, an evidence base: about three years of documented piloting that could withstand scrutiny. Third, and most importantly, the migration was facilitated by a favourable funding environment. The

University of Ghana-Unisplendour Software Systems (Tsinghua University) ICT-Based Distance Education Project (“Chinese Phase 2”), a US\$37.59 million initiative supported by loans and grants from the Government of the People’s Republic of China, provided the necessary financial backing. After the University delegation headed by the first author attended the Sakai Global Conference in San Diego in June 2013, the Project Management Team endorsed the adoption of Sakai as the University’s LMS, replacing KEWL.

In April 2014, the University of Ghana installed and commissioned the Sakai Learning Management System (LMS) at the Korea Information Access Centre in the Balme Library, with Dr Wilma Hodges leading the technical implementation and training team. The platform became fully operational during the 2014/2015 academic year. The transition, however, was contingent on the convergence of the three enabling factors discussed above. Had any one of these factors been absent, the University might have continued using the KEWL platform for a considerably longer period. This experience demonstrates that technology adoption in resource-constrained universities is shaped not only by the availability of technology but also by institutional leadership, technical capacity, and funding opportunities. It further suggests that the circumstances that facilitated the University of Ghana's transition from KEWL to Sakai may not necessarily apply to subsequent waves of educational technology adoption.

The Sakai project at the University has since survived four Vice-Chancellors and four Registrars, and it has required the collective efforts of numerous stakeholders to sustain it. With gratitude, we remember those who served the project and have since passed on among them Professor Mumuni Dakubu, Mr. Reuben Aggor, Dr. Samuel Kofi Badu-Nyarko, Professor Elom Dovlo, and Dr. Samuel Somuah as well as the many colleagues, technologists, and support staff whose largely unseen labour kept the platform alive.

The Sakai Project in Global Context

The University of Ghana’s adoption placed it within a distinctive global movement. Sakai originated in 2003/2004 as a collaboration among the University of Michigan, Indiana University, the Massachusetts Institute of Technology, and Stanford University, funded by a US\$2.3 million Andrew W. Mellon Foundation grant, to build an open-source alternative to commercial LMSs. Its architecture evolved from Michigan’s CompreHensive collaborativE Framework (CHEF), its name playfully honouring both that acronym and Hiroyuki Sakai of the television programme *Iron Chef*. Governance passed in 2012 to the Apereo Foundation, and as Dr. Hodges recounted in her keynote, the platform has moved through more than two decades of releases from Sakai 1.0 in

2004, through the landmark Sakai 10 of 2014 (the year of the University's adoption), to Sakai 25, with deep Microsoft 365 integration and expanded language support.

Two aspects of this history are particularly significant for African institutions adopting learning management systems. First, Sakai remains the only major LMS that can be hosted and managed entirely on an institution's own servers. This characteristic has become increasingly important as data sovereignty has emerged as a central concern in African digital policy, a trend reflected in the African Union's *Continental Artificial Intelligence Strategy* (2024). In this context, self-hosting is more than a technical option. It provides institutions with greater control over student data, enables adaptation to local requirements, and reduces dependence on vendor pricing structures and policy changes. The second aspect is more cautionary. Sakai represents a relatively small and contested segment of the global LMS market, and its community-source model relies on the continued participation and contributions of member institutions. Openness, therefore, should not be understood as an automatic guarantee of sustainability. Rather, as several contributions to this edition suggest, it encompasses varying degrees of accessibility, adaptability, interoperability, and community governance. The extent to which these benefits are realised depends on the availability of infrastructure, human capacity, and institutional policy support.

Over the past decade, the University of Ghana has benefited substantially from participation in the Sakai community. The next decade, however, raises a different question: whether the University will move beyond being a beneficiary to becoming an active contributor through software development, research, and the documentation of African use cases. This remains an important issue for the future development of the platform and its relevance within African higher education.

Institutional Integration and Pedagogical Transformation and Its Limits

In its early years, Sakai's use was concentrated in ICDE and subsequently SCDE and its regional learning centres, connecting distance learners across Ghana to tutors in Accra and beyond modest in scale but revolutionary in intent. By the mid-2010s, faculties across disciplines were integrating the platform into teaching, and since the COVID-19 pandemic Sakai has been the official LMS of the entire University. At the level of practice, the transformation has been real. Structured course sites allow a semester's content to be mapped coherently; the Lessons tool supports guided learning paths; discussion forums extend dialogue beyond the class period and give quieter students a stage; wikis and e-portfolios turn group projects into genuine co-creation; and the assessment suite: Tests & Quizzes, Assignments, Rubrics, Gradebook supports authentic assessment as, for, and of learning. Empirical work within the University confirms these

affordances: Attiogbe et al; (2025) found that feedback strategies and an embedded course syllabus bear a significant relationship to learning improvement among distance learners on the Sakai platform.

The migration from KEWL was also accompanied by deliberate curriculum development, the Master of Arts in Distance Education and E-Learning [DEEL] (2012), the doctoral course ADLT 704: *Educational Technology and Innovation*, and a generation of M.Phil and Ph.D. theses on digital pedagogy whose authors now hold academic and administrative positions across Ghana's universities. This mentorship pipeline has produced a sustained stream of publications on faculty acceptance and use of LMSs (Asamoah et al., 2024), lecturers' willingness or reluctance to embrace them (Asamoah & Oheneba-Sakyi, 2024), demand- and supply-side analyses of Sakai and Moodle in developing countries (Asamoah, 2020), adult learners' experiences of using Sakai LMS (Biney, 2020), and graduate students' knowledge of the platform (Sahoo et al., 2023).

Examining the Impact Claims Critically

A candid appraisal, however, must resist the narrative of unbroken triumph and the conference itself, to its credit, supplied the countervailing evidence. Decade-long survey data presented at Sakai@10 show that faculty use concentrates on a narrow band of tools, principally announcements and assignments, with the platform's richer interactive resources seldom exploited; the 'backbone' is, for many courses, a noticeboard. Studies of first-year undergraduates reveal digital-skills deficits and reliance on peers rather than structured onboarding. Graduate students' knowledge of the platform's features has been found to be low, with gender disparities in that knowledge (Sahoo et al., 2023) a finding that should trouble an institution committed to inclusive digital transformation. The plenary panel highlighted several serious challenges with the University's Learning Management System (LMS). Although the institution operates eight servers with a theoretical capacity to support about 3,500 concurrent users, the system is routinely overloaded during assessment periods. Infrastructure limitations are also evident, with only 550 computer workstations available to serve the entire student population. Participants further noted persistent difficulties with Turnitin integration, while some faculty members continue to resist or avoid using the platform altogether. Research comparing public and private universities reveals a similar pattern: students appreciate the convenience of having learning materials and resources centralized within the LMS, but they are dissatisfied with the limited interaction available in many courses. As a result, many students turn to WhatsApp and other social media platforms for meaningful communication and collaboration that the LMS is intended but often fails to facilitate.

The analytical point is not that these deficits negate the achievement; it is that they specify its character. What the decade produced is broad, shallow adoption resting on a committed core of deep users concentrated in SCDE, the department repeatedly identified in this edition's contributions as the most proficient user community. Adoption, in other words, has not yet matured into institutionalisation: into the routine, university-wide, pedagogically ambitious use that the platform's affordances permit and its rhetoric implies. Existing research on LMS adoption offers a useful lens for interpreting these findings. Although perceived usefulness and ease of use influence users' willingness to engage with technology, facilitating conditions, including infrastructure, training opportunities, workload support, and institutional culture, often determine the extent of sustained adoption (Asamoah & Oheneba-Sakyi, 2024; Asamoah et al., 2024). Where such enabling conditions are inadequate, meaningful engagement with the LMS is likely to remain limited. This is the KEWL lesson returning in milder form, and it frames everything that follows.

COVID-19: Lifeline, Stress Test, and Cautionary Tale

March 2020 remains the hinge of this story. The COVID-19 pandemic closed lecture halls almost overnight, transforming Sakai from a useful teaching tool into the University's academic lifeline. Within weeks, thousands of courses migrated online. Lecturers learned to upload teaching materials, design online assessments, and combine synchronous teaching tools with Sakai's asynchronous learning environment. Students logged in from living rooms, shared computers, and mobile phones, connecting from Accra, Tamale, and communities across Ghana. Through this rapid transition, academic life continued. Degrees were completed, research activities persisted, and teaching was sustained under unprecedented circumstances. This achievement should not be underestimated. Sakai's impact also extended beyond the University's own programmes. In April 2020, the Pan-African Doctoral Academy (PADA) used the platform to host a virtual seminar. This was followed by a three-week faculty training programme in October 2020 and its first Virtual Doctoral School in November 2020. These initiatives brought together participants from universities in Albania, Ghana, Kenya, Mali, Nigeria, South Africa, Uganda, and Zimbabwe. At the height of the global crisis, Sakai became more than a learning management system; it served as an instrument of international collaboration and Pan-African academic solidarity.

Yet analytical honesty requires two important qualifications. First, a conceptual distinction must be made. What the University achieved in 2020 was *emergency remote teaching*, not deliberately designed online learning. Hodges et al., (2020) introduced this distinction to prevent crisis-driven instructional improvisation from being mistaken for well-planned digital education. The University's rapid response demonstrated that the technological platform was available and that

teaching could continue under extraordinary circumstances. However, it did not by itself demonstrate the pedagogical quality, sustainability, or institutional maturity associated with established online learning systems. Second, the empirical evidence suggests that the gains achieved during the crisis were not fully sustained. Data presented at the conference by the University's Academic Quality Assurance Unit shows that non-use of core Sakai tools increased from 32.7% of courses in 2020/2021 to 49% in 2021/2022. At the same time, only half of uploaded course syllabi met compliance standards. These figures indicate that much of the adoption observed during the pandemic was driven by necessity rather than by lasting institutional transformation.

The pattern is revealing. The pandemic produced a sharp surge in technology use because participation was effectively compulsory. Once those pressures eased, engagement with key digital tools began to decline. In other words, the University demonstrated remarkable resilience during the crisis, but resilience born of improvisation proved difficult to sustain. This is the central lesson of the pandemic period. If digital learning is to become a durable institutional capability rather than a temporary emergency response, it must be embedded in structures, policies, and routines. The conference's recommendations for systematic digital orientation, stronger policy enforcement, and real-time monitoring should therefore be understood not as administrative afterthoughts but as the essential mechanisms through which emergency adaptation can be converted into lasting institutional capacity.

The Sakai@10 Conference and This Special Edition

It was against this backdrop that the School of Continuing and Distance Education (SCDE) convened the **Sakai@10 Anniversary Conference** to document, celebrate, and critically interrogate the University of Ghana's "Sakai story." The conference was formally opened with a welcome address delivered on behalf of the Provost of the College of Education and was chaired on behalf of the Vice-Chancellor, Professor Nana Aba Appiah Amfo. In remarks presented on her behalf, the Vice-Chancellor observed that Sakai had become woven into the very fabric of teaching, learning, and connectedness within the University.

The programme brought together multiple perspectives on the platform's development and impact. It featured a lead presentation on the conference theme, delivered by the first author from an insider's perspective that drew on his direct involvement in the planning, implementation, management, and institutionalisation of Sakai at the University of Ghana. The presentation traced the platform's evolution over the decade, reflected on key strategic decisions and implementation

challenges, and assessed its contribution to teaching and learning across the University. A keynote address was delivered by Dr. Wilma Hodges, who reflected on the history, evolution, and future of the global Sakai project. Participants also engaged in a plenary panel discussion that brought together the voices of faculty members, students, and administrators. To deepen discussion and reflection, the conference further organised a series of concurrent breakout sessions around six thematic areas:

- *Evolution and impact of LMSs in higher education;*
- *Faculty and student experiences with LMSs;*
- *Open-source platforms and the future of learning in higher education;*
- *Accessibility, equity, and inclusion in Sakai implementation;*
- *Integrating artificial intelligence and emerging tools with LMSs; and*
- *The role of LMSs in emergency remote teaching and learning.*

The papers in this special edition originated as presentations delivered across the conference's six sub-themes and were subsequently refined through the journal's peer-review process. Reflecting MJDES's multidisciplinary mission, the collection encompasses a wide range of methodological approaches, including quantitative, qualitative, mixed-methods, systematic-review, and reflective-collaborative studies. A methodological caveat should be acknowledged at the outset. Much of the research on Sakai at the University of Ghana, including the historical account presented in this article, has been produced by individuals who have been directly involved in the platform's development, implementation, or management. Such proximity provides valuable access to institutional knowledge, historical detail, and operational realities that might otherwise remain undocumented. At the same time, it carries the risk of confirmation bias and favourable interpretation. Recognising this limitation strengthens rather than weakens the case for future research. It highlights the need for more independent, comparative, and longitudinal studies capable of evaluating Sakai's impact from perspectives beyond those of its principal advocates and implementers. With this caveat in view, we now synthesise the principal themes that emerge from the contributions to this special edition.

Emerging Themes from a Decade of Practice and Research

From Rejection to Reliance and Partial Relapse

Several contributions trace Sakai's trajectory from initial apprehension driven by data costs, navigation difficulty, and inadequate training to indispensability during COVID-19, and then to the partial relapse documented in the post-pandemic monitoring data. Discipline-specific studies add texture: language learners in Swahili, Arabic, and Spanish preferred Sakai-based examinations for their accessibility and navigability, while identifying missing special-language characters,

technical glitches, data costs, and invigilator unfamiliarity as obstacles requiring targeted customisation. Theoretically informed research drawing on technology affordances and constraints and new institutional perspectives suggests that stakeholders' experiences with a Learning Management System (LMS) are influenced not only by the technology itself but also by the institutional environment in which it is used. Institutional norms, practices, and expectations shape how users engage with the LMS. This perspective helps explain why the same LMS software can produce markedly different outcomes across departments within the same university.

Faculty and Student Experiences

The lived experiences of stakeholders point to a consistent conclusion: the major barriers to realizing the full educational value of the Learning Management System (LMS) are no longer primarily technological but organizational. Faculty members frequently describe Sakai as a valuable tool for course planning and managing large student enrolments. However, many acknowledge that they use only a limited portion of its available features. Similarly, students recognize the platform's contribution to learning but report challenges such as inconsistent course design, uneven lecturer engagement, and limited mobile accessibility. Administrators have taken steps to support adoption through structured and tiered training programs that have reached more than 300 faculty members. Despite these efforts, several challenges remain unresolved, including inadequate server capacity, concerns about academic integrity in online assessments, and resistance to change among some staff members. These experiences mirror findings from previous studies, which show that LMS adoption is encouraged by factors such as perceived usefulness, ease of use, and adequate facilitating conditions. At the same time, adoption and effective utilization are often constrained by heavy workloads, infrastructure limitations, and gaps in training and support (Asamoah & Oheneba-Sakyi, 2024; Asamoah et al., 2024).

Collectively, the evidence suggests that technological improvements alone are unlikely to produce substantial gains. To unlock the full potential of the platform, investments in the LMS must be accompanied by comparable investments in people, institutional policies, capacity building, and organizational change.

How Open is Open?

A third cluster of studies critically examines the concept of *openness*, which forms the foundation of Sakai and other open-source learning platforms. These contributions argue that openness should not be understood as a simple binary condition. Rather, it exists on a spectrum encompassing dimensions such as accessibility, adaptability, interoperability, equity, sustainability, and

community governance. The literature further demonstrates that, particularly in low-resource contexts, the benefits of open-source platforms are not guaranteed. Instead, the realization of openness depends heavily on supporting conditions, including adequate infrastructure, human capacity, and enabling policy frameworks. Case studies from both public and private universities in Ghana reveal several persistent constraints, including unreliable internet connectivity, high bandwidth costs, limited access to digital devices, shortages of technical maintenance expertise, and inconsistent institutional policy support.

These findings carry important implications. They challenge a common assumption within open-source advocacy that freedom from licensing costs automatically translates into greater educational access and opportunity. The evidence suggests otherwise. While open-source platforms may remove financial and legal barriers associated with proprietary software, they do not automatically eliminate structural and institutional obstacles to participation. Openness, therefore, should be viewed not as an inherent property of a platform but as an outcome that must be actively created and sustained through investment, governance, capacity building, and supportive policies. Where these conditions are absent, the practical benefits of openness remain limited, and an open-source platform can become as exclusionary in its effects as a proprietary alternative.

Accessibility, Equity, and Digital Inclusion

A recurring theme across literature is that educational technology should serve to bridge, rather than widen, the digital divide (Warschauer, 2003; van Dijk, 2020; Adarkwah, 2021). However, the evidence suggests that this outcome does not occur automatically. Instead, it depends on deliberate institutional efforts to ensure equitable access and participation. The studies (Adarkwah, 2021; Darko-Adjei & Ankrah, 2020; Sahoo et al., 2023) reviewed identify several factors that continue to contribute to digital inequality within Ghanaian universities. These include economic barriers that limit access to devices and connectivity, disparities in technological infrastructure, gender differences in LMS awareness and usage, and variations in digital proficiency across academic departments. The literature also highlights the socio-cultural dimensions of LMS adoption, an area that remains insufficiently explored despite its potential influence on technology acceptance and use.

Research on e-capacity building further reveals significant gaps in the institutional capabilities required to support effective digital learning (Aczel et al., 2008; Awidi & Cooper, 2015). Deficiencies have been reported in instructional design, content production, learner support, and community-building capacities. In particular, studies (Anane & Adusei, 2024; Awidi & Cooper,

2015) point to a shortage of instructional design technologists, raising concerns about whether existing human resources are sufficient to support the University's digital learning ambitions. The literature (Anane & Adusei, 2024) also draws attention to the equity implications of institutional policies governing LMS access. One notable example is the linkage of platform access to fee payment requirements. Such policies raise important questions about who is able to participate fully in online learning and under what conditions. Unlike technological limitations, these are matters of institutional governance and policy choice.

Taken together, these findings suggest that digital inclusion is not determined by technology alone. Rather, it is shaped by a combination of economic, social, organizational, and policy factors. Addressing the digital divide therefore requires not only technological provision but also sustained investment in capacity building, equitable policies, and inclusive institutional practices.

LMSs in Emergency Remote Teaching

Finally, several contributions revisit the COVID-19 crisis period with the benefit of hindsight. A systematic review of LMS adoption across African universities, informed by Moore's (1993) Theory of Transactional Distance, concludes that much of the pandemic-era literature focused on technological deployment and access. While these issues were understandably urgent during the crisis, they often overshadowed deeper pedagogical concerns, including learner autonomy, meaningful dialogue, and institutional coherence. The post-pandemic monitoring studies discussed earlier provide an important extension to this analysis. They show that emergency-driven adoption can achieve rapid uptake of digital learning technologies, but the gains are often difficult to sustain when implementation is not accompanied by pedagogical redesign, capacity building, and effective governance structures. In many cases, initial enthusiasm and usage decline once the immediate crisis has passed.

Across the studies reviewed, a clear pattern emerges: digital education cannot be evaluated solely in terms of access, participation rates, or technology deployment. Instead, its long-term success depends on the quality of teaching and learning experiences it supports, as well as the institutional systems that sustain them. This shift in emphasis reframes digital education in Africa from a technology- and access-centred agenda to a more pedagogically and institutionally grounded research programme. It is precisely this broader and more critical perspective that this special edition seeks to advance.

The Generative AI Turn: The Evidence Base and Its Warning

The emergence of generative artificial intelligence (GenAI) represents the most consequential development confronting the University's digital learning environment today. Recognising its growing significance, a recent PRISMA-guided systematic review conducted by a University of Ghana research team, including the present author, examined 246 studies on the ethical integration of GenAI in higher education (Yarboi et al., 2026). The review provides both a valuable evidence base and a cautionary message for institutions seeking to adopt AI responsibly. The study identified five recurring and interconnected ethical domains. The most frequently discussed was academic integrity and authenticity, appearing in 89% of the reviewed studies. This was followed by privacy, bias, and data governance (73%); equity, access, and inclusion (71%); AI literacy, human agency, and pedagogical redesign (69%); and transparency, accountability, and explainability (67%). Taken together, these findings suggest that the ethical integration of GenAI cannot be reduced to concerns about student misconduct or cheating. Rather, it is a systemic challenge involving assessment design, pedagogy, institutional capacity, data governance, and educational equity. This broader interpretation is one that the present article both endorses and extends.

Three findings from the review are particularly relevant to the University of Ghana. The first concerns the limited representativeness of the global evidence base. African contexts accounted for only 11.4% of the studies reviewed, while Ghana represented just 2.8%, equivalent to seven studies (Yarboi et al., 2026). As a result, many of the ethical frameworks, policy models, and governance approaches currently shaping international discussions have been developed primarily within contexts characterised by stronger infrastructure, more mature regulatory environments, and largely Anglophone educational systems. These conditions differ substantially from those found in many Ghanaian universities. Consequently, importing such frameworks without adaptation risks repeating a familiar mistake: applying externally developed solutions without sufficient consideration of local realities. The University avoided this error when adopting Sakai through a carefully managed pilot process; a similar approach will be necessary for AI governance.

The second finding relates to institutional preparedness. The review revealed a significant governance gap within Ghanaian higher education. Only 14% of the institutional contexts examined possessed comprehensive GenAI policy frameworks, and none had established structured faculty AI training programmes or formal mechanisms for reviewing AI-related practices. This contrasts sharply with policy coverage levels of between 78% and 82% reported in North America and Europe. The review characterises this situation as one of *governance*

vulnerability, whereby AI adoption proceeds largely through individual experimentation rather than institutionally coordinated and accountable implementation.

The third finding concerns equity and inclusion. Although GenAI has the potential to democratise academic support by providing feedback, explanations, tutoring assistance, and language support, these benefits are unevenly distributed in practice. Access often depends on reliable internet connectivity, adequate devices, premium subscription services, and levels of digital literacy. Existing evidence from Ghana indicates significant digital-literacy gaps among students (Nkansah & Oldac, 2024) as well as uneven awareness and understanding of GenAI among academics (Adarkwah et al., 2023). These disparities raise concerns that AI could reinforce rather than reduce existing educational inequalities.

The review further highlights a troubling tension between equity and academic integrity. Some of the AI-supported learning practices most beneficial to disadvantaged students may conflict with integrity frameworks developed in very different educational contexts. This concern is amplified by evidence showing that AI-generated text detection tools can exhibit bias against non-native English writers (Liang et al., 2023). For a multilingual African university, reliance on such tools as a governance solution could unintentionally disadvantage the very students who stand to benefit most from AI-enabled support.

When viewed against the historical trajectory outlined in this lead paper for the Special Edition, a striking pattern emerges. KEWL was introduced before the infrastructure, training, and support systems necessary for effective use were in place, and the initiative ultimately failed. Sakai's implementation was more successful because it followed a carefully piloted and evidence-informed adoption process. Nevertheless, the platform was not accompanied by sustained investments in governance, capacity building, and institutional support sufficient to transform adoption into deep institutionalisation. As a result, engagement remained widespread but often superficial, declining in contexts where usage was no longer actively required.

GenAI now appears to be following a similar path, though at a much faster pace and with significantly higher stakes. Unlike previous technologies, AI is arriving through students' smartphones, personal devices, and freely available online tools rather than through formal procurement and institutional deployment processes. At the same time, the systematic review characterises the broader higher education sector as having limited AI governance structures. In effect, universities may be entering a third cycle of technological adoption without fully addressing the lessons of the previous two.

The stakes are higher because GenAI reaches directly into the core functions of higher education. Unlike an LMS, which primarily supports the organisation and delivery of learning, GenAI raises fundamental questions about authorship, assessment validity, knowledge production, and the integrity of academic credentials. The pace of adoption is also unprecedented. No infrastructure project, procurement process, or commissioning ceremony is required; AI tools are already embedded in students' and lecturers' everyday digital environments.

The central lesson of the Sakai decade is therefore highly relevant to the present moment. Technology alone does not produce meaningful educational transformation. Without governance, capacity building, training, and deliberate attention to equity, adoption tends to remain shallow, uneven, and difficult to sustain. The GenAI moment represents the first major test of whether that lesson has truly been learned.

The April 2026 AI Policy: A First Answer, Briefly Appraised

The University of Ghana has already taken its first significant step in responding to the challenges posed by generative artificial intelligence. In April 2026, the University adopted the *Policy on the Use of Artificial Intelligence at the University of Ghana* (University of Ghana, 2026), thereby establishing a formal framework for AI governance. Notably, this is the very kind of institutional response that participants at the Sakai@10 Conference identified as necessary for the responsible integration of AI into higher education.

When assessed against the governance framework developed in the systematic review by Yarboi et al. (2026), the policy compares favourably with many existing institutional approaches. It can be situated within what the review describes as the “balanced” category of AI governance frameworks. Several features are particularly noteworthy. The policy is informed by local survey evidence rather than being imported wholesale from external contexts. It provides relatively clear guidance on the disclosure and citation of AI use, reserves high-stakes academic and administrative decisions for human judgment, and demonstrates a strong commitment to accessibility. It is also unusual in its reciprocal approach, requiring transparency not only from students but also from faculty and the University itself regarding AI use.

However, the policy's strengths are accompanied by important limitations. As the systematic review notes, implementation remains the weakest dimension of AI governance in higher education worldwide, and the University's policy exhibits many of the same challenges. While it establishes expectations for responsible AI use, it does not create a dedicated governance body to oversee implementation. Nor does it provide funding for capacity building, faculty development,

or student training. The policy is similarly silent on sanctions, appeals procedures, and mechanisms for periodic review and revision.

More fundamentally, the policy imposes compliance obligations without guaranteeing equitable access to AI tools. In effect, it regulates the use of technologies that many students and staff can access only through personal devices, private subscriptions, and individual financial resources. This raises the possibility that compliance and effective participation may become functions of personal means rather than institutional provision. Furthermore, the policy does not address several concerns that recent scholarship identifies as central to ethical AI governance, including multilingualism, biases in AI-text detection systems (Liang et al., 2023), questions of data sovereignty (African Union, 2024), and the need for assessment redesign in response to AI-assisted learning and writing (Cotton et al., 2024; Yarboi et al., 2026).

A comprehensive evaluation of the policy falls beyond the scope of this article, which focuses primarily on the first decade of Sakai at the University of Ghana. Nevertheless, the key questions that such an evaluation would inevitably raise can be stated succinctly. Who is responsible for implementing and overseeing the policy, and with what resources? Can faculty and students comply with its requirements in equitable ways? How will alleged violations be investigated and adjudicated fairly? What safeguards exist for institutional and personal data? And how will AI governance be integrated with the University's existing digital governance structures, including those developed around Sakai? These questions return us to the central lesson of the Sakai decade. Adoption should not be confused with institutionalisation. The AI policy represents an important act of adoption, but adoption alone does not guarantee meaningful and sustainable change. The institutionalisation of AI governance, through resources, structures, training, accountability mechanisms, and continuous evaluation, remains the more demanding task ahead. Yet embedded within these challenges is a significant opportunity. Because Ghanaian universities remain at a relatively early stage of AI governance development, they are not yet locked into mature but potentially ill-suited models imported from other regions (Yarboi et al., 2026). This creates space for innovation and contextual adaptation.

In this regard, the University of Ghana is particularly well positioned. It possesses a decade of institutional learning from LMS implementation, an established body of research on digital pedagogy, experience managing a self-hosted open-source platform, and a newly adopted AI policy awaiting operationalisation. Together, these assets provide a strong foundation for developing governance approaches that integrate ethical principles, pedagogical objectives, and institutional policy within a locally grounded framework. Such efforts could also contribute

beyond the University itself. The global literature on AI governance continues to be dominated by perspectives originating in North America and Europe, while African experiences remain underrepresented (Yarboi et al., 2026). This creates an opportunity for the University to develop approaches that respond to African educational realities and draw on relational and communal ethical traditions, including Ubuntu, which remain strikingly underexplored in current AI governance debates.

Ultimately, the systematic review advances an important insight: the margins of the evidence base are analytically central. The contexts in which ethical AI integration is most difficult are often the contexts from which the most valuable theoretical and practical lessons emerge. If this proposition is correct, then institutions such as the University of Ghana are not merely recipients of global governance models. They are potential sites for generating the next generation of theory, policy, and practice for the ethical integration of AI in higher education.

Lessons of the Decade, Restated Critically

The lessons conventionally drawn from the Sakai decade and rehearsed at the conference remain valid, but the evidence assembled in this Special Edition, together with the trajectory of the new AI policy, permits sharper formulations:

- **Adoption is not institutionalisation.** Deploying a platform or adopting a policy is the beginning of digital transformation, not its achievement. Institutionalisation requires sustained investment in training, workload recognition, monitoring, and pedagogical redesign and it is measurable, as the post-pandemic engagement decline demonstrates.
- **Infrastructure and training are inseparable.** The histories of KEWL and Sakai suggest that infrastructure and training cannot be treated as separate concerns. Both are recurring institutional commitments rather than one-off capital expenditures. The limitations of each platform were linked not only to technological challenges but also to insufficient ongoing support and capacity development. Sustainable digital transformation therefore requires continuous investment in both technological resources and user training.
- **Resilience must be designed, not improvised.** The COVID-19 achievement was real, but it was emergency remote teaching, and its gains decayed when compulsion eased. Robust systems, redundancy, and institutionalised continuity planning are the durable form of the pandemic lesson.
- **Openness is conditional.** Open-source licensing provides the foundation for openness, but not its realisation. Accessibility, adaptability, and equity are achieved only through

sustained investments in infrastructure, human capacity, and policy support. In their absence, an open-source platform can become just as restrictive and exclusionary as a proprietary one.

- **Equity is a design principle, not an afterthought.** Every wave of educational technology at the University has stratified access by bandwidth, device, data cost, literacy, and gender before corrective action was taken. A policy that imposes compliance obligations without providing equitable access to AI tools risks transforming lawful use from an institutional entitlement into a function of personal means and private resources
- **Governance must keep pace with technology.** Governance is measured not by policy statements alone, but by the institutional machinery that supports them. The experiences of KEWL, Sakai, and now GenAI reveal a recurring pattern in which adoption advances faster than governance capacity, with the resulting burdens falling most heavily on the least-resourced users. Principles, prohibitions, and disclosure requirements provide a foundation, but it is governance bodies, budgets, training, equitable access, due process, and continuous review that ultimately determine whether technological innovation produces inclusion or inequality (Yarboi et al., 2026).
- **Research must drive policy and include independent evaluation.** The University's own scholarship has informed training, implementation, and strategic planning. Yet an evidence base produced predominantly by committed institutional actors should be complemented by independent, comparative, and longitudinal research. Such work is essential for validating findings, identifying blind spots, and supporting stronger claims about institutional impact and effectiveness.

Looking Ahead: Policy, Practice, and a Research Agenda for the Next Decade

Looking ahead, the challenge for the University of Ghana is to think bigger and act more boldly, while remaining guided by the lessons of the past decade which indicate that successful digital transformation depends not only on technological adoption but also on governance, capacity building, and equitable access. Against this backdrop, the strategic directions identified at the Sakai@10 Conference remain both relevant and compelling, and the emergence of GenAI gives them renewed urgency. These priorities include advancing mobile-first and offline-capable learning environments, recognising that smartphones remain the primary means of access for many students. They also include integrating AI and academic-integrity tools within the University's

governed and self-hosted Sakai ecosystem rather than leaving students and faculty dependent on unregulated consumer platforms.

Beyond the University itself, the conference highlighted opportunities to extend digital transformation into pre-tertiary education and to support broader Pan-African digital education initiatives. Such initiatives would promote open-source technologies, culturally relevant learning resources, and shared digital infrastructure capable of reducing costs and expanding access across institutions. Equally important is the continued development of communities of practice that can pilot, evaluate, and refine emerging technologies through systematic inquiry rather than technological enthusiasm alone.

These priorities align closely with the University's Strategic Plan (2024-2029) and are already reflected in the School of Continuing and Distance Education's expanding programme portfolio. Among the initiatives are MA/MPHIL Human Resource Development and M.Phil in Educational Technology, all of which are designed and delivered face to face, blended, and fully online modes supported by the Sakai LMS. Together, these developments signal an emerging vision of digital transformation that extends beyond platform adoption to encompass innovation in teaching, learning, research, and institutional capacity building.

At the institutional level, the immediate priority is to move beyond policy adoption and towards implementation. The University's April 2026 AI Policy provides an important framework, but its effectiveness will depend on the governance structures, resources, and capacities that support it. In other words, the task is to build the institutional machinery around the policy itself. This priority aligns with several recommendations advanced at the Sakai@10 Conference. These include establishing a well-resourced directorate dedicated to digital educational advancement, creating a dedicated budget for LMS development and maintenance, and appointing an academic officer with expertise spanning both pedagogy and information technology within the IT Directorate.

Equally important are continued investments in server infrastructure, learning-centre computing facilities, and instructional design personnel. The conference also highlighted the need for mandatory hybrid-format LMS and digital-literacy training for both faculty and students, beginning at orientation and continuing throughout their engagement with the University. Accessibility must likewise remain a priority, with systematic use of platform features that support students with special educational needs. For AI governance specifically, implementation should be guided by a clear sequence. A standing governance committee, linked to the E-Learning Quality Control Committee, should provide oversight and accountability. Institutional access to approved AI tools should be established before compliance requirements are enforced, ensuring that

responsible use is not dependent on personal resources. Mandatory AI-literacy programmes, supported by dedicated funding, should follow alongside initiatives to redesign assessment practices for AI-rich learning environments. Such work should be recognised within faculty workload models. In addition, the University should establish transparent evidentiary standards and appeal procedures for AI-related misconduct cases and develop a data sovereignty and procurement framework that leverages its self-hosted Sakai environment. The guiding principle should be simple: governance and provision must precede enforcement. This reverses the sequence that contributed to the limitations of both the KEWL and Sakai experiences.

The implications are equally significant for researchers and, in particular, for MJDES readers and future contributors. The field must mature methodologically as well as thematically. Much of the existing literature remains dominated by cross-sectional studies of perceptions and attitudes. While such studies have generated valuable insights, their explanatory value is increasingly limited. Future research should prioritise longitudinal designs capable of tracking adoption, engagement, and learning outcomes across multiple academic years. Greater attention should also be given to studies of actual technology use rather than self-reported behaviour. Learning analytics, classroom observation, and digital ethnography can provide richer evidence about how digital technologies are integrated into teaching and learning. Similarly, researchers should evaluate governance, training, and support interventions, focusing not merely on what policies prescribe but on whether they change practice, for whom, and at what cost. The University's April 2026 AI Policy presents a particularly timely case for such evaluation. Equity must remain central to this research agenda. Future studies should examine how factors such as gender, language, disability, fee-payment status, and geographic location interact to shape digital participation and educational outcomes. Design-based research is also needed to develop and test authentic assessment approaches suited to AI-enabled learning environments. At the same time, independent and comparative studies across Ghanaian and African institutions would help assess the transferability of findings generated largely by institutional insiders.

Finally, the field requires more ambitious theory-building grounded in African realities. Areas such as Ubuntu-informed ethics, data sovereignty, epistemic justice, and locally situated models of AI governance remain underdeveloped despite their growing importance. Expanding research in these areas would enable African universities not only to respond to global debates but also to shape them. By embedding this research agenda within the continued evolution of its digital learning environment, the University of Ghana can move beyond being a consumer of educational technology and governance models. Instead, it can become a significant contributor to theory

development, governance innovation, and contextually grounded approaches to digital education and artificial intelligence.

Conclusion

Ten years after its introduction, the evidence presented at the Sakai@10 Conference and throughout this Special Edition supports a conclusion that acknowledges both achievement and limitation. Sakai has evolved into far more than a technological platform at the University of Ghana. It enabled teaching and learning continuity during a global crisis, contributed to the development of a new generation of scholars and practitioners in digital education, and connected the University to an international community committed to open-source innovation and collaboration. At the same time, the University's experience over the past decade reveals several important lessons. It highlights the distinction between adopting a technology and fully institutionalising it. It demonstrates the difference between crisis-driven adaptation and resilience built through deliberate planning and sustained investment. It shows that the promise of openness is not automatically realised but depends on supportive conditions. Most importantly, it illustrates how digital transformation can either reduce existing inequalities or inadvertently reproduce them.

These lessons should not be viewed as shortcomings in the University's digital transformation journey. Rather, they constitute its most valuable contribution. They provide a foundation for understanding the challenges that now accompany the rapid emergence of generative Artificial Intelligence (GenAI). In many respects, GenAI tests the same institutional questions that shaped the University's experience with KEWL and Sakai, but at a much faster pace and with significantly higher stakes. The University has already begun to respond. The adoption of the *Policy on the Use of Artificial Intelligence at the University of Ghana* in April 2026 represents an important first step and provides the foundation for a more coordinated approach to AI governance. The policy contains many of the elements needed to avoid repeating the patterns identified throughout this article. However, experience from the Sakai decade suggests that neither policy nor technology alone produces meaningful change. The real challenge lies in implementation. Effective governance depends not only on principles and regulations but also on the institutional structures that support them. Governance requires resources, oversight, capacity building, training, accountability mechanisms, and ongoing evaluation. Consequently, the future impact of the University's AI policy will depend less on the strength of its wording than on the resources and institutional commitment devoted to its operationalisation.

As co-chairs of the Sakai@10 Conference and guest editors of this special edition, we therefore invite readers to engage with the articles that follow not as a commemoration of past achievements but as a critical, evidence-based assessment intended to inform the future. The purpose of this collection is not simply to reflect on a decade of digital learning but to contribute to the decisions that will shape the next one. The central lessons emerging from this review are clear. Governance must precede technological adoption. Equity must be built into digital systems by design rather than addressed retrospectively. Digital and AI literacy should be treated as essential infrastructure rather than optional support services. Research must remain a continuous component of digital transformation, with particular emphasis on independent, longitudinal, and African-centred scholarship capable of informing both policy and practice. Ultimately, the success of the University's next phase of digital transformation will depend not on how quickly it adopts new technologies, but on how effectively it governs, supports, and evaluates them. The University's second decade of digital learning will be judged by its ability to align technology, governance, pedagogy, and equity in ways that produce meaningful and sustainable educational outcomes

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From Kakai to Lifeline: Unpacking the Transformational Role of Sakai LMS for Seamless Academic Continuity During and Post-COVID

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ABSTRACT

When the Sakai Learning Management System (LMS) was first introduced at the University of Ghana particularly within the Distance Education (DE) programme, it was met with scepticism and resistance, earning the informal label “kakai”, a local term meaning "monster." Initially used for uploading slides and course materials, Sakai was perceived as cumbersome and overwhelming by both faculty and students. However, the COVID-19 pandemic marked a dramatic turning point. With the abrupt suspension of face-to-face teaching, Sakai emerged as an indispensable tool for academic continuity, transforming its image from a misunderstood platform to a digital lifeline. This study examines the transformation of the Sakai Learning Management System (LMS) at the University of Ghana. Using a qualitative case study design, data were collected through semi-structured interviews with 45 students and 7 faculty across three phases: pre-COVID, during COVID, and post-COVID. Participants were purposively selected from the Distance Education programme, and interviews were analysed thematically. The findings reveal a significant shift in perceptions, usage, and institutional support for Sakai over time. Pre-COVID, Sakai was minimally adopted. During COVID-19, the platform became central to academic continuity, prompting rapid digital adaptation among students and faculty. In the post-COVID period, Sakai usage normalized and became embedded in blended learning practices, with users demonstrating improved digital confidence and valuing the platform’s organisational and pedagogical benefits. The study concludes that Sakai’s evolution from a feared system to a trusted academic lifeline was

driven by crisis-enabled and growing digital literacies among users. The findings underscore the need for sustained infrastructural investments, continuous training, culturally responsive communication, and stronger policy frameworks to support long-term digital transformation in higher education. The study contributes to limited literature on the sociocultural dimensions of LMS adoption in African universities and offers practical insights for strengthening technology-enhanced learning in resource-constrained contexts.

Keywords: *Sakai Learning Management System, Digital Learning, COVID-19, Higher Education, Ghana*

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Introduction

The COVID-19 pandemic is regarded as one of the most drastic upsets in the history of higher education, which fundamentally changes the way teaching and learning is organised and conducted across the globe (Bozkurt et al., 2020; Crawford et al., 2020). When universities were forced to shut down face-to-face learning, institutions quickly adapted to remote and technology-mediated learning settings to maintain the continuity of academics (Daniel, 2020; Hodges et al., 2020). What had initially been developed as a response to a global health crisis soon developed into a mass re-evaluation of pedagogical processes, revealing the weaknesses as well as potential responses of higher education systems. This has been especially strong in the Global South, where a large number of universities have not institutionalised digital learning infrastructures to the extent that they were before the pandemic (Adedoyin and Soykan, 2020). In African higher education environments, the shift to remote learning was complicated by long-standing issues, such as insufficient ICT infrastructure, unreliable internet access, expensive data packages, and the digital illiteracy of different stakeholders (e.g., students and faculty), among others (Dube, 2020; Mpungose, 2020; Tadesse and Muluye, 2020). Regardless of these limitations, the pandemic also brought opportunities of faster digitalization, universities investing in online learning, creating virtual learning policy, and increasing capacity-building opportunities in technology-enhanced teaching (Watermeyer et al., 2021; Crawford, 2023). In this changing environment, Learning Management Systems (LMS) became key structures of maintaining academic practice. In addition to serving a conventional purpose of storing course materials, LMS platforms turned out to be essential locations of instruction delivery, communication, assessment management, and student engagement (Bond et al., 2021; Turnbull et al., 2021). The LMS in a sense became the eponymous learning environment to many institutions which primarily acted as a point of contact where teaching and learning was done in times of disruption.

The University of Ghana offers a good example of how digital technologies may be perceived and used differently over time, with the Sakai Learning Management System, which is informally known by students as Kakai, a local word meaning something complicated or frightening. Before the pandemic, Sakai was viewed as challenging to navigate and was rarely utilized by both the faculty and students. But the advent of COVID-19 had to create a rapid change towards online learning, which placed Sakai as a key activity in ensuring academic continuity. This change, over time, led to a change in the user perceptions and institutional practices, as the platform became more and more a part of the teaching and learning processes. Such a transformation is not only a

shift in the use of technology, but it also indicates a wider restructuring of pedagogical processes, institutional support systems, and digital skills in the university. The reasons behind such transformations are especially relevant in resource-constrained settings, where the adoption of digital can be largely influenced by infrastructural, cultural, and institutional factors. It is against this background that this research investigates the transformation of Sakai LMS at the University of Ghana in three stages namely: pre-COVID, during COVID-19 and post-COVID. In particular, the paper examines how the platform facilitated academic continuity in the context of the pandemic, how the perceptions and usage patterns changed among students and faculty, and how the institutional interventions impacted the adoption and integration of the platform into teaching processes. The study offers a context-specific, experience-based analysis, which makes a contribution to the current debate on digital transformation, resilience, and sustainable adoption of learning technologies in African higher education.

Study Objectives

The study was guided by the following research objectives

1. To examine how Sakai LMS supported academic continuity during the COVID-19 pandemic at the University of Ghana.
2. To explore the transformation in perceptions and usage of Sakai LMS among lecturers and students, moving from the pre-COVID “Kakai” era.
3. To assess the institutional supports, policies, and capacity-building interventions available for the use of Sakai during and after the pandemic.
4. To analyse the extent to which Sakai LMS has shaped post-COVID teaching and learning practices at the University of Ghana
5. To identify challenges, lessons, and opportunities for strengthening LMS integration at the university of Ghana.

Literature Review/Gaps Identified

The COVID-19 pandemic has caused a sudden shift to the remote and technology-mediated form of learning, which has created a body of scholarship on the importance of Learning Management Systems (LMS) in ensuring academic continuity. The research in the global context is consistent in pointing out that LMS platforms were the most relied on infrastructures facilitating the teaching process, communication, assessment, and student engagement during the time when traditional face-to-face teaching was not possible anymore (Bozkurt and Sharma, 2020; Hodges et al., 2020; Bond et al., 2021). Instead of being used as storage of instructional resources, LMSs were developed as full-scale learning platforms that allowed institutions to continue with their academic activities during a crisis context (Adedoyin and Soykan, 2020; Turnbull et al., 2021).

Before the pandemic, LMS penetration in most of the Global South, specifically in African higher education, was typified by the low adoption rates and unequal incorporation into teaching. Researchers attribute this to a set of factors such as low digital competence among users, resistance to change, infrastructural, and institutional support (Lwoga, 2014; Mpungose, 2020; Tadesse and Muluye, 2020; Afolabi and Ajani, 2023). Most often, the LMS systems were minimally utilized, i.e. to post the lecture notes or administrative messages, and were not deeply embedded in the pedagogical activities. These tendencies were frequently supported by the cultural tendency to prefer face-to-face teaching and the view of LMS platforms as complicated or tiresome (Govender,

2010; Strang and Vajjhala, 2017). The COVID-19 pandemic served as a turning point in this direction. As the physical classroom is put on hold, LMS services quickly become both more peripheral and more vital to the academic continuity. The process of this transformation has been widely reported, both in the global and African settings, in which institutions have been forced to digitize in large volumes and large scale (Daniel, 2020; Crawford et al., 2020; Agormedah et al., 2020; Owusu-Fordjour et al., 2020). According to scholars, this is the era of emergency remote teaching, which is marked by quick adaptation, improvisation, and fast digital education (Hodges et al., 2020). Notably, this transition accelerated the usage of LMS, but it also helped to develop digital skills in a student and faculty, since learners had to operate in online learning settings to a greater extent (Bond et al., 2021).

One of the themes that can be identified based on the literature is the institutional support and the role it can have in determining the effectiveness of LMS adoption. Access to ICT infrastructure, training programmes, technical support, and clear policy frameworks have been found to be the key to successful integration (Garcia-Morales et al., 2021; Watermeyer et al., 2021). The availability of a digital approach to operations in the institutions meant that institutions that had already developed a digital strategy were more capable of scaling the usage of LMS in the pandemic compared to those without such systems. This underscores organisational preparedness and capacity-building in facilitating sustainable digital transformation. Although there have been more users applying LMS platforms during the pandemic, research claims that users have had mixed experiences. On the one hand, online learning settings have been pointed out as flexible, convenient, and accessible to students (Bond et al., 2021; Agormedah et al., 2020). Conversely, issues of low connectivity, digital burnout, lack of interactivity, and access inequity have remained to impair the results of learning (Dube, 2020; Mhlongo et al., 2023). Likewise, professors have been forced to overcome the challenges of course redesign, learning to use new technologies, and keeping students active in online environments (Rapanta et al., 2020; Watermeyer et al., 2021). Such experiences highlight the dynamic and highly skewed character of LMS integration in higher education.

New studies indicate that LMS platforms have maintained a focal position in teaching and learning especially in blended and hybrid learning frameworks (Bond et al., 2021; Turnbull et al., 2021) in the post-COVID era. It is common knowledge that the pandemic catalyzed the already ongoing processes of digital transformation, forcing the institutions to reconsider the principles of pedagogy and invest in more adaptable and robust learning environments (Garcia-Morales et al., 2021). In Africa, researchers believe that this change is a chance to reinforce access, enhance pedagogical innovation, and institutional resilience, as long as the issues with the infrastructure and capacity are resolved (Puplampu, 2023; Moyo, 2023).

Despite this accumulating body of literature, some significant gaps still exist. To begin with, a considerable amount of the available research is dedicated to the general trends of LMS adoption or the overall experience of online learning, and little effort is made to determine how the specific LMS platforms develop in the context of a specific institution over time. Second, although institutional support plays a role, there is a lack of empirical research on the presentations of training, policy reforms, and ICT investments- shape the adoption and use of LMS in practice especially at the African universities. Third, sustainability of LMS integration is not well studied in the long-term and understanding of the integration in the context of the emergency stage of the

pandemic is studied, instead of the lasting change in pedagogy. In addition, there is a dearth of literature concerning the sociocultural aspects of LMS adoption, in which the local meaning, perceptions and narratives affect the user in technology use. The ideas like informal terming of Sakai as Kakai manifest implicit cultural discourses of digital system that could influence adoption behaviours in a manner that is not exhaustively defined in traditional models of technology adoption. The research fills these gaps by giving a context-specific, longitudinal analysis of transformation of Sakai LMS at University of Ghana through three particular stages, which are pre-COVID, during COVID, and post-COVID. The study will provide detailed insights into the nature of digital learning systems development in resource-constrained settings and add to more grounded knowledge of the digital transformation in African higher learning through its user-centered approach and prioritization of lived experiences and institutional processes.

Research Design

The present study employed a qualitative research methodology with the case study design to determine the transformational role of Sakai Learning Management System (LMS) in ensuring continuity of academic activities at the University of Ghana before, after and during the COVID-19 pandemic. The qualitative case study methodology was deemed suitable as it provided the opportunity to look in depth into the lived experiences, perceptions, and interactions of the participants with Sakai and its real-life institutional environment. This method is consistent with interpretive research traditions that aim to comprehend complicated social and technological phenomena in their development. Semi-structured interviews were used to collect data and offered the flexibility of participants to share their experiences and ensured that the data were aligned with the objectives of the study (Creswell and Poth, 2018). The research was designed in three stages, namely, pre-COVID, during COVID, and post-COVID, to reflect the changes in LMS use, perceptions, and institutional support over time.

The population of the study included students and faculty that had firsthand experience with Sakai through the three phases and were enrolled in the Distance Education (DE) programme at the University of Ghana. The selection of participants was based on purposive sampling, which was determined by their relevancy to the research questions and their experience with the LMS. Qualitative research does not use statistical representativeness to determine its sample size, but it is determined by the richness and relevance of data (Patton, 2015). Thus, the participants were identified with consideration to their capacity to give detailed insight into the phenomenon under study. The total number of students and faculty members involved in the three stages was 45 and 7 respectively. The sample used was student participants who were Level 300 cohorts of Information Studies because they were significantly exposed to Sakai in the Distance Education programme. Faculty participants were chosen according to their ongoing participation in teaching in the programme at more than one stage, which allowed viewing LMS usage longitudinally. The data collection process was undertaken until the desired level of depth and redundancy in the responses was reached, which meant that the thematic saturation was reached.

Before commencing the process of data collection, potential participants were approached and given relevant information about the study, its purpose, scope, and ethical considerations. There was voluntary participation and all the participants were informed before the administration of interviews. The study conformed strictly to ethics, such as confidentiality, anonymity, and the right to withdraw. The interviews were done either on a face-to-face or telephone basis according to the availability of the participants and the nature of the situation. There were about twenty-minute interviews. Interviews were recorded (audio-taped) with the agreement of the participants; in

situations in which no agreement on the recording was given, intensive notes were made. All interviews were then transcribed verbatim, to guarantee accuracy and completeness of data.

The thematic analysis was used to analyse the data, in an iterative and inductive manner. Repeated reading of transcripts was done by the researchers to get familiarised with the data after which initial codes were created. These codes were subsequently organized into larger categories and themes which illustrated common themes in the responses of the participants. The coding was done in a group involving the authors and hence could be discussed, interpretations analysed, and themes refined to maximize the level of analytical consistency. The trustworthiness of the analysis was to be guaranteed through a number of strategies. These were peer debriefing within the research team, repetitive code and theme comparison and close alignment of the findings with the narratives of the participants. The element of reflexivity was also upheld in the analysis process whereby the researchers engaged in critical reflection of their interpretations in order to reduce bias. Although the research offers valuable information on the transformation of Sakai LMS, it should be mentioned that the study uses self-reported data and is local to the University of Ghana. In that way, the research always focuses on the richness of insight, rather than on generalisability. The limitation of using interview data without any other sources including system analytics or institutional documents is recognized as a weakness and is addressed later in the limitations section.

Table 1: Study Population/Sample across three phases

Phase	Academic Year	Total Population		Sample Size	
		Students	Faculty/facilitators	Students 2%	faculty10%
Pre-COVID	2019/2020	540	69	11	7
During COVID	2020/2021	786	69	16	7
Post-COVID	2023/2024	956	69	18	4
Total		2282	69	45	18

Source: Field Data 2019-2024

Findings/Results

Response rate

The response rate for students was 100% at all three phases, as all sampled participants completed the interviews. At the faculty level, the response rate was 100% for both Phase 1 (pre-COVID) and Phase 2 (during COVID). For Phase 3 (post-COVID), 4 out of the 7 faculty members, representing a 57.1% response rate, took part in the interviews.

Respondents' Characteristics

To maintain confidentiality, anonymity, and ethical integrity, all respondents in the study were represented using self-generated pseudonyms. For faculty participants, the same pseudonyms were maintained across all three phases of the study because the same individuals were involved in both the pre-COVID and during-COVID interviews, with only a reduced number participating in the post-COVID phase. In contrast, different student cohorts were interviewed at each phase, and therefore, new pseudonyms were assigned to student participants for each period since the respondents were not the same. In total, the study engaged 45 students across the three phases and 7 faculty members during both the pre-COVID and during-COVID stages. During the post-COVID phase, only 4 of the original 7 faculty members were available and participated. This distribution is summarised in Table 2. As presented in Table 2, across the three phases, a total of 45 students participated in the study, with 11 respondents in the pre-COVID phase (5 females and 6 males), 16 during COVID (8 females and 8 males), and 18 in the post-COVID phase (7 females and 11 males), drawn from centres including Accra, Kumasi, Tamale, Bolga, Tema, Sunyani, and Tsito. Faculty participation consisted of all 7 facilitators during the pre- and a 57.1% response rate. This distribution reflects broad regional representation and consistent engagement across the study period.

Table 2: Respondents Characteristics

Students									Faculty			
Pre-covid (n=11)			During-Covid (n=16)			Post-Covid (n=18)			Pre & during		Post covid	
<i>Pseudonyms</i>	gender	center	<i>Pseudonyms</i>	gender	center	<i>Pseudonyms</i>	gender	Center	<i>Pseudonyms</i>	Gender	<i>Pseudonyms</i>	Center
Adwoa	Female	Accra	Charity	Female	Accra	Yaa	Female	Kumasi	Daniel	Male	Michael	Accra
Esi	Female	Kumasi	Kelvin	male		Owusu	male	Tema	Michael	Male	Samuel	Accra
Kojo	male	Accra	Kwaku	male	Takoradi	Isaac	male	Accra	Samuel	Male	Mary	Accra
Adams	male	Tamale	Kwabena	male	Bolga	Joseph	male	Accra	Sarah	Female	Daniel	Accra
Abu	male	Bolga	Larbi	male	Accra	Justice	male	Sunyani	Fati	Female		Kumasi
Ato	male	Accra	Razak	male	Kumasi	Collins	male	Accra	Mary	Female		Tamale
Kay	male	Accra	Jonas	male	Accra	Emma	male	Accra	Issah	male		Bolga
Kuku	male	Accra	Frank	male	Accra	Stephen	male	Tema				
Akos	Female	Tisto	Bada	male	Accra	Abigail	Female	Accra				
Abena	Female	Accra	Kwame	male	Accra	Gifty	Female					
Kwesi	male	Accra	Rebecca	Female	Accra	Eben	male	Tema				
			Lydia	Female	Sunyani	Kofi	male	Accra				
			Princess	Female	Accra	Janet	Female	Tamale				
			Aba	Female	Accra	Yaw	male	Accra				
			Emelia	Female	Accra	Afua	Female	Accra				
			Patience	Female	Accra	Esther	Female	Accra				
						Efua	Female	Tsito				
						Issahu	Female	Accra				

Source: Field Data 2019-2024

Response coding and Analysis

The findings of the study are presented in three phases pre-COVID, during COVID, and post-COVID reflecting the evolving experiences of students and faculty with the Sakai LMS over time. Across the three phases, the analysis revealed significant shifts in perceptions, usage patterns, and institutional support mechanisms that shaped Sakai's transformation from a platform viewed with apprehension ("Kakai") to a critical academic lifeline that sustained teaching and learning during the pandemic and influenced post-COVID pedagogical practices. The themes that emerged provide insight into the pragmatic, technological, pedagogical, and institutional dimensions that underpinned Sakai usage across the study period.

Pre-COVID (2019/2020)

The pre-COVID phase revealed that awareness and utilization of Sakai among Distance Education students and faculty were present but limited by perceptions of complexity, inadequate training,

and infrastructural constraints. Three major themes emerged: namely limited LMS adoption and minimal integration into teaching, perceived difficulty and negative attitudes (the “kakai” narrative), and insufficient institutional and technical support, as shown in Table 3

Table 3: Summary of Pre-COVID Themes and Categories

Theme	Categories
limited LMS adoption and minimal integration	• occasional use of Sakai for uploading slides • minimal lecturer engagement • weak LMS–curriculum alignment
perceived difficulty and negative attitudes	• "kakai" perceptions • navigation difficulties • limited digital literacy
insufficient institutional and technical support	• lack of training • poor internet and device constraints • no structured guidance

A significant observation from the findings that emerged from the pre covid phase interviews was that Sakai had not yet been mainstreamed into pedagogical practice. For many participants, the LMS was used only when absolutely required, often for accessing lecture slides or submitting isolated assignments. Students reported that lecturers seldom uploaded comprehensive content on the LMS, resulting in limited motivation to engage meaningfully with the system. This was compounded by the perception that Sakai was difficult to use. The informal nickname “Kakai” symbolized a broader sense of fear, frustration, and unfamiliarity associated with the platform. Students felt that the system was not user-friendly, while faculty expressed concerns over inadequate training and the additional workload required to prepare materials for online delivery.

Some of the students for instance said

“I only go on Sakai when the lecturer said they have posted slides; apart from that, i hardly used it for anything else.” (Kojo {Student; Male, Accra Center})

“Most of my courses never appeared on Sakai. So, for me, it doesn’t really feel like part of our learning.” (Adwoa {Student; Female, Accra Center})

“Sakai is too difficult to understand. The first time I logged in, I got confused and left it. That’s why we called it ‘Kakai.’” (Esi {Student; Female, Kumasi Center})

“Sometimes when you try to open notes, it will freeze or take too long. For me I just felt the system is not friendly at all.” (Adams {Student; Male, Tamale Center})

Some of the responses from the lectures were;

“Sakai to me is optional. Most of us, especially me still prefer face-to-face teaching because that is what I am used to, and its less complex.” (Samuel {Faculty; Male, Accra Center})

“I uploaded notes occasionally, but not consistently. There is no strong push from the university to use the system fully, and I feel it’s a bit complicated.” (Daniel {Faculty; Male, Accra Center})

“Honestly, Sakai seemed a bit complex. Without proper training, it felt easier to continue with our normal mode of teaching.” (Michael {Faculty; Male, Accra Center})

The findings also showed that infrastructure issues further compounded these challenges. Limited access to stable internet, especially for students in remote regions, significantly hindered their use of Sakai. Faculty members also cited intermittent connectivity at the learning Centres and lack of systematic orientation as barriers to adoption. These were captured by some of the students as follows:

“Network issues are too much. At home I couldn't access it, and even at the centre, the internet is also not reliable.” (Abu {Student; Male, Bolga Center})

“Nobody really taught us how to use Sakai. We just tried on our own or asked friends.” (Ato {Student; Male, Accra Center})

Some faculty members also indicated:

“Internet connectivity at the centres are not strong, so even when I wanted to use Sakai, it becomes a bit frustrating.” (Sarah {Faculty; Female, Accra Center})

“We never had formal training sessions. If there have been then I was not aware of it. The only training I should say if it was one was when we were introduced to how we can share assignment. Everything was somewhat done by the office not us. We had to figure things out ourselves, which made many of us avoid the platform, including me.” (Mary {Faculty; Female, Tamale Center})

5.3.2. During COVID-19 (2020/2021)

As presented in table 4, four main themes emerged from the analysis of the findings from the interviews with both students and faculty. These included Sakai as an emergency academic lifeline, increased engagement and rapid digital adaptation: significant challenges in connectivity and system stability, and strengthened institutional support and structured training. Students and lecturers overwhelmingly described Sakai as the only platform that made teaching and learning possible during lockdowns. The system according to the responses became a central hub for lectures, assessments, announcements, and discussion forums.

Table 4: Summary of Themes During COVID-19

Theme	Categories
Sakai as an Emergency Academic Lifeline	• Main instructional tool • Submission and assessment hub • Communication centre
Increased Engagement and Digital Adaptation	• Higher LMS usage • Faculty learning-by-doing • Student reliance on Sakai
Persistent Connectivity and Technical Challenges	• Internet/data costs • Slow system response • Assessment-related issues
Strengthened Institutional Support	• ICT training • Orientation programmes • Increased university communication

Source Field Data- 2019-2024

The findings from the COVID-19 phase revealed a dramatic transformation in the use and perception of Sakai LMS, as both students and faculty were compelled to rely on the platform as the primary means of sustaining academic activities during lockdowns. Participants consistently described Sakai as the only viable academic lifeline at the time. As one student noted,

“When school closed, Sakai became everything. If you didn’t go on Sakai, you basically missed all your lectures.” (Charity {Student; Female, Accra Center})

Similarly, another student emphasized its centrality, stating,

“It was the only place we could get notes, submit assignments, and know what was happening. Without it, I don’t think the semester would have continued.” (Kwaku {Student; Male, Takoradi Center})

This period was also marked by heightened engagement and rapid adaptation, even among those who had previously avoided the platform. Many students acknowledged that the crisis forced them to become proficient users. One explained,

“I started using Sakai every day because I had no choice. At first it was stressful, but later I became used to it.” (Kwabena {Student; Male, Bolga Center})

However, this increased use was not without difficulty. A student reflected on connectivity challenges, saying,

“Sometimes the internet would disappoint me during quizzes, and it was very frustrating. But overall, Sakai helped us continue school.” (Larbi {Student; Male, Accra Center})

Faculty members corroborated these experiences, highlighting a steep learning curve but also significant progress in digital competence. One lecturer stated,

“COVID forced us to learn Sakai properly. Overnight we had to move everything online, so we had no option but to master the system.” (Issah {Faculty; Male, Bolga Center})

Another described a major shift in teaching routines:

“I uploaded materials every week and used the announcement tool more than before. Sakai became my main teaching platform.” (Daniel {Faculty; Male, Accra Center})

Despite these positive adaptations, participants consistently mentioned connectivity challenges and system limitations. A faculty member reported,

“The online teaching was good but the internet challenges were a big problem. Sometimes I couldn’t upload materials because of slow connectivity.” (Michael {Faculty; Male, Accra Center})

The findings also highlighted improved institutional involvement and technical support. Unlike the pre-COVID period, both students and faculty acknowledged structured training, frequent communication, and ICT support from the university. As one lecturer put it,

“The university gave several trainings, and that helped a lot. Before, we didn’t have this level of support.” (Sarah {Faculty; Female, Accra Center})

This response signaled a significant shift in the university's approach to digital teaching and learning, contributing to greater user confidence and resilience during the crisis.

5.3.3. Post-COVID (2023/2024)

The post-COVID phase revealed that the experiences of the pandemic shifted user attitudes permanently. Sakai transitioned from a crisis tool to a foundational component of blended learning. As presented in Table 5, three major themes emerged namely normalization of Sakai in blended and technology-enhanced learning, improved perceptions and user confidence and the need for system enhancement and continuous support. Nevertheless, although the responses depicted an improvement in usage the respondents still highlighted some areas requiring attention.

Table 5: Summary of Post-COVID Themes

Theme	Categories
Normalization of Sakai in Teaching and Learning	• Routine LMS use • Support for blended learning • Organised content access
Improved Perceptions and User Confidence	• Increased digital literacy • Ease of navigation • Positive attitudes
Need for System Enhancement and Continued Support	• Desire for upgrades • Integration with modern tools • Continuous training needs

Source Field Data- 2019-2024

Indeed, the post-COVID findings illustrate a significant shift in how students and faculty perceived, interacted with, and valued the Sakai LMS. Unlike the pre-COVID era where Sakai was often underutilized and viewed with apprehension participants described a more positive, confident, and integrated approach to its use in the 2023/2024 academic year. Across interviews, Sakai had transitioned from an emergency substitute to a normalized and essential component of blended learning.

Students expressed that Sakai had become deeply embedded in their academic routines. One student explained,

“Now, every course I take has something on Sakai. It’s the first place I check when the semester starts.” (Yaa {Student; Female, Kumasi Center})

Another highlighted the convenience of the platform, saying,

“Sakai makes learning easier because everything is organised there, notes, quizzes, announcements, it really helps us plan.” (Owusu {Student; Male, Tema Center})

These reflections contrast sharply with the pre-COVID “Kakai” narrative, demonstrating a meaningful cultural and behavioural shift.

As one student put it,

“When the name was first mentioned to me in level 100 I was like what is this one too,....laughs;;, but now it’s part of me. So for me, I will say its not Kakai it’s a learning platform that makes life easy pizzzy ...Laughs;;,.” (Isaac {Student; Male, Accra Center})

Faculty echoed these sentiments, noting that their experiences during the pandemic had significantly improved their digital teaching competence. A lecturer who had complained about it been difficult during the pre-covid phase now remarked,

“After COVID, I became very comfortable with Sakai. I now use it even when teaching face-to-face because it keeps my course structured.” (Michael {Faculty; Male, Accra Center})

Another explained how Sakai enhanced pedagogical efficiency:

“It helps me track submissions and communicate with students easily. I can’t imagine teaching without it now.” (Samuel {Faculty; Male, Accra Center})

Despite this positive transformation, participants pointed out areas that still required improvement. Students frequently mentioned the need for system upgrades and more reliable connectivity. One student commented,

“Sakai is good, but sometimes it still slows down. I wish the university would improve the speed and add more modern features.” (Joseph {Student; Male, Accra Center})

Faculty similarly expressed the desire for continuous professional development. A facilitator explained,

“We need refresher training occasionally. Technology keeps changing, so the support shouldn’t stop.” (Mary {Faculty; Female, Accra Center})

Discussion of Findings

This study examined the transformation of the Sakai Learning Management System (LMS) at the University of Ghana across three temporal phases—pre-COVID, during COVID, and post-COVID—revealing a dynamic process shaped by shifting user perceptions, institutional interventions, and contextual pressures. The findings demonstrate that Sakai’s evolution from a marginal and often resisted platform (“Kakai”) to an indispensable academic tool was not linear, but rather the result of an interaction between technological exposure, institutional support, and crisis-driven necessity.

In the pre-COVID phase, the limited adoption of Sakai reflects broader patterns observed across African higher education, where LMS platforms were often underutilised and weakly integrated into pedagogical practice (Lwoga, 2014; Mpungose, 2020). The findings suggest that this low uptake was not solely a technical issue but also a sociocultural one. The characterization of Sakai as “Kakai” symbolises a deeper perception of complexity, uncertainty, and resistance, highlighting how cultural meanings attached to technology can shape user engagement. This aligns with existing scholarship indicating that perceptions of difficulty and lack of familiarity significantly influence technology adoption behaviours (Govender, 2010; Strang & Vajjhala, 2017). Thus, the pre-COVID experience underscores that technological availability alone is insufficient; user perception and contextual relevance are equally critical.

The COVID-19 phase marked a decisive turning point, as the sudden disruption of face-to-face teaching created conditions in which Sakai transitioned from an optional tool to a necessity. This finding reinforces global evidence that the pandemic functioned as a catalyst for accelerated digital adoption in higher education (Bozkurt et al., 2020; Crawford et al., 2020). However, beyond increased usage, the study reveals a deeper transformation in user behaviour and competence. Both students and faculty were compelled to engage with the LMS more intensively, leading to rapid skill acquisition and increased familiarity. This progression reflects a broader pattern in which sustained exposure to technology enhances perceived

usefulness and ease of use over time, thereby influencing acceptance and continued use. Importantly, the findings also highlight the central role of institutional support in enabling this transition. The shift from minimal pre-COVID support to structured training, improved communication, and technical assistance during the pandemic significantly enhanced user confidence and engagement. This supports existing literature emphasising that organisational readiness, capacity-building, and policy direction are critical determinants of successful LMS integration (Garcia-Morales et al., 2021; Watermeyer et al., 2021). The University's interventions during this period demonstrate how institutional responsiveness can mitigate initial resistance and facilitate more effective adoption of digital learning systems.

In the post-COVID phase, the normalization of Sakai within teaching and learning practices suggests that the changes initiated during the pandemic were not merely temporary adaptations but have contributed to longer-term pedagogical transformation. The integration of Sakai into routine academic activities, particularly within blended learning models, reflects a shift towards more flexible and technology-enhanced learning environments. This aligns with emerging research indicating that digital practices adopted during the pandemic have, in many cases, become embedded in post-pandemic educational systems (Bond et al., 2021; Turnbull et al., 2021). A key contribution of this study lies in demonstrating that transformation in LMS adoption is not only technological or institutional but also experiential and cultural. The shift from viewing Sakai as “Kakai” to recognising it as an essential academic tool reflects a reconfiguration of user attitudes, digital competencies, and pedagogical practices. This transition underscores the importance of understanding technology adoption as a socially constructed process influenced by user experience, institutional context, and external pressures. At the same time, the persistence of challenges particularly related to connectivity, system performance, and the need for continuous training highlights that digital transformation remains an ongoing process rather than a completed shift. These findings echo broader concerns within African higher education regarding infrastructural limitations and digital inequalities (Dube, 2020; Arakpogun et al., 2020; Akpan et al., 2024). Addressing these challenges is essential not only for sustaining LMS usage but also for ensuring equitable access to digital learning opportunities. The findings GENERALLY suggest that crisis-driven adoption can serve as a powerful entry point for long-term digital transformation, but its sustainability depends on continued institutional investment, user support, and system improvement. The case of Sakai at the University of Ghana illustrates how necessity, when combined with institutional action and user adaptation, can reshape both technological practices and pedagogical cultures within higher education.

Conclusion

The study demonstrates that Sakai's transformation from a platform viewed with doubt and anxiety (“Kakai”) to a reliable academic lifeline was not a spontaneous occurrence but the outcome of several interrelated factors. The COVID-19 pandemic acted as a critical catalyst, compelling both students and faculty to confront and overcome earlier barriers to technology adoption. What had previously been a supplementary tool, used inconsistently and often reluctantly, became indispensable for the continuity of teaching and learning under conditions of extreme uncertainty. This crisis-driven necessity accelerated the development of digital competencies across the university community, validating the argument that technological adaptation often emerges most strongly in periods of disruption. Equally important was the role of institutional commitment, which evolved significantly across the three phases examined. While the pre-COVID period was characterised by minimal support, the university's strategic response during the pandemic through structured training, proactive communication, and strengthened ICT assistance provided the scaffolding needed for users to engage meaningfully with Sakai. This institutional shift underscores the importance of leadership, investment, and policy direction in enabling sustainable digital transformation, particularly in resource-constrained environments. Moreover, the post-COVID findings demonstrate that Sakai has become firmly integrated into the university's teaching and learning ecosystem. Its use now

extends beyond emergency circumstances to support blended learning, digital resource management, assessment, and course organisation. This sustained integration signals that the university has entered a new phase of technology-enabled education, where digital tools are not simply reactive solutions but essential components of pedagogical practice. The experiences gained during the pandemic have created a strong foundation for further innovation, including the expansion of blended learning models, integration with emerging technologies, and the strengthening of digital pedagogy. However, the study also acknowledges persistent challenges, including infrastructural constraints, system performance issues, and the need for continuous training. These limitations serve as important reminders that digital transformation is an ongoing journey requiring sustained investment, strategic planning, and responsiveness to user needs. Addressing these gaps will be vital for ensuring equitable access and maintaining the momentum gained through the pandemic-era shift.

Study Limitations and Areas for Further Research

Although this study provides important insights into the transformation of Sakai LMS at the University of Ghana before, during, and after the COVID-19 pandemic, some limitations must be acknowledged. First, the study relied on a qualitative case study design using purposive sampling, which, while appropriate for exploring lived experiences in depth, does not allow for broad generalisation to all students and faculty within the university or across other universities in Ghana. The three cohorts sampled pre-COVID, during COVID, and post-COVID were representative of Information Studies students and Distance Education faculty; however, the experiences of learners in other disciplines or in the regular stream may differ in significant ways, limiting the transferability of findings.

Second, the study depended on self-reported experiences gathered through semi-structured interviews. Participant accounts may be influenced by recall bias, particularly for the pre-COVID period, as individuals may remember past challenges more or less intensely depending on their later experiences during and after the pandemic. Similarly, participants who were more confident or comfortable with digital technologies may have been more willing to engage in interviews, potentially skewing the data toward more articulate or digitally engaged respondents. Third, even though the study captured changes across three distinct phases, it does not account for the everyday, micro-level interactions with technology that might be revealed through observational or system-usage data. Direct analytics from Sakai such as user logs, frequency of access, or tool utilisation metrics could offer complementary insights into behavioural patterns that self-reported data alone cannot fully capture.

A notable conceptual limitation relates to the cultural meanings attached to technology, which emerged strongly in the findings but remains largely underexplored in existing literature. The nickname “Kakai” often used by students to describe Sakai symbolises perceptions of fear, difficulty, and inefficiency associated with the LMS, with “Kakai” locally connoting a “monster.” While this study highlights how such cultural framings shaped early user resistance and influenced patterns of adoption, it was not designed to systematically examine the deeper sociocultural narratives underpinning these meanings. This represents an important gap, as technology acceptance is influenced not only by perceived usefulness and ease of use but also by social, cultural, and symbolic interpretations (Venkatesh et al., 2003). Understanding how culturally embedded metaphors like “Kakai” affect digital adoption, behaviour, and pedagogical engagement remains an under-researched area that warrants further inquiry. Given these limitations, a longitudinal study examining changes in LMS usage with real-time system analytics would provide deeper insights into user behaviour beyond interview accounts. Second, comparative studies across faculties, universities, or LMS platforms could illuminate broader patterns of digital transformation in Ghanaian higher education.

Practical Recommendations

Based on the findings of the study, the following practical recommendations are proposed to strengthen the effective and sustainable use of Sakai LMS at the University of Ghana and to guide broader digital transformation efforts within higher education institutions. First, if not already in place, the University should institutionalise continuous and structured training programmes for both students and faculty. While emergency training during COVID-19 improved digital competence, the post-COVID period demonstrated an ongoing need for refresher sessions, targeted workshops, and onboarding modules for new cohorts. These training programmes should adopt a hands-on approach, with demonstrations of core Sakai tools such as assignments, assessments, forums, and gradebook to enhance digital confidence and pedagogical effectiveness.

Again, the University should prioritise the upgrade and optimisation of digital infrastructure that supports Sakai. Persistent challenges related to system speed, downtime, and storage limitations hinder user experience. Enhancing server capacity, improving system responsiveness, and ensuring stable integration would significantly improve functionality. Additionally, increasing bandwidth and improving Wi-Fi coverage across campus and regional centres would help address the connectivity challenges students and faculty frequently reported. The study further recommends the development of clear institutional policies that formalise the integration of Sakai into all courses. These policies should outline expectations for the minimum use of Sakai, such as uploading course outlines, weekly lecture materials, announcements, and continuous assessment tasks. Such guidelines will ensure consistency across courses and reduce disparities in LMS engagement that were evident in the pre-COVID period. Policy enforcement should be supported by incentives and performance benchmarks that encourage faculty adoption.

Moreover, there is a need to strengthen technical and pedagogical support systems at both the central ICT directorate and regional learning centres. Establishing a tiered support system where immediate troubleshooting is available at the faculty or departmental level, with more advanced issues escalated to ICT specialists would enhance responsiveness. Dedicated e-learning support assistants or graduate interns at regional centres could provide timely guidance to students, particularly those in the Distance Education programme. Likewise, the University should invest in user-centred design improvements and culturally responsive communication strategies. Given the historical “Kakai” perception associated with Sakai, communication materials should intentionally demystify the platform. This could include short video tutorials, FAQs, infographics, peer-support groups, and testimonials from students and faculty who now use Sakai confidently. Such initiatives would help reshape lingering negative perceptions and reinforce the view of Sakai as an accessible, supportive learning tool.

Additionally, the University should promote a blended learning pedagogy that fully leverages Sakai’s capabilities. Faculty development programmes should incorporate instructional design principles, active learning strategies, and assessment techniques suited to blended environments. Encouraging lecturers to use Sakai for quizzes, discussion forums, collaborative activities, and timely feedback will enrich the learning experience beyond basic content uploading. Another recommendation is for the University to establish mechanisms for routine monitoring and evaluation of Sakai usage across faculties and regional centres. Collecting analytics on login frequency, tool usage, submission patterns, and course activity will help the institution identify gaps, inform targeted interventions, and improve decision-making. This aligns with best practices in LMS quality assurance and supports evidence-based digital transformation. Finally, future LMS-related initiatives should incorporate sociocultural considerations into system design and implementation. As demonstrated by the “Kakai” narrative, cultural perceptions significantly influence

adoption. Engaging students and faculty in co-design, feedback sessions, pilot testing, and cultural-sensitivity reviews will ensure that Sakai remains a user-friendly, context-appropriate platform that resonates with the university community.

Conflict of Interest Statement

The authors declare no conflict of interest. The research was conducted independently, and no external funding or personal relationships influenced the design, analysis, or reporting of the study.

Declaration of Generative AI and AI-assisted technologies Use

During the preparation of this work, the authors used Grammarly and ChatGPT (version 4.0) to improve language and readability. The authors confirm that these tools were used solely for language editing and not for generating scientific content. The authors have reviewed and edited the output and take full responsibility for the content of this manuscript.

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Appendix

APPENDIX 1- PARTICIPANT INFORMATION SHEET

Study Title:

From Kakai to Lifeline: Unpacking the Transformational Role of Sakai LMS for Seamless Academic Continuity During and After COVID-19 at the University of Ghana.

Principal Investigator

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Dr. Alfred Ato Yankson, Department of Physics, University of Ghana

Purpose of the Study:

This study seeks to explore how students and faculty perceived, used, and adapted to the Sakai LMS across three phases before COVID-19, during COVID-19, and in the post-COVID era. The study aims to understand how the LMS evolved and what factors shaped its adoption and effectiveness.

Type of Participation:

You are invited to take part in a semi-structured interview lasting approximately 20–30 minutes. With your permission, the interview will be audio-recorded. Yes/No

Voluntary Participation:

Your participation is voluntary. You may withdraw at any time without penalty.

Confidentiality:

All information provided will be treated confidentially. Pseudonyms will be used in place of your real name. No identifying information will appear in the published study.

Possible Risks and Benefits:

There are no known risks associated with participation. Your insights will contribute to improving digital learning systems and support services at the University.

Contact Information:

If you have any questions, please contact:

Dr. Monica Mensah Danquah

APPENDIX 2- INFORMED CONSENT FORM

I have had read to me the information provided above. I understand the purpose of the study, what participation involves, and my rights as a participant.

I voluntarily agree to take part in this study.

Tick as appropriate: (Interviewers responsibility)

- ☐ I agree to participate in the interview. ☐ I agree to be audio-recorded.
☐ I prefer NOT to be audio-recorded (notes will be taken instead).

Participant Name: _____

Date: _____

Researcher Signature: _____

3. Interview Introductory Script

Good morning/afternoon, and thank you for agreeing to participate in this study.

My name is xxxxxxxx, and I am part of a research being conducted on how the Sakai LMS was used before, during, and after COVID-19 at the University of Ghana. The aim is to understand how the system supported teaching and learning, how perceptions have changed over time, and what lessons the University can apply for future digital transformation.

Your participation is voluntary, and you may choose not to answer any question or stop the interview at any time. Everything you share will remain confidential, and your real name will not appear anywhere in the study. I will use a pseudonym to represent your views.

With your permission, I would like to record the interview to ensure accuracy. If you prefer not to be recorded, I will take notes instead.

Do you have any questions before we begin?

Thank you once again for your time and contribution.

APPENDIX 3- INTERVIEW GUIDES:

INTERVIEW GUIDE: STUDENTS (Pre-COVID, During COVID, Post-COVID)

Section A: Demographic Information

1. Age: _____
2. Gender: _____
3. Centre/Region: _____
4. Programme: Information Studies (DE)

5. Level: 300
6. Years of experience using Sakai:
 - Less than 1 year / 1–2 years / More than 2 years

Section B: Interview Questions (Students)

1. Awareness and Experiences With Sakai (Pre-COVID focus)

1. Tell me about your first experience using Sakai LMS.
2. Before COVID-19, how often did you use Sakai, and for what purposes?
3. What challenges did you face when using Sakai before the pandemic?
4. How would you describe your attitude towards Sakai at that time (e.g., ease of use, usefulness, confidence)?

2. Sakai During COVID-19 (Crisis Adaptation)

1. How did your use of Sakai change when teaching and learning shifted fully online during COVID-19?
2. In what specific ways did Sakai support your learning during the pandemic?
3. What major challenges did you encounter (e.g., connectivity, navigation, assessments)?
4. Did you receive any support or training on how to use Sakai during this period? If yes, was it helpful?

3. Post-COVID Experiences (Sustainability and Transformation)

1. How do you use Sakai now that in-person learning has resumed?
2. How does your current experience compare to your pre-COVID and COVID experiences?
3. Do you consider Sakai an important part of your learning now? Why or why not?
4. What improvements would you recommend to make Sakai more user-friendly and effective?

4. Broader Reflections

1. What role do you think Sakai plays in supporting academic continuity at UG?
2. What lessons do you believe the university has learned from using Sakai?
3. How can the institution improve its digital learning systems in the future?

INTERVIEW GUIDE: FACULTY (Pre-COVID, During COVID, Post-COVID)

Section A: Demographic Information

1. Age: _____

2. Gender: _____
3. Centre (for DE facilitators): _____
4. Role: Lecturer / Tutor / Facilitator
5. Years teaching with Sakai:
 - Before 2015 / 2015–2019 / 2020–present

Section B: Interview Questions (Faculty)

1. Pre-COVID Use of Sakai

1. When did you begin using Sakai LMS in your teaching?
2. Before COVID-19, how did you integrate Sakai into your teaching activities?
3. What challenges or limitations affected your use of Sakai during this period?
4. How did your students respond to Sakai before the pandemic?

2. Teaching With Sakai During COVID-19

1. How did COVID-19 change your teaching practices with respect to Sakai?
2. Which Sakai tools did you rely on the most (e.g., announcements, assignments, quizzes, forums)?
3. What major challenges did you face while using Sakai during this period?
4. What type of institutional support or training did you receive, and how helpful was it?
5. How did your students engage with Sakai during the pandemic?

3. Post-COVID Use of Sakai (Blended Learning)

1. How are you currently using Sakai in your teaching now that in-person learning has resumed?
2. Do you consider Sakai essential in your teaching practices? Why or why not?
3. How does Sakai support blended or technology-enhanced learning in your courses?
4. What improvements would you suggest to enhance Sakai's effectiveness for instructors?

4. Institutional and Policy Reflections

1. What lessons do you believe emerged from the university's use of Sakai during COVID-19?
2. What additional support should the university provide to strengthen LMS integration?
3. How can UG improve long-term digital transformation and readiness in teaching and learning?



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Exploring Language Learners' Experiences and Perceptions of Sakai Online Exams at the University of Ghana

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ABSTRACT

The COVID-19 pandemic brought major changes to teaching, learning, and assessment in higher education. At the University of Ghana, many courses were delivered online; hence, some assessments had to be conducted virtually. One major response by the university was the introduction of Sakai-based exams, which could be taken either on campus or remotely. This approach, which was used to support traditional in-person exams, has now become a long-term method of assessment. This study aims to explore how language learners experience and perceive Sakai-based exams. Using a mixed-method approach and a sample size of 387, we gathered data from language learners at the School of Languages, University of Ghana, to examine their opinions, challenges, and overall satisfaction with online exams on the Sakai platform. The findings reveal that, despite challenges reported by language learners, such as the absence of special characters, technical issues, and inadequate support systems, approximately 73% prefer Sakai-based exams to traditional exams. Based on the respondents' experiences, this study makes the following recommendations: 1. There should be the inclusion of on-screen special characters for languages that require them. 2. Institutions of Higher Learning should have pre-recorded training sessions that tackle technical aspects of Sakai during exams. 3. There should be enhanced and real-time support systems during Sakai-based exams. The findings will help inform strategies to improve online assessment methods, ensuring they are fair, user-friendly and supportive of student success. These recommendations are valuable for both instructors and institutions as they continue to use digital tools in assessment.

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Keywords: Sakai, online assessment, language learner, students' experiences, LMS

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Introduction

In the era of growing instructional technology and assistive assessment tools that help improve teaching and learning, language learners seem to be a few steps behind in fully accessing all their benefits. As such, Hoque et al. (2020) argue that Learning Management Systems (henceforth LMS) need to address the specific needs of language learners. LMS has become essential in higher education globally, as they provide tools that support teaching, learning, and assessment. Studies have shown that LMS platforms can streamline examinations, support independent learning, and provide immediate feedback to students (Bui, 2022). They became widely used when universities were forced to adopt online and distance learning solutions to sustain academic activity during the COVID-19 pandemic (Khatser & Khatser, 2022). Even beyond the pandemic, pressures such as rising enrollments and limited physical infrastructure compelled institutions to adopt more blended learning approaches, making LMS platforms an essential part of the university ecosystem.

However, their effectiveness depends on the experiences of learners. For language learners in particular, online assessments present unique challenges such as difficulties with diacritics, written accent marks, and media integration. While existing research has examined LMS use in higher education broadly, less attention has been given to language learners' specific needs (Hoque et al., 2020). This gap is significant because language courses often require special features such as written accent marks and special characters not as critical in other fields, and overlooking them may limit the effectiveness, usability, accessibility and fairness of language-related assessments via these platforms.

At the University of Ghana, Sakai (LMS) has been operational for ten years now, at the time of this study. In this regard, the present study seeks to:

- Explore the effectiveness of Sakai-based assessments from the perspective of language learners at the School of Languages, University of Ghana.
- Examine the opinions, challenges, and overall satisfaction of language learners with the platform.

By analysing the perception of language learners, we can gain a deeper understanding of whether Sakai enhances assessment and allows them to really demonstrate their depth of knowledge and understanding of course items.

General Perceptions of Sakai LMS-based Exams

Learning Management Systems platforms have assessment tools embedded in them to administer and manage assessments. It enables instructors to create and grade

assessments efficiently (Slamet & Mukminatien, 2024). Research suggests that LMS-based assessments can help improve learning as they allow instructors to give timely feedback to students (Slamet & Mukminatien, 2024). In addition, the use of LMS has been shown to significantly reduce teachers' workload, with studies reporting up to a 40% decrease in marking time (Atkinson & Lim, 2013). Students generally view LMS-based examinations positively, highlighting friendly interfaces (Cakiroglu et al., 2017; Slamet & Mukminatien, 2024). This view is supported by Garg & Goel (2022), who argue that the ability to navigate LMS easily and receive instant feedback can make assessments more interactive and learner-centered. However, technical issues or insufficient support can undermine student confidence in the assessment process. As such, LMS platforms must fully support the exam process with reliable servers and technical help (Khare & Lam, 2008). Even though these perceptions explained above are coming from a general contextual background, they will serve as a basis for examining related perceptions by language learners from the University of Ghana context.

Comparison of Online vs. Traditional Exams

When comparing Sakai to traditional pen-and-paper examinations, Sakai offers significant logistical and pedagogical benefits. For example, automated grading, reduced marking times, and lower administrative costs ease the burden on instructors, particularly in large classes (Atkinson & Lim, 2013; Turner, 2015). For students, online formats can reduce exam-related anxiety, particularly in the arts and social sciences, where preparation for digital assessments is often perceived as less stressful (Cross et al., 2023). In sharp contrast to Cross et al. (2023), Al Hashimi et al (2022) reported that several respondents who were art and design students from the University of Bahrain and Petra University in Jordan preferred face-to-face to online exams. They attribute this preference to online learning and assessments negatively impacting their performance. Even though Atkinson & Lim (2013) revealed the advantages of online assessments, their observations did not specifically address their impact on language learners. We also observe that Cross et al. (2023) and Al Hashimi et al (2022) report on student preference on the use of online and face-to-face exam modes had no consideration specifically for language learners. Thus, in this study, we explore language learners' perception of online assessments.

Challenges in Online Assessment

There are multifaceted challenges emerging from technological, psychological, and procedural domains associated with the use of LMS platforms for assessments. Majola and Mudau (2022) posit that frequent technical challenges and unresponsive digital platforms can distract exam participation, thereby increase student anxiety and affect performance. It is important to note that these disruptions and distractions may not merely inconvenience learners, but they also affect the examination's fairness and reliability.

Also, Hoque et al. (2020) discovered that online platforms' current support for essential features like the incorporation of special characters, audio input, and interactive elements for valid and reliable language assessment is a challenge. This reveals a significant gap in both research and practice. With the knowledge that language assessments often require these features, it is essential to investigate this area about language learners' assessment. Thus, understanding the limitations and challenges of Sakai's design is crucial to improving its usage in language learning across diverse educational contexts like the University of Ghana.

Additionally, Majola and Mudau (2022) explain that in South Africa, frequent interruptions in power supply and unstable internet connectivity are the basis for some of the challenges faced during online-based exams. These conditions cause an intermittent cutting off of access during exams, causing frustration and sometimes forcing students to retake the exams. In the long run, the psychological burden on students who often feel helpless due to technical failures beyond their control deepens. With the University of Ghana being in a country faced with such a predicament, students may be exposed to challenges of a similar nature during Sakai-based online examinations.

Similarly, Romaniuk and Łukasiewicz-Wieleba (2021) reveal systemic issues such as sudden platform crashes or lagging during critical exam phases, which further temper with student confidence in the exam process. They establish the premise that many students rely on older computers or mobile devices that may not fully support Sakai's functionalities, leading to inconsistent interaction with exam materials and potential data loss. Malik (2023) observed that students used the new LMS because they could easily access it on their phones. Since this observation cuts across online examination platforms and some language learners at the University of Ghana are exposed to, it explains why we seek to explore the challenges that they face during Sakai-based online exams and propose solutions for these issues.

Moreover, diacritics and special characters are important features in language learning as noted in Akimov and Malin (2020). However, Yilmaz (2017) discloses that inconsistencies in how Sakai renders these characters across different browsers or devices can result in corrupted or missing text, further confusing examiners and unfairly penalizing learners who take the online-based assessments. The challenges directly undermine and impact language learners' confidence and motivation. This calls for intervention, especially on the part of language learners. Hence, the study addresses the situation and suggests ways to make Sakai-based exams fair to language learners.

Support Systems in Digital Assessments

Amid these challenges, Romaniuk & Łukasiewicz-Wieleba (2021) state that faculty members play a pivotal role in addressing challenges related to online assessment contexts. Their roles include mastering Sakai's functionalities, anticipating common student difficulties, and devising flexible assessment approaches that accommodate varying learner capabilities and technical constraints. Also, faculty availability for prompt communication alleviates student anxiety and clarifies expectations, fostering a more supportive examination environment. Likewise, Majola and Mudau (2022) suggest that institutional support structures are useful in controlling technical and procedural difficulties experienced by students during online exams. Instituting effective and accessible IT help desks constitutes a great step for addressing issues ranging from login troubles and software problems to real-time connectivity disruptions. Their responsiveness and competence influence student exam confidence and success. Again, Abeywickrama and Dissanayake (2022) reveal that comprehensive training programs focusing on Sakai's functionalities and exam protocols enhance learner familiarity and reduce avoidable errors. Initiatives such as orientation sessions, practice exams, and available tutorials enable students to anticipate and navigate exam conditions. Additionally, Yilmaz (2017) posits that continuous technical support during live exam sessions offers critical intervention opportunities, preventing minor issues from escalating into major disruptions.

Similarly, Reedy et al (2021) state that faculty willingness to adapt assessment formats based on learner feedback signifies a student-centered approach that acknowledges emerging challenges. They propose that relaxing time constraints or redesigning question types can significantly improve inclusivity and fairness. On this claim, Khan et al. (2021) also stipulate that instructors often serve as intermediaries between students and IT departments, transmitting technical guidance and mediating support access. Moreover, Munyaradzi et al (2022) found that lack of user expertise and inadequate support for lecturers and learners impacted their willingness to use the LMS platform.

The studies above reveal the importance of support from faculty, LMS technicians and designers and institutions in creating a user-friendly environment for learners who take online assessments. They should not only be preoccupied with using new technologies but rather see to it that it is effectively used to maximise its benefits.

Research Design

This study employs a mixed-methods research design, combining both quantitative and qualitative approaches to provide insight into students' experiences and perceptions. Quantitative data was gathered through close-ended questions, which allowed for statistical analysis of general trends and patterns, while qualitative data was gathered from open-ended questions. This data provides detailed insights into experiences and perceptions of language learners in the School of Languages at the University of Ghana.

Population and Sampling

The target population of this study comprises undergraduate language learners enrolled in the School of Languages at the University of Ghana who have experienced Sakai online exams. A purposive sampling technique was used to select participants who are language learners and have participated in online assessments. Purposive sampling was used because it gave researchers the opportunity to select participants who fit their study. A total of 387 students participated in this study. The study population was made up of students enrolled in a language course in the School of Languages at the University of Ghana who had previously participated in at least one Sakai online exam. Names and other personal identifiers were not collected from the participants to prevent any bias.

Data Collection Instruments

A structured questionnaire was developed, comprising both closed-ended questions and open-ended questions. Language learners' perceptions regarding ease of use, fairness, and overall satisfaction were quantified by using multiple-choice questions. The personal experiences, challenges, and suggestions for improvement of the learners were explored using open-ended questions. This study did not use pre-existing instruments. Researchers designed the questionnaires to seek the perspectives of Ghanaian foreign language learners on using Sakai LMS for assessments at the University of Ghana.

Ethical Clearance Statement

Participation in this study was voluntary and the questionnaires for this study were distributed electronically via student platforms over a period of three weeks. Participants were also provided with an information page explaining the purpose of the study and

assured of confidentiality. Also, in the preparation of this paper, Microsoft Copilot was used to draft the questionnaire for data collection. The authors acknowledge full responsibility for the intellectual content of this work and have ensured that the questionnaire was reviewed and revised for accuracy and appropriate academic style and to maintain the scholarly integrity of this paper.

Validity and Reliability

To ensure that only language students answered the questions, the questionnaire link was shared during language class times. Then, students who opted to participate were encouraged to complete the form within 10-15 minutes. Even though participation was anonymous, participants were able to access the questionnaire using their email address. Hence, one participant could not answer the questionnaire twice.

Data Presentation and Discussion

In this study, the qualitative components of the data were coded manually and analyzed thematically using Braun and Clarke framework. This allowed researchers to identify patterns in learner's experiences, challenges and perceptions of Sakai based exams. On the other hand, data from quantitative components were analyzed using descriptive statistics such as charts and table. Descriptive statistics were chosen over inferential analysis because the study did not seek to test hypotheses or establish causal relationships, but rather to identify dominant patterns and areas of convergence or divergence in learners' experiences. This choice aligns with the study's pedagogical focus on understanding learner perspectives rather than making generalisable predictive claims.

The quantitative data collected from the closed-ended items in the questionnaire were analysed using descriptive statistical procedures. This approach was considered appropriate given the exploratory nature of the study and its focus on capturing language learners' perceptions, experiences, and preferences regarding Sakai-based online examinations. First, responses from participants who indicated that they had not taken a Sakai-based language examination were excluded from further analysis. As a result, all quantitative analyses were conducted on data from 336 respondents, representing 86.8% of the total sample. This ensured that findings reflected the experiences of learners who have participated in Sakai-based online language assessments.

The questionnaire items were measured using Likert-scale response formats such as agreement levels, frequency, and preferences. Quantitative data were coded numerically and analysed using percentages and distribution patterns. These statistics were used to summarise key trends in learners' perceptions of platform accessibility, assessment effectiveness, fairness, satisfaction, preference for exam mode, and the prevalence of technical challenges. Results were presented using tables and charts to enhance clarity and allow for straightforward interpretation of response patterns.

Lastly, the quantitative findings were not treated in isolation. They informed and guided the qualitative analysis by highlighting key areas such as technical challenges, support mechanisms, and assessment preferences. Thus, at the discussion phase, quantitative trends were therefore triangulated with qualitative responses to strengthen the credibility and reliability of the findings.

This section thematically presents the findings of the study on language learners' experiences and perceptions of Sakai online exams in the School of Languages at the University of Ghana. Three main themes are analyzed in this study: students' perceptions of Sakai, challenges experienced by language learners, and recommendations for improvements. The purpose of these themes is to answer the following research questions:

1. What are the perceptions and experiences of language learners in the School of Languages at the University of Ghana towards Sakai online exams?
2. What challenges do language learners in the School of Languages at the University of Ghana face when using Sakai for examinations?
3. In what ways can Sakai be improved to accommodate language learners' exam experience?

Data Presentation and Discussion

A total of 387 students participated in the survey. The demographic breakdown is as follows:

Table 1: Gender

Male	19.4%
Female	80.6%

Source: Data

Table 2: Age

15-20	44.2%
21-25	53.5%
26 and above	2.3%

Source: Data

Table 3: Language Program

Arabic	3.1%
Chinese	40.6%
French	16.8%
Kiswahili	19.6%
Russian	2.1%
Spanish	31.5%
English	1.2%

Source: Data

Table 4: Level of Study

Level 100	37.5%
Level 200	14.5%
Level 300	35.4%
Level 400	12.7%

Source: Data

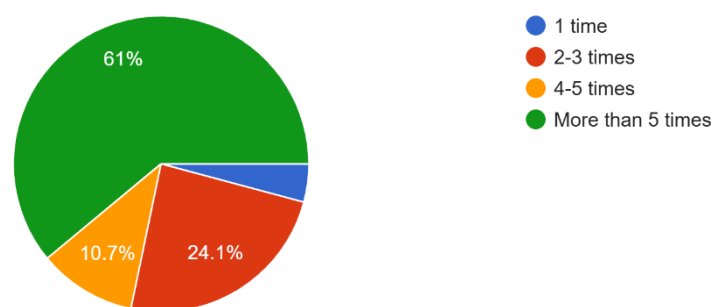
Table 5: Taken Sakai Exam at least once

Yes	86.8%
No	13.2%

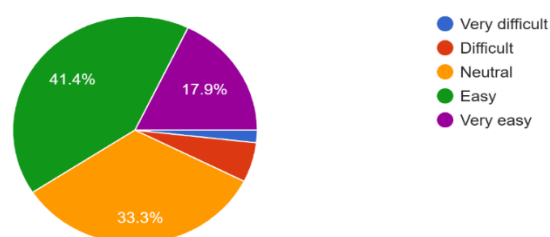
Source: Data

As presented in table 5, only 86.8% of respondents have taken online language assessment via Sakai. The remaining 13.2% of the respondents who selected 'No' automatically ended the questionnaire session, and hence the data on perceptions, experiences, challenges and recommendations towards Sakai for exam purposes among language learners was based on the 86.8% (336), which from this point is considered as our 100%.

Language Learners' Perceptions of Sakai for Language Assessment

Chart 1: Frequency of Language Assessment via Sakai

Data collected shows a total of 34.8% of respondents have taken language assessments on Sakai between 2-5 times while 61% of the respondents have taken Sakai based assessments more than 5 times. The remaining 4.2% of the respondents have used it only once.

Chart 2: Accessibility and Usability of Sakai

Respondents were asked to rate the ease with which they navigate the Sakai platform, and as shown in Chart 2, most of the respondents said it was easy and very easy to use, making up 59.3% of the responses.

Consistent with the earlier data presented in Chart 2, 59.2% of the respondents stated that they are confident navigating the Sakai platform, while only 3.3% indicated that it was difficult using the platform during assessments. Similarly, 48.5% of the respondents admit that Sakai assessments allow them to demonstrate their knowledge effectively. 64.3% of the respondents agree that using Sakai for exams supports fair and unbiased assessment,

with only 8.4% disagreeing with this statement. The study probed further into the suitability of Sakai in reflecting their true abilities. 50% of the respondents agreed that using Sakai reflected their true abilities, as against 17.6% who disagreed with this. The overall satisfaction of the Sakai platform was tested. 53.6% of the respondents reported that they were satisfied with Sakai for assessment purposes. 36.3% of the respondents took a neutral stance, while 10.2% were not satisfied with Sakai. The qualitative data provides responses in this regard such as:

“Easy to navigate”

“Easy, navigable, accesible”

“Effectively convenient for use”

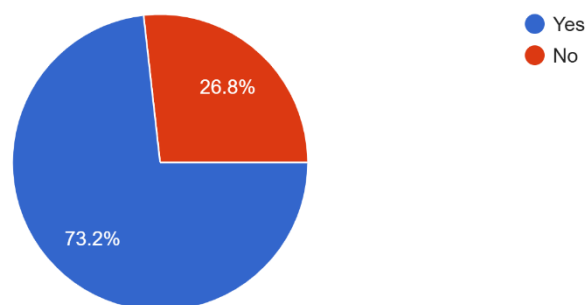
“Efficient, accessible, secure”

“Effective, easy to use and navigate”

“Effective, easy to operate and beginner friendly”

“Easy, suitable and learner friendly”

Chart 3: Preference on Sakai vs. Traditional Exams



In chart 3, we observe that 73.2% of the respondents prefer Sakai end-of-semester exams to traditional exams with answer booklets. The respondents went on to choose various reasons why they prefer Sakai, including:

I feel less exam stress in a digital environment. (63.9%)

The timer and progress tracker help me manage my time. (55.6%)

I don't have to worry about my handwriting not being legible. (51.2%)

Typing is easier and faster for me than writing by hand. (45.2%)

The remaining 26.8% of the respondents who prefer traditional exams to Sakai-based exams also chose factors that influence this decision. These include:

Technical issues during Sakai exams cause me stress. (58.7%)

I express thoughts more clearly in handwriting. (57.7%)

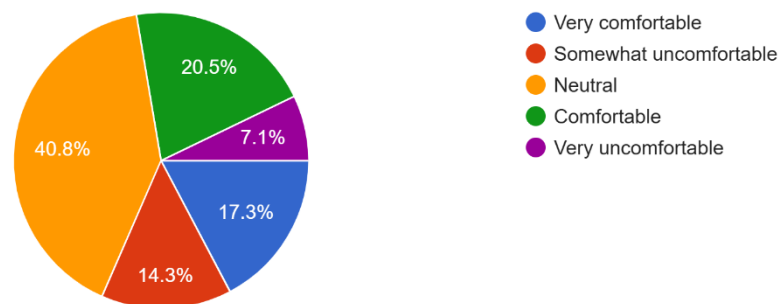
I do not trust Sakai to submit all my answers in case of a technical challenge (39.4%)

I concentrate better in a traditional exam setting (36.5%)

Challenges Experienced by Language Learners when Taking Sakai Assessments

This section presents data showing that respondents experience challenges when taking Sakai based assessments. The data is presented in the charts below.

Chart 4: Using the Keyboard for Language Assessments



As depicted in chart 4, the majority of the respondents are neutral on this question, and 27.6% are comfortable using the keyboard for their language assessment.

Some respondents mentioned personal experience in relation to their use of special characters during Sakai-based exams. Some of the experiences shared include:

“Unavailability of special characters.”

“It’s hard to access special characters.”

“Not being able to use special characters.”

“Not being able to input characters.”

“Chinese characters are not visible enough on the screen.”

“As [a] Chinese students, we have no access to special characters than to copy and paste.

This hasn't proven to be effective all time[s] and it end up affecting the overall score. In addition, there are times whereby some diagrams may not have some features for you to look at it and answer, even though the answer has been programmed on the system and in that case, refusing to answer it is a zero and answering it anyhow you think too will give you zero. In tandem to the earlier indicators, it has an impact on the overall score.”

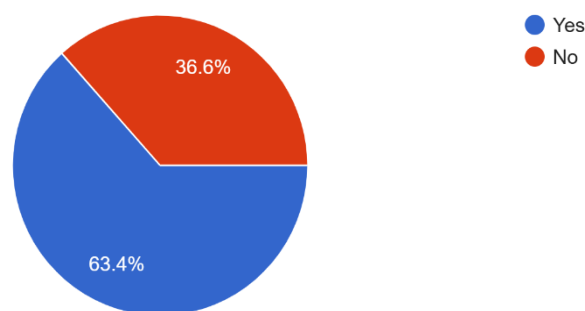
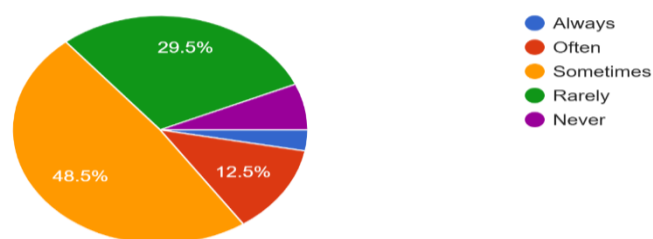
Chart 5: Respondents' Experiences with Technical Issues

Chart 5 confirms technical challenges are experienced by language learners when taking language assessments. 63.4% of the respondents have faced technical challenges while taking assessments.

Chart 6: Frequency of Technical Challenges

In chart 6, respondents report on the frequency of technical challenges during language exams. A majority of the respondents suggested that they experience technical challenges sometimes. 3% of them said that they always experienced technical challenges.

Some examples of technical challenges were presented to the respondents. The distribution of the options is as follows:

"Sakai was slow and unresponsive." (51.2%)

"The computer froze." (31.5%)

"I could not input special characters." (30.1%)

"Submission issues." (20.5%)

Respondents also reported personal experiences that are related to technical challenges during assessment on Sakai. Some of the most mentioned are stated below:

"Network Issues"

"Technical glitches"

"Slow and unresponsiveness"

“Moving to the next question delays and there were some few times I was unable to access Sakai”

“Submission of assignments before I finished and before the allotted [allocated] time had elapsed”

“Sometimes impossible to see the characters given for some questions”

Other technical issues revealed by respondents include:

“Sometimes an image attached to a question doesn’t appear even though the lecturer uploaded it.”

“Submission of assignments before I finished and before the allotted [allotted] time had elapsed”

“Erasure of answers during technical difficulties”

“If the network is disrupted, then SAKAI starts logging people out. It sometimes doesn't open when you want it to either.”

“For audio assessments, students are unable to either forward or replay audios to and from a specific point. We have to wait till the audio ends before we can do so.”

Chart 7: Challenges when Seeking Help during Sakai Exams



The data in chart 7 suggests that 36.6% of the respondents received help, but the help was delayed, while 30.1% of the respondents noted that the help they received was very timely and effective. 16.4% mentioned that even though help is available, it is not useful for the language-related problem. Respondents also register their personal experiences with getting support when needed during Sakai exams. Some of these include:

“Couldn’t load pictures but it was solved fr me because it was somewhat a general issue.”

“...unhelpful invigilators or IT personnel...”

“The indifference of some invigilators”

64.3% of the respondents also stated that they turned to invigilators for support during Sakai exams, while 37.5% of the respondents stated they turned to IT personnel for assistance when taking exams on Sakai.

Recommendations made by Learners for Improvement on Sakai-based Exams

In this study, the respondent made recommendations that can be considered for improving Sakai-based exams for language learners:

60.1% said there should be an on-screen keyboard for special characters

Give more time to students studying languages with special characters (55.4%)

Language lecturers should allow for practice exams on Sakai before the real exam (48.8%)

Real-time support for students when there are technical issues (35.4%)

The above figures illustrate the changes the respondents would like to experience while using Sakai for exam purposes.

Respondents also highlighted some personal recommendations that are mentioned below:

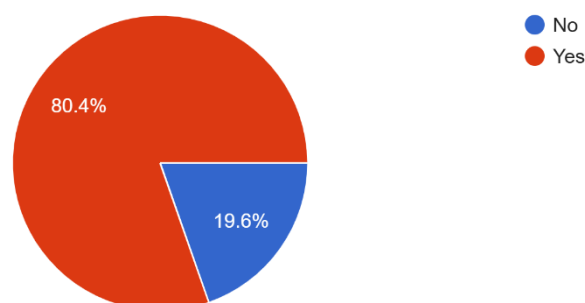
“More practice with the Sakai before exam so that we can get used to it”

“Language lecturers should allow for practice exams on Sakai before the real exam, Give more time to students studying languages with special characters”

“Lectures should consider students who face technical issues during examination on Sakai since it's bo[not] fault of theirs”

“New introduction of characters on exam day”

Chart 8: To use or not to use?



When the respondents were asked if they would recommend the use of Sakai-based language assessments, an overwhelming 80.4% of the respondents said they would recommend Sakai for language assessments.

Discussion

In this section, we interpret and contextualize the key findings presented in the previous section. It explores the implications of learners' experiences and perceptions of Sakai-based assessments at the University of Ghana, relating these findings to existing literature thematically. The discussion aims to provide a comprehensive understanding of the challenges and areas for improvement within the current Sakai online assessment system for language learners, ultimately informing recommendations for enhancing the online assessment process. The discussion for this study will be presented thematically, following the structure of the data presented in the previous section.

Language Learners' Perceptions of Sakai Platform Accessibility: "Easy, Navigable, Accessible"

The issues of platform accessibility, ease of use, and a navigable interface have been raised in recent studies of LMS platforms in conducting assessments. As mentioned by Slamet and Mukminatien (2024), the LMS interface plays an important role in platform usability. This study reveals, as shown in chart 2 that, majority of the students found the Sakai platform fairly navigable and easy to use. This reflects a similar study by Grag and Goel (2022), who also reported that students found the online assessment platform easy to navigate when answering questions. It is important to mention the overall accessibility of the Sakai platform, as Abeywickrama and Dissanyake (2022) confirm that usability issues within the software environment of online exams significantly affect students' experiences. In support of their claim, 59.2% of the respondents of this study strongly agree and agree that the easy interface that the Sakai platform provides makes them confident when taking language assessments.

Also, in line with previous studies on Sakai and other LMS usability, some respondents perceived the Sakai platform to be easy to navigate, effective, convenient for use, beginner-friendly, suitable, secure, and accessible. This suggests that Sakai reduces possible barriers that might distract learners during examinations. However, the findings also indicate that general navigability does not guarantee pedagogical accessibility for language learners. Learners' positive perceptions of Sakai's interface coexist with persistent challenges related to linguistic representation. This contradicts claims in prior studies that LMS design necessarily enhances assessment effectiveness. For language learners, accessibility is not limited to logging in or moving between questions. It also includes the ability to demonstrate depth knowledge in language related courses through examinations. The findings highlight that platforms designed without sensitivity to language-specific needs may remain pedagogically limiting despite being user-friendly.

Effectiveness of Sakai as an Assessment Tool

Furthermore, on their ability to demonstrate understanding of course materials during assessments, 48.5% of respondents agreed and strongly agreed that Sakai was an effective tool for assessment. However, the majority, which was 51.5%, disagreed and strongly disagreed with this assertion. This differs from what Slamet and Mukminatien (2024) reveal in their study: that the use of LMS helped students to achieve the expected learning outcomes. 64.3% of respondents also agreed that the Sakai platform is fair and unbiased for language assessment. This confirms an assertion made by Turner (2015) and Akay and

Gumusoglu (2020), that online quizzes and examinations easily measure the students' knowledge and comprehension levels. When it comes to self-reported performance on Sakai, 50% of the respondents agreed or strongly agreed that the Sakai assessment truly reflected their ability, whilst 32.4% of respondents were neutral. This representation is also reflected in the respondents' opinions on their overall satisfaction with Sakai-based online assessment, where about 53.6% were generally satisfied with Sakai LMS. It is discovered that Sakai based language assessment was the best experience ever, and okay to use.

In spite of the above assertions confirming that some learners agree that Sakai is effective for language-based assessments, the quantitative data reveal that learners' views on Sakai's effectiveness as an assessment tool were divided. This shows the diverse opinions on online assessments in language education. While some respondents felt Sakai enabled them to demonstrate understanding, others had varying opinions. This finding contrasts with studies that report LMS-based assessments as broadly effective in measuring learning outcomes (Mukminatien, 2024), suggesting that effectiveness is conditional rather than universal. This means that when platforms restrict learners' ability to input or display language accurately, assessment effectiveness is compromised.

Students' Perception of Sakai versus In-person Exams with Answer Booklet

The transition from traditional to online examination using LMS has shown promising results in various educational contexts. In gauging the language learners' perspective on their preference when it comes to taking exams on Sakai versus the traditional in-person exams with answer booklets, 73.2% of the respondents, constituting a majority, stated that they prefer exams conducted on Sakai to the traditional exams. This reflects a positive attitude by students towards Sakai-based exams. This sentiment is similarly expressed by Cakiroglu et al. (2017) and Figaredo et al. (2022), whose participants favoured LMS-related exams. A major factor that seems to influence this decision was that students reported feeling less exam stress in a digital environment (63.9%). Cross et al. (2023) also found out that students feel less anxious when revising for online exams. Other factors that students reported on include the role that the timer and progress tracker play in time management (55.6%) and that they don't have to worry about the legibility of the text since it isn't handwritten (51.2%).

However, the remaining 26.8% who prefer the traditional exams state reasons like stress caused by technical challenges (58.7%), better expression of thoughts when writing by hand (57.7%), and difficulties faced when typing special characters in languages other than English (47.1%). Participants in Slamet & Mukminatien (2024) report experiencing technical issues when taking online exams. Majola and Mudau (2022) also list certain challenging factors that are similar to those found in this study. They highlighted aspects that range from technological, psychological, and procedural domains.

Moreover, from the qualitative data, it can also be noted that Sakai-based online examination is preferred over in-person because it is eco-friendly. Its usage helps prevent the indiscriminate cutting down of trees to produce examination answer booklets in the case of traditional pen and paper exams. Hence makes online exams sustainable and eco-friendly in comparison to answering questions on paper.

Again, what is notable is that the preference for Sakai-based online exams persisted despite the prevalence of technical challenges. Rather than rejecting online assessment in

response to these issues, learners chose to balance the benefits of Sakai-based online exams against their limitations. This finding challenges the negative interpretations of online assessment and suggests that learners may be more adaptable and open to digital assessment than in-person exams with answer booklets.

Technical Issues

When it comes to reliability on the Sakai platform, students reported having experienced technical issues. When asked whether or not they have encountered these technical issues on the Sakai platform, about 63.4% of the respondents chose yes. Upon further investigation into the frequency of these issues, only 6% of the respondents indicated that they have never experienced these difficulties during a language-related exam. This data confirms some respondents' fear of experiencing a technical issue during exams online, hence their preference for traditional methods of writing exams. Technical difficulties, such as unreliable internet connectivity and software failures, as identified by Majola and Mudau (2022), frequently disrupt and distract exam participation, causing a rise in student anxiety and potentially affecting performance outcomes. Even though 63% of our respondents feel less stressed in digital environments, frequency with technical issues could cause anxiety as Abeywickrama and Dissanayake (2022) confirm that usability issues within the software environment of online exams significantly affect student experience. Our findings revealed that about 51.2% of respondents noted that Sakai was slow and unresponsive during assessment. In addition, 31.5% of respondents indicated that the computer froze during the exam. Another 19% of respondents reported having login issues. These technical inconveniences contribute to cognitive distractions, diverting attention from content mastery to interface management, which is particularly detrimental during high-stakes assessments as posited by Abeywickrama and Dissanayake (2022). For example, students revealed that Sakai wasn't able to save answers, which led to restarting the assessment. Also, Sakai would log out without completion of ongoing exams. And there are times where the platform is unable to display images that are uploaded for assessment purposes.

The above opinions clearly reveal the kinds of technical issues that language learners encounter when participating in online exams via Sakai. The coexistence of reported technical issues and lower exam stress among some respondents contradicts prior claims that technology heightens anxiety. The findings in this study suggest that anxiety in online exams is shaped less by the digital format itself and more by the reliability and predictability of the assessment tool. As such, there is the need to make LMS more reliable and accessible.

Keyboard/special characters: “Sometimes impossible to see the characters given for some questions”

Special characters play a big role in assessing language learners. One key feature of language is the special characters that come with it. According to Akimov and Malin (2020), the display of special characters, including accents, diacritics, and unique scripts that form the orthographic standards of languages, is required in language assessments. They emphasize that problems with entering these characters are common on online platforms like Sakai, which depend on standard keyboard layouts that may not ordinarily support these special symbols. This often causes language learners to use alternatives or incomplete representations, which can lead to a decline in answer quality and assessment

accuracy. In our present study, about 30.1% of respondents revealed that they could not input special characters during an online exam. When it comes to mastery of the keyboard, only 37.8% indicated that they were comfortable using Sakai in typing the target language. This is consistent with data obtained where students chose the traditional method of writing exams over Sakai. 41.7% said that they had difficulties typing special characters during assessment.

Moreover, language learners face challenges with typing special characters in the language exam. This finding represents a critical contribution to the literature, as it draws attention to how the lack of subject-specific functionalities in instructional technologies can limit their effectiveness. In language learning contexts, diacritics, accents, and scripts are essential as they carry and convey meaning in the respective language. When learners are unable to represent these accurately, assessment outcomes may fail to reflect true competence. As such, considerations of fairness and validity must include learners' capacity to express language accurately within the platform, rather than focusing only on task design or scoring procedures.

Support Mechanisms during Online Assessments:

Online assessments require support for technical challenges that students face. In this study, the respondent indicated having challenges like login issues, slow internet connectivity and unresponsive Sakai. To ascertain the support students get, we asked the students who they turned to for support during these issues. About 64.3% of respondents turn to invigilators while 37.5% turn to IT personnel for support. 12.3% of respondents opted to solve their issues by themselves, and 6.3% did not ask for help. We asked students to rate the support they have received during Sakai-related exams, and 33.6% reported that despite receiving support, the support was delayed. Also, 30.1% indicated that they receive timely and effective support. About 16.4% stated that help was available but was not useful for language-related problems. 8% of respondents indicated that they did not receive any support when they needed it. Majola and Mudau (2022) suggest that institutional support structures are useful in controlling technical and procedural difficulties experienced by students during online exams. Instituting effective and accessible IT help desks constitutes a great step for addressing issues ranging from login troubles and software problems to real-time connectivity disruptions. Their responsiveness and competence influence student exam confidence and success. Engaging students on their perception of how supportive their instructors were in preparing them for online exams on Sakai, about 54.8% of respondents indicated that their instructors were helpful and very helpful. 33.3% of respondents were neutral. Romaniuk and Łukasiewicz-Wieleba (2021) are of the view that faculty members play a key role in facilitating smooth online-based examination experiences. Their preparation does not only involve mastering technological interfaces but also realizing common student difficulties and devising contingency strategies. Responsive communication channels established by faculty help resolve student concerns, contributing to reduced anxiety and clearer expectations of outcome.

Again, language learners face problems with invigilators and IT personnel during online assessments via Sakai. While some students received timely assistance, others reported delayed or ineffective support in relation to language-specific issues. The reliance on invigilators rather than IT personnel suggests a blurring of pedagogical and technical responsibilities during online exams. This indicates a need for clearer coordination and role

preparation so that support providers can respond effectively to both technical disruptions and language-specific assessment challenges. It could also mean that students reach out to invigilators when they face technical issues because they are their immediate point of call in the exam hall.

Recommendations: “There is more room for improvement”

Students are the main users of the Sakai thus it is prudent to explore changes and improvements through their lenses. When asked on aspects that need improvement, 9.8% of respondents mentioned platform usability, 17% chose time management tools and 49.4% of respondents indicated technical support issues. Also, on-screen keyboards with alphabets of the target language and time limit were among concerns raised by the respondents.

It is important to acknowledge that 60.1% of our respondents recommend the inclusion of special characters for language-related exams. Another recommendation that was made by 55.4% of respondents highlighted the need for more time for languages with special characters and diacritics. On the issue of student familiarization with the Sakai platform about 48.8% say there is also the need to develop mock exams for language students to enable them practice taking assessment via Sakai to familiarize themselves with the Sakai interface and the Test and Quizzes tool. This recommendation aligns with the proposal made by 33% of respondents for the inclusion of asynchronous workshops to train students on how to navigate the Tests and Quizzes tool on Sakai before exams. It is worth mentioning that about 35.4% indicated that there should be real-time support for students when there are technical issues. In addition, 38.4% of respondents hint at improved display of attached media files during language exams.

Notably, the views show that Sakai online-based exams can be improved to optimize its effectiveness for language-related exams. Recommendations from learners demonstrate a strong desire to improve Sakai-based online assessment rather than abandoning it. Request for on-screen keyboards, inclusion of special characters for language-related exams, additional time, practice exams before main exams, and real-time support reflect learners' understanding of what they need to demonstrate learning and taking assessments more effectively.

Conclusion

Overall, the current study suggests that LMS-based examinations can be effective alternatives to traditional formats as more universities adopt blended and online learning. The data from the study shows that 80.4% of respondents favour the use of Sakai for language-related assessment despite highlighting significant challenges. As a result, it is worth noting that for these platforms to be fully effective and support fair and inclusive assessments, there is the need to address challenges reported by respondents. Again, drawing from student feedback, we recommend that LMS platforms invest more in making their platform accessible and tailored to the specific needs of the diverse learners, including language learners. They should also have periodic system updates to address challenges of connectivity and usability to optimize user experience. Universities should also partner with LMS companies to organise periodic training for instructors and IT personnel on how best to support learners in real-time during exams. The suggestion made by students for

asynchronous training should be made into a simple course for freshmen, which is required to be completed on Sakai before the commencement of first-semester exams.

Recommendations

Future studies could adopt mixed-method or experimental research designs that combine survey data with objective measures such as Sakai's system analytics and students' performance. In addition, investigating instructors' pedagogical practices, assessment strategies and technological challenges would provide a more comprehensive understanding of Sakai-based language assessment and strengthen evidence-based decision-making in higher education. Future research should also consider comparative studies across multiple universities and educational contexts, which would provide broader insights and perspectives into Sakai-based examinations across institutions. Also, future studies should incorporate focus group discussions or in-depth interviews to give room for respondents to express their views in detail.

Limitations

This study has some limitations that should be considered when interpreting the findings. First, the study relied on self-reported data, which may be subject to self-report bias and recall inaccuracies. Also, the study only focused on the School of Languages at the University of Ghana and allowed for an in-depth examination of students' experiences with Sakai only at the University of Ghana leaving out other institutions. Finally, the uneven representation of language programs among participants may not fully capture the experiences of learners across all language disciplines. Moreover, the limited depth of some responses hindered a detailed interpretation of students' experiences.

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Leveraging Open-Source Learning Management Systems (LMS) for Resilient and Inclusive Higher Education in Ghana: Lessons from the Sakai LMS Journey

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Abstract

Over the past decade, the Sakai Learning Management System (LMS) has played a central role in advancing digital learning at the University of Ghana, offering insights for higher education in Sub-Saharan Africa. Despite adoption, institutions face challenges including high costs, limited scalability, accessibility gaps, and constraints on technological autonomy. Proprietary LMS solutions often restrict customisation, limiting alignment with local pedagogical, cultural, and infrastructural needs. This article examines the potential of open-source LMS platforms to foster resilient, inclusive, and sustainable digital learning, using Sakai as a case study. Guided by Dynamic Capabilities Theory, the paper employed qualitative approach, including semi-structured interviews with ten purposively selected participants: three LMS administrators, three instructors or e-learning leads, three teaching and learning policy leads, and one faculty champion. Findings

reveal that Sakai enhances institutional resilience by maintaining continuity of instruction during disruptions and supporting flexible pedagogical approaches. The platform promotes inclusion through mobile access, adaptable content, and mentorship-driven adoption, though challenges persist in faculty training, technical support, and policy enforcement. Sustainability depends on strategic governance, funding, capacity development, and engagement with global open-source communities. The study contributes by demonstrating how open-source LMS platforms function as dynamic organisational capabilities, enabling higher education institutions to respond to evolving challenges, advance digital inclusion, and leverage technology for effective and sustainable teaching and learning.

Keywords: Sakai, open-source LMS; higher education; digital inclusion; Dynamic Capabilities Theory; Ghana.

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Introduction

The digital transformation of higher education has increasingly positioned learning management systems (LMS) as critical infrastructure for teaching, learning, and institutional continuity (Allam, et al., 2024). Globally, universities have adopted LMS platforms to support blended and fully online learning, facilitate assessment, and enhance student engagement. However, in many low- and middle-income contexts, the implementation of digital learning technologies has been shaped by financial constraints, infrastructural limitations, and uneven digital skills among faculty and students (Andreoni et al., 2021). In Sub-Saharan Africa, reliance on proprietary LMS solutions has often resulted in high licensing costs, limited flexibility, and dependence on external vendors, constraining institutions' ability to adapt platforms to local pedagogical, cultural, and accessibility needs. These challenges have renewed interest in open-source LMS platforms as viable alternatives for sustainable digital learning.

Universities in Ghana have embraced digital learning platforms to respond to growing student enrolments, limited physical infrastructure, and rising expectations for flexible and technology-enhanced education (Amponsah et al., 2024). These developments were further accelerated by the COVID-19 pandemic, which exposed both the potential and the fragilities of existing digital learning systems. As higher education institutions transition into a post-pandemic environment, questions of resilience, inclusivity, affordability, and technological autonomy have become central to digital learning policy and practice.

In Ghana, the University of Ghana represents one of the longest and most extensive experiences with open-source LMS adoption through its use of the Sakai Learning Management System. Over the past decade, Sakai has served as the core platform for online teaching, learning, and assessment, supporting institutional efforts to expand access and maintain academic continuity during periods of disruption. The Sakai LMS journey illustrates how open-source platforms can

enhance institutional resilience by enabling local control, cost management, and system customisation. At the same time, it reveals persistent challenges related to governance structures, faculty capacity, technical support, and the integration of emerging digital innovations.

Digital inclusion and accessibility have emerged as critical dimensions of higher education quality and equity (Matsieli & Mutula, 2024; Amjad et al., 2024). For that matter, LMS platforms play a central role in shaping learners' access to course content, assessments, and academic support services. In the Ghanaian context, disparities in internet access, device availability, and digital literacy continue to affect students' learning experiences. Although open-source LMS platforms offer opportunities to embed accessibility features and inclusive design practices, empirical evidence on how these potentials are realised in practice remains limited. Understanding how the Sakai LMS supports inclusive and accessible teaching and learning is therefore essential for informing broader digital education strategies.

From a theoretical perspective, Dynamic Capabilities Theory provides a useful lens for examining how universities sense digital opportunities, seize technological options, and reconfigure institutional resources to sustain digital learning systems (Renz & Hilbig, 2023). The ability of higher education institutions to adapt open-source LMS platforms over time depends not only on technical infrastructure but also on organisational learning, human capacity development, and collaborative governance arrangements. In Ghanaian higher education, the extent to which institutions have developed such capabilities remains underexplored.

Although existing literature highlights the potential of open-source LMS platforms to enhance resilience, inclusion, and sustainability (Nanayakkara, 2017), there is a lack of in-depth, context-specific studies examining long-term institutional experiences in Ghana. Few studies integrate organisational theory to explain how universities develop the capabilities required to sustain digital learning systems over time. Moreover, the interaction between institutional capacity, inclusive practices, and technological sustainability remains underexplored. By applying Dynamic Capabilities Theory, this study addresses these gaps by examining how the University of Ghana has developed, constrained, and transformed its digital learning capabilities through the Sakai LMS journey.

Against this backdrop, the article investigates how the Sakai open-source LMS supports resilience in digital learning at the University of Ghana (objective 1), identifies institutional, technical, and human capacity challenges affecting its effective use (objective 2), assesses its role in promoting inclusive and accessible teaching and learning practices (objective 3), and develops a framework for strengthening the sustainability of open-source LMS platforms in Ghanaian higher education institutions (objective 4). By grounding the analysis in Dynamic Capabilities Theory, the paper contributes to the literature by linking open-source LMS adoption to institutional resilience and inclusion, while proposing a sustainability framework grounded in empirical evidence from a leading Ghanaian university.

Related Literature and Theory

Learning Management Systems and Digital Learning Resilience in Higher Education

Learning management systems have become integral to institutional resilience in higher education, functioning as critical infrastructure for instructional continuity and academic coordination. Digital learning resilience refers to an institution's capacity to sustain teaching and learning during disruption while adapting digital systems to evolving pedagogical and organisational demands. The COVID-19 pandemic demonstrated that universities with established LMS ecosystems were

better positioned to maintain academic operations, while those with fragmented or underdeveloped systems experienced significant disruption (Sims, 2025).

In resource-constrained contexts, resilience is shaped less by technological sophistication and more by institutional adaptability and control over digital systems. Studies in Sub-Saharan Africa emphasise that locally managed LMS platforms enable universities to respond more effectively to infrastructural instability, policy shifts, and fluctuating enrolments. Open-source LMS platforms offer greater flexibility for contextual customisation and cost management, thereby supporting long-term resilience.

Dynamic Capabilities Theory provides a useful analytical lens for understanding LMS-enabled resilience as an organisational process. Institutions exhibit resilience when they can sense environmental disruptions, seize appropriate digital solutions, and reconfigure internal resources to sustain academic delivery. Long-term engagement with open-source platforms such as Sakai illustrates how digital resilience emerges through iterative learning, institutional experimentation, and adaptive governance rather than through one-off technology adoption (Owusu-Ansah & van der Walt, 2021).

Institutional, Technical, and Human Capacity Challenges in Open-Source LMS Adoption

Despite their strategic potential, open-source LMS platforms present significant implementation and sustainability challenges (Nanayakkara, 2017). Institutional constraints often include weak governance arrangements, limited policy coherence, and the marginal positioning of digital learning within broader academic strategies. When LMS initiatives are treated primarily as technical projects, institutional ownership and accountability tend to be fragmented, undermining effective use.

Technical challenges remain prominent in open-source environments, where institutions assume responsibility for system hosting, maintenance, and security. While open-source platforms reduce licensing costs, they require sustained investment in infrastructure and specialised expertise. In developing contexts, shortages of skilled technical staff and limited funding frequently result in delayed upgrades, performance inefficiencies, and user dissatisfaction (Asamoah, 2021; Olugbade et al., 2023). Furthermore, human capacity challenges are equally critical. Faculty engagement with LMS platforms is shaped by digital competence, pedagogical readiness, and institutional incentives. Empirical evidence suggests that inadequate training, high workloads, and limited recognition of digital teaching reduce sustained faculty adoption. Students may also face digital literacy constraints, further limiting the pedagogical effectiveness of LMS platforms (Bwalya, 2021).

Within Dynamic Capabilities Theory, these challenges reflect gaps in institutions' ability to seize and transform digital opportunities. Open-source LMS platforms provide autonomy, but without deliberate investment in organisational learning and capacity development, their potential remains under-realised. Context-specific evidence on how Ghanaian universities navigate these challenges, particularly in long-standing LMS deployments, remains limited.

Open-Source LMS Platforms, Inclusion, and Accessibility in Higher Education

Digital inclusion and accessibility have become central to higher education quality and equity (Amjad et al., 2024). LMS platforms structure access to learning materials, assessments, and academic support, thereby shaping students' participation and outcomes. Inclusive digital learning environments accommodate diverse learning needs, technological conditions, and socio-economic backgrounds. Open-source LMS platforms offer distinct advantages for inclusion through flexible

design and customization (Chatzialexiou & Anastasiadou, 2025). Institutions can adapt interfaces for low-bandwidth environments, integrate assistive technologies, and localise content delivery without vendor restrictions. Munna et al. (2024) concord that such flexibility is particularly relevant in contexts where students rely on mobile devices or experience intermittent connectivity.

However, inclusive outcomes are not automatic. As espoused by Obeid (2024) accessibility features are underutilised due to limited faculty awareness, absence of inclusive design standards, and weak institutional enforcement. In developing country contexts, structural inequalities related to income, geography, and disability further complicate digital inclusion efforts. Dynamic Capabilities Theory frames inclusion as an outcome of institutional sensing and reconfiguration. Universities must identify patterns of learner exclusion, seize appropriate technological and pedagogical responses, and realign teaching practices accordingly. Despite increasing policy attention to inclusive education in Ghana, empirical analyses of how LMS platforms are operationalised to advance accessibility remain scarce.

Sustainability of Open-Source LMS Platforms in Higher Education

Sustainability remains a persistent concern in LMS implementation, encompassing technical viability, pedagogical relevance, and organisational integration (Akacha & Awad, 2023). For open-source LMS platforms, sustainability is closely linked to institutional ownership, governance stability, and continuous innovation. Unlike proprietary systems, open-source platforms depend on local capacity and collaborative ecosystems rather than vendor-driven support (Haque, 2025). Empirical studies (e.g. Nanayakkara, 2017) indicate that sustainable open-source LMS deployment is strengthened through institutional participation in developer communities, shared support arrangements, and long-term funding commitments. However, many African universities implement LMS platforms in isolation, limiting opportunities for shared learning and innovation.

Dynamic Capabilities Theory conceptualises sustainability as a process of continuous transformation (Teece, 2007). Institutions sustain LMS platforms when they repeatedly reconfigure technical infrastructure, develop human capacity, and integrate emerging technologies such as learning analytics and artificial intelligence. In Ghanaian higher education, sustainability is often undermined by project-based funding, leadership turnover, and weak national coordination of digital learning initiatives. The literature offers limited context-specific frameworks that integrate organisational, technical, and pedagogical dimensions of open-source LMS sustainability. This study addresses this gap by drawing on the Sakai LMS experience at the University of Ghana to inform a capability-driven framework for resilient and inclusive digital learning in Ghanaian higher education.

Theoretical Framework: Dynamic Capabilities Theory

This paper is grounded in Dynamic Capabilities Theory, which explains how organisations adapt, renew, and sustain competitive and functional advantage in environments characterised by uncertainty and rapid change (Teece, 2020). Originating from the resource-based view of the firm, Dynamic Capabilities Theory extends beyond the possession of valuable resources to emphasise an organisation's capacity to purposefully integrate, build, and reconfigure internal and external competencies over time. In the context of higher education, dynamic capabilities are reflected in universities' ability to continuously adapt organisational processes, technologies, and human resources to meet evolving educational demands.

Dynamic capabilities are commonly conceptualised as three interrelated processes: sensing, seizing, and transforming. In this study, Dynamic Capabilities Theory provides an analytical framework for examining the Sakai LMS journey at the University of Ghana. The theory informs

the analysis of how the institution has developed resilience in digital learning, navigated institutional, technical, and human capacity challenges, and promoted inclusive teaching and learning practices through an open-source LMS platform.

Empirical studies highlight the role of dynamic capabilities in open-source ecosystems. Fukawa et al. (2021) show that organisations pursuing open-source strategies during digital transformation must develop sensing and seizing capabilities to align open technologies with strategic objectives. Faridian and Neubaum (2021) emphasise the importance of ambidexterity in open-source ecosystems, noting that organisations require dynamic capabilities to balance exploration, exploitation, and shared asset utilisation. Abbate et al. (2022) extend this perspective by conceptualising digital platforms as capability ecosystems, where value co-creation depends on an organisation's ability to continuously reconfigure relationships, knowledge, and technological assets.

Despite these advances, most empirical applications of Dynamic Capabilities Theory in open-source contexts focus on commercial organisations and innovation-driven firms. There remains limited application of the theory to higher education, particularly in developing country contexts and in relation to digital learning platforms. This study addresses this gap by applying Dynamic Capabilities Theory to examine the long-term institutional use of an open-source LMS in a Ghanaian university. By situating the Sakai LMS journey within a dynamic capabilities framework, the paper contributes theoretically by extending the application of the theory to higher education digital infrastructure.

Methodology

Research Design

Our paper adopted a qualitative case study design to examine the long-term adoption and governance of the Sakai LMS at the University of Ghana. A case study approach was considered appropriate because it enables in-depth exploration of complex, context-dependent phenomena within real-life institutional settings (Tasci et al., 2020). Rather than aiming for statistical representativeness, the study seeks analytical depth and theoretical insight into how open-source LMS platforms operate within resource-constrained higher education environments. The study was guided by Dynamic Capabilities Theory, which informed both data collection and analysis. The theory provided a conceptual lens for examining how the institution sensed digital learning challenges, seized strategic opportunities through open-source adoption, and transformed organisational practices over time. The intent is therefore analytical generalisation, whereby insights from a theoretically significant case contribute to broader understanding of digital learning resilience and inclusion in similar higher education contexts.

Study Context

The University of Ghana, established in 1948, is the oldest and largest public university in Ghana, with a total student population of 63,646 including 667 international students, 9,509 graduate students, and the remainder enrolled in undergraduate programmes as at. The university has a long-standing commitment to digital learning (University of Ghana, n.d.) and represents one of the longest sustained implementations of an open-source LMS in Ghanaian higher education, with over a decade of continuous use.

The Sakai LMS serves as the institution's primary learning management platform, supporting blended and online teaching, assessment, and academic communication. While the system is centrally managed, it is implemented across multiple colleges, schools, and departments, providing

a rich and diverse context to examine institutional governance, technical and human capacity development, and practices promoting inclusive digital learning. The sustained use of Sakai at the University of Ghana offers unique insights into how open-source LMS platforms can enhance resilience, accessibility, and innovation in higher education settings in Sub-Saharan Africa.

Participants and Sampling

The sample size of ten (10) was guided by the principle of information power, whereby fewer participants are required when the study aim is narrow, the case is information rich, and participants hold deep expertise in the phenomenon under investigation. Each participant occupied a strategic position within the LMS ecosystem and was directly involved in decision-making, implementation, or advanced use of Sakai, ensuring that the data captured institutional rather than peripheral perspectives. Data were collected through purposive sampling of key institutional actors directly involved in the governance, implementation, and pedagogical use of the Sakai LMS. Purposive sampling was employed to ensure that participants possessed in-depth knowledge and practical or experiential experience relevant to the study objectives. A total of ten participants were recruited, comprising:

- Three central LMS administrators or systems engineers responsible for technical management and system development
- Three instructors or e-learning leads involved in course design and faculty support
- Three teaching and learning policy leads with responsibility for institutional digital learning strategy
- One faculty champion recognised for advanced and innovative use of the Sakai LMS.

This multi-stakeholder sample allowed for triangulation of perspectives across technical, pedagogical, and policy dimensions of LMS implementation. Although the sample is limited to one institution and ten participants, it was carefully selected to capture the depth and diversity of experience necessary for analytical generalisation, rather than statistical generalisation, as recommended in qualitative case study research (Yin, 2018). The inclusion of both implementers and strategic decision-makers ensures that findings reflect a holistic understanding of the LMS ecosystem within the University of Ghana.

Data Collection Method and Procedure

For data collection method, semi-structured interviews were conducted with ten purposively selected participants directly involved with Sakai LMS adoption and implementation. Participants included three LMS administrators or systems engineers responsible for technical management, three instructors or e-learning leads involved in course design and faculty support, three teaching and learning policy leads responsible for institutional digital learning strategy, and one faculty champion recognised for advanced LMS use and innovation.

The semi-structured interview guide was designed to align with the study objectives and the analytical lens of Dynamic Capabilities Theory, focusing on sensing, seizing, and transforming capabilities, as well as inclusion, accessibility, and sustainability. The guide comprised seven sections: *background and role, sensing capabilities, seizing capabilities, transforming capabilities, inclusion and accessibility, sustainability, and reflections*. It contained fifteen open-ended questions exploring participants' experiences with Sakai LMS adoption, perceived benefits and challenges, capacity development initiatives, accessibility practices, governance, and views on future innovation, including integration of artificial intelligence.

In June 2025, participants were first contacted through formal institutional channels and provided with an information sheet outlining the purpose of the study, ethical considerations, and expectations regarding participation. Interview sessions were scheduled between August 2025 at times convenient to participants and conducted either face to face or via secure online platforms, depending on participant availability. Each interview lasted approximately thirty to forty-five minutes. Prior to commencement, informed consent was obtained, and participants were reminded of their right to withdraw at any stage. Interviews followed the guide systematically while allowing flexibility to probe emerging issues and clarify responses. This procedural approach ensured consistency across interviews while supporting the generation of rich and contextually grounded qualitative data.

All interviews were conducted with participants' informed consent, audio-recorded, and transcribed verbatim to ensure accuracy. The semi-structured format allowed for consistency across interviews while providing flexibility to probe emerging themes and clarify responses, enhancing the depth and richness of the data collected. All interviews were conducted with participants' informed consent, audio-recorded, and transcribed verbatim to ensure accuracy.

Data Analysis

Data analysis followed a thematic analysis approach, combining deductive and inductive coding. An initial coding framework was developed based on the core constructs of Dynamic Capabilities Theory, namely sensing, seizing, and transforming. This deductive phase enabled systematic examination of how institutional capabilities shaped LMS resilience, inclusion, and sustainability. Inductive coding was subsequently applied to capture emergent themes not fully explained by the theoretical framework, such as faculty workload, informal support networks, and perceptions of technological autonomy. Codes were iteratively refined through constant comparison across interview transcripts. To enhance analytical rigour, coding was conducted in multiple cycles, with themes reviewed and refined to ensure coherence, internal consistency, and alignment with the study objectives.

Trustworthiness and Rigour

Several strategies were employed to ensure the trustworthiness of the findings. Data triangulation was achieved by integrating interview data with institutional document analysis and perspectives from multiple stakeholder groups. Peer debriefing was conducted during the coding process to enhance interpretive consistency and reduce researcher bias. Thick description was used to provide contextual detail, enabling readers to assess the transferability of the findings. An audit trail documenting data collection decisions, coding processes, and analytical reflections was maintained throughout the study. These measures collectively strengthened the credibility, dependability, and confirmability of the findings.

Ethical Considerations

Ethical approval for the study was obtained from the appropriate institutional review body at the University of Ghana. All participants were informed about the purpose of the study, their voluntary participation, and their right to withdraw at any stage without penalty. Confidentiality was ensured through anonymisation of participant identities and secure storage of data. Findings are reported in a manner that protects participants and the institution from potential harm.

Methodological Limitations

While the qualitative case study design enabled in-depth and contextually grounded analysis, the findings are not intended to be statistically generalisable to all Ghanaian universities. However, the study explicitly pursues analytical and theoretical generalisation by linking empirical insights to Dynamic Capabilities Theory.

The selection of a single, mature case allows examination of processes and mechanisms that are often inaccessible in short-term or multi-site studies, particularly in relation to sustainability, institutional learning, and governance of open-source systems. Rather than claiming representativeness, the article offers transferable insights that may inform similar higher education institutions facing comparable digital learning challenges in Sub-Saharan Africa and other resource-constrained contexts. Future research could extend this study through comparative case studies across multiple Ghanaian universities, longitudinal designs examining capability development over time, or mixed-method approaches incorporating student learning outcomes and usage analytics.

Analysis of Interview Data

The analysis reveals a layered and evolving account of how the Sakai LMS has shaped digital learning resilience, inclusion, and sustainability at the University of Ghana. Rather than a linear implementation narrative, participants described an ongoing institutional learning process marked by adaptation, negotiation, and uneven capacity development. Five interrelated themes structure the findings.

Resilience as Organisational Adaptation Rather Than Mere Continuity

Participants framed resilience not simply as the ability to keep teaching going, but as the institution's capacity to absorb disruption and reorganise core academic processes under pressure. While the COVID period served as a catalytic moment, administrators emphasised that Sakai had already become embedded in academic routines before the crisis, which enabled rapid institutional response. An interviewee shared his view:

"When the pandemic arrived, we were not starting from scratch. Sakai was already part of our teaching culture, so the challenge was scaling its use rather than introducing it." (LMS Administrator 2)

An LMS administrator reflected that resilience emerged from prior experimentation rather than emergency improvisation, noting that the university had already invested in internal technical expertise and governance structures. Instructors echoed this view, describing how the platform allowed them to rethink pedagogy rather than merely replicate face to face teaching online. Several noted that asynchronous tools became particularly valuable for students with connectivity challenges, allowing learning to continue despite infrastructural constraints. However, resilience was described as fragile and uneven. Participants acknowledged that server performance, bandwidth limitations, and student digital skills periodically undermined continuity. Another interviewee commented:

"There were periods when heavy traffic slowed the system, and some students struggled because they lacked the digital skills to fully utilise the platform." (LMS Administrator 1)

These tensions reveal resilience as a dynamic and ongoing process rather than a fixed outcome, aligning with the transforming dimension of dynamic capabilities in which systems are continually adjusted in response to stressors. This theme demonstrates how institutional sensing of disruption translated into adaptive reconfiguration of digital learning practices.

Technical, Institutional, and Human Capacity Challenges

Rather than isolated obstacles, participants described capacity challenges as mutually reinforcing constraints shaping LMS effectiveness. Administrators emphasised the hidden labour involved in maintaining an open-source system, including upgrades, integrations, and security management. An LMS Administrator remarked:

"People often think open source means free, but maintaining Sakai requires skilled personnel, constant upgrades, server optimisation and security monitoring." (LMS Administrator 3)

They stressed that technical sustainability depends on institutional recognition of this labour as strategic rather than merely operational. Instructors also foregrounded human capacity challenges, particularly uneven faculty confidence and pedagogical fluency. An instructor shared his view:

"Most lecturers know how to upload lecture notes, but many are still unfamiliar with interactive tools such as quizzes, peer discussions and collaborative learning features." (Instructor 2)

Several observed that while basic LMS use was widespread, deeper engagement with interactive and collaborative tools remained limited. This was attributed not to resistance, but to competing academic pressures and insufficient pedagogical support structures. Policy leads highlighted institutional tensions, noting that while digital learning policies existed, enforcement and coordination across faculties varied significantly. Without consistent incentives or accountability mechanisms, LMS engagement depended heavily on individual motivation rather than institutional expectation. Together, these insights illustrate sensing capabilities at work, as participants identified internal misalignments that constrain the full realisation of LMS value.

Inclusion and Accessibility for Supporting Diverse Learners

Participants widely endorsed inclusion and accessibility as core values underpinning Sakai adoption. Administrators pointed to technical affordances such as mobile access, flexible content formats, and compatibility with assistive technologies. An interviewee narrated:

"Students can access course materials on their phones, revisit recorded lectures and use different content formats depending on their learning needs." (LMS Administrator 1)

Instructors described deliberate instructional design choices intended to accommodate diverse learning styles and participation patterns. Another interviewee remarked:

"I intentionally upload videos, PDFs and narrated presentations because not all students learn effectively through one format." (Instructor 3)

Yet participants were candid about the gap between aspiration and practice. Policy leads acknowledged that inclusive design was not uniformly embedded across departments and often depended on individual champions rather than systematic enforcement. The faculty champion

described inclusion as a cultural practice that spreads through demonstration and peer influence rather than policy alone.

These accounts suggest that seizing capabilities are present but unevenly institutionalised. The LMS provides the tools for inclusion, but organisational routines and incentives have not fully matured to ensure consistent application.

Sustainability as Strategic Alignment and Institutional Commitment

Sustainability was framed less as a technical issue and more as a question of long-term institutional commitment. Administrators stressed that open-source systems reduce licensing costs but increase the need for stable internal investment in skills and infrastructure. An administrator narrated thus:

"Apart from the software requiring licence fees, sustainability depends on investing in people, infrastructure and continuous system improvement." (LMS Administrator 2)

Instructors linked sustainability to continuous professional development, arguing that without regular training, faculty engagement declines over time. An instructor commented:

"Training cannot be a one time workshop. Every semester new lecturers need support and experienced staff need refresher training." (Instructor 1)

Policy leads emphasised strategic alignment, noting that Sakai's sustainability depends on its integration into broader teaching and learning strategies rather than treatment as a standalone system. Engagement with the global Sakai community was described as both a technical and strategic resource, enabling knowledge exchange, shared problem solving, and system evolution. An administrator expressed his view:

"The global Sakai community allows us to learn from other universities, solve technical problems collaboratively and continuously improve the platform." (LMS Administrator 3)

This theme reflects transforming capabilities, as sustainability emerges from deliberate reconfiguration of governance, funding, and partnerships.

Innovation as Controlled Experimentation Rather Than Rapid Disruption

Innovation was described as incremental and cautious rather than disruptive. Administrators discussed pilot initiatives involving learning analytics and early AI applications, emphasising the need to balance experimentation with reliability. An LMS administrator shared his opinion:

"We are testing AI features gradually because reliability and educational quality are more important than adopting technology simply because it is new." (LMS Administrator 1)

Instructors also reported using analytics to refine assessment and feedback practices, while remaining cautious about data interpretation and workload implications. Policy leads highlighted the importance of evaluating emerging technologies against institutional values of equity and accessibility. The faculty champion described innovation as a process of guided experimentation,

where success depends on institutional support and peer learning rather than individual enthusiasm alone. A faculty Champion narrated:

"Innovation succeeds when lecturers are supported to experiment, share experiences and learn from one another rather than being forced to adopt new technologies." (Faculty Champion)

This theme underscores how dynamic capabilities enable innovation through deliberate seizing and transforming processes rather than uncritical adoption of new technologies.

Table 1: Mapping Themes to Study Objectives and Dynamic Capabilities

Theme	Objective	Dynamic Capabilities Dimension
Resilience: Continuity of Digital Learning	Objective 1	Sensing & Transforming
Capacity Challenges	Objective 2	Sensing
Inclusion and Accessibility	Objective 3	Seizing
Sustainability	Objective 4	Transforming
Innovation and Emerging Technologies	Objective 1 & 3	Seizing & Transforming

Discussion of Findings

The findings of this study provide important insights into the role of open-source LMS, specifically Sakai, in fostering resilient, inclusive, and sustainable digital learning in Ghanaian higher education. The discussion below integrates the study objectives with the Dynamic Capabilities Theory, situating the findings within current literature and highlighting broader implications for practice and policy.

Resilience in Digital Learning

The findings indicate that the Sakai LMS substantially strengthened the University of Ghana's ability to sustain teaching and learning during periods of disruption, particularly during the COVID 19 pandemic. Participants consistently reported that the platform enabled continuity of lectures, assessments, and academic communication, thereby reducing instructional downtime. This reinforces earlier studies that identify open source LMS platforms as critical enabling operational continuity in resource constrained higher education environments (Allam et al., 2024).

Administrators highlighted that Sakai supported both synchronous and asynchronous teaching, allowing flexibility in course delivery for students located in remote or underserved areas. Instructors emphasised that tools such as discussion forums, multimedia uploads, and assignment workflows facilitated pedagogical adaptation under constrained conditions. At the same time, participants acknowledged persistent challenges, including intermittent server downtime, bandwidth limitations, and uneven student digital literacy, which posed risks to sustained resilience if left unaddressed.

From the perspective of Dynamic Capabilities Theory, these findings reflect the institution's sensing and transforming capabilities. The university demonstrated an ability to recognise external shocks and internal system gaps, and to reconfigure teaching processes to preserve instructional continuity. This illustrates how digital learning platforms function not only as technical tools but also as strategic resources that enhance organisational resilience in volatile and uncertain environments.

Institutional, Technical, and Human Capacity Challenges

Participants identified a range of challenges related to infrastructure, human capacity, and institutional governance that constrained the effective use of the Sakai LMS. Administrators pointed to the technical demands of server management, system integration, and continuous software updates. Faculty members noted that limited training and uneven digital competence restricted their ability to utilise advanced LMS features such as learning analytics and adaptive tools. Policy leads emphasised gaps in funding models and governance structures that affected system sustainability.

These findings are consistent with prior research showing that successful adoption of open source technologies in higher education depends on the alignment of infrastructure, institutional support, and human resource capacity (Nyamboga et al., 2024; Namayala et al., 2024). Without such alignment, LMS use may remain largely transactional, limiting its potential to enhance pedagogical quality and learning outcomes.

Viewed through Dynamic Capabilities Theory, these challenges underscore the centrality of sensing capabilities. Universities must continuously identify deficiencies in technical systems, faculty skills, and policy frameworks in order to respond effectively to evolving digital demands. The findings therefore highlight the need for sustained investment in capacity building and institutional learning to fully leverage the transformative potential of open source LMS platforms.

Inclusion and Accessibility

The study found that Sakai supports inclusive and accessible teaching and learning through features such as mobile compatibility, flexible content formats, and adaptable assessment design. Participants noted that these features expanded access for students with varying learning needs and technological constraints. Faculty champions played a key role in demonstrating inclusive practices and mentoring colleagues, thereby encouraging broader uptake of accessibility oriented LMS use.

Despite these strengths, participants observed that inclusive practices were unevenly implemented across faculties. While institutional policies promoting inclusion exist, their translation into consistent pedagogical practice remains limited (Van Wingerden, 2021). This suggests that inclusion is shaped not only by system functionality but also by faculty capacity, institutional incentives, and monitoring mechanisms.

These findings align with literature indicating that open source LMS platforms can enhance equity and access when deliberately aligned with inclusive pedagogical strategies (Bogers et al., 2019; Teece, 2020). From a Dynamic Capabilities perspective, this reflects seizing capabilities, as institutional actors actively mobilise technological features and human resources to address diverse learner needs and reduce structural barriers to participation.

Sustainability and Long Term Adoption

Sustainability emerged as a central concern among participants, extending beyond technical system maintenance to include staffing continuity, funding stability, and strategic alignment. Administrators emphasised the importance of robust infrastructure and dedicated technical personnel, while instructors highlighted the role of continuous professional development in sustaining meaningful LMS use. Policy leads stressed that embedding LMS adoption within institutional strategy enhanced long term viability.

Participants also underscored the value of engagement with the global Sakai community, which facilitated knowledge sharing, peer support, and cost effective system maintenance. Such collaborations were viewed as particularly important in mitigating resource constraints and supporting incremental system improvement over time.

These findings support earlier studies which argue that long term adoption of open source LMS platforms depends on strategic governance, stakeholder engagement, and resource planning (Teece, 2020; Faridian and Neubaum, 2021). Within the Dynamic Capabilities framework, sustainability reflects transforming capabilities, as the university continually reconfigures internal structures and external partnerships to maintain system relevance and effectiveness (Akacha, & Awad, 2023).

Innovation and Emerging Technologies

Participants identified significant opportunities for integrating emerging technologies such as artificial intelligence and learning analytics into the Sakai LMS. Administrators described pilot initiatives that tracked student engagement and performance data to support early intervention. Instructors noted the pedagogical value of analytics in refining assessment design and providing targeted learner support.

At the policy level, participants emphasised the need for strategic evaluation of emerging technologies to ensure alignment with institutional priorities, accessibility goals, and ethical considerations. Innovation was therefore framed not as rapid technological adoption, but as a measured and contextually grounded process.

These findings are consistent with literature on open source ecosystems, which highlights their capacity to support experimentation, innovation, and collaborative value creation in educational contexts (Abbate et al., 2022; Fukawa et al., 2021). From a Dynamic Capabilities perspective, these initiatives demonstrate both seizing and transforming capabilities, as technological opportunities are selectively adopted and integrated into institutional routines to enhance learning outcomes sustainably.

Conclusion

This study explored the adoption and implementation of the Sakai open-source LMS at the University of Ghana, focusing on its role in fostering resilience, inclusion, and sustainability in higher education. Guided by Dynamic Capabilities Theory, the study examined how the university sensed emerging gaps in digital learning, seized opportunities through LMS adoption and governance, and transformed institutional practices to integrate new technologies and inclusive teaching approaches.

The findings indicate that Sakai has significantly enhanced the university's capacity to maintain continuity of instruction during disruptions, demonstrating resilience in digital learning. The LMS provides flexible teaching and learning tools that support asynchronous and synchronous engagement, improving access for diverse student populations. However, persistent challenges such as limited faculty training, technical capacity gaps, and inconsistent governance highlight the need for systematic institutional support to fully exploit the potential of open-source platforms.

In terms of inclusion and accessibility, Sakai facilitates equitable learning opportunities through mobile access, adaptable content formats, and flexible pedagogical design. Yet achieving full accessibility requires continuous faculty mentoring, awareness raising, and deliberate policy enforcement. Sustainability emerged as a critical theme, emphasizing the importance of strategic

planning, collaboration with open-source communities, and the integration of emerging technologies such as artificial intelligence and learning analytics to enhance personalization and learner engagement.

The paper contributes to both theory and practice by demonstrating that open-source LMS platforms can serve as dynamic organisational capabilities that enable higher education institutions in resource-constrained contexts to sense challenges, seize opportunities, and transform practices for long-term impact. Practically, universities can leverage these insights to strengthen technical capacity, develop inclusive digital learning policies, and foster sustainable collaboration with the global open-source community.

In conclusion, the Sakai LMS journey at the University of Ghana offers valuable lessons for Sub-Saharan Africa and other similar contexts. By strategically embracing open-source digital learning platforms, higher education institutions can achieve resilient, cost-effective, and inclusive education while positioning themselves to innovate and respond proactively to future technological and pedagogical challenges.

Implications of the Study

The findings of this article have significant theoretical, practical, and policy implications for higher education institutions in Ghana and similar contexts, particularly regarding the adoption and sustainability of open-source LMS.

Theoretical Implications

By applying Dynamic Capabilities Theory, this study demonstrates that open-source LMS platforms function as strategic organisational capabilities. The LMS enables institutions to sense emerging challenges in digital learning, seize opportunities through adoption and governance, and transform processes to integrate innovative technologies and inclusive pedagogical practices. This extends prior research on open-source technologies by showing how universities in resource-constrained settings can actively reconfigure resources and processes to achieve resilience, inclusion, and sustainability. The paper also contributes to the literature on digital learning in higher education by providing context-specific evidence from Sub-Saharan Africa, highlighting the importance of organisational capabilities in driving effective technology adoption.

Practical Implications

The study offers actionable insights for university administrators, faculty, and technical teams. First, continuous capacity building is essential. Training, mentoring, and technical support for faculty and staff enhance LMS adoption and ensure that advanced functionalities, including analytics and AI integration, are effectively utilised. Second, institutional policies and governance frameworks should embed LMS adoption into the broader digital learning strategy to promote consistent use, accountability, and sustainability. Third, fostering collaboration with global open-source communities provides access to shared knowledge, system updates, and innovation, reducing costs and increasing institutional autonomy. Fourth, integrating emerging technologies within LMS platforms can support personalised learning and improve student engagement, if usability, accessibility, and inclusivity are prioritised.

Policy Implications

At the policy level, the study underscores the need for national and regional strategies to support open-source LMS adoption in higher education. Governments and regulatory bodies should

consider developing frameworks that provide sustainable funding, technical support, and training initiatives for universities. Policies should also encourage knowledge sharing and collaboration among institutions to maximise the benefits of open-source platforms while ensuring compliance with accessibility and inclusion standards. Such strategic support can enable higher education institutions to achieve resilient, equitable, and future-ready digital learning ecosystems.

Implications for Future Research

The article highlights areas for further investigation. Future research could examine the impact of integrating advanced technologies such as artificial intelligence on teaching and learning outcomes in open-source LMS platforms. Comparative studies across universities in different Sub-Saharan African countries could also provide insights into best practices and contextual factors influencing LMS adoption and sustainability. Finally, longitudinal studies could track the long-term impact of open-source LMS adoption on institutional resilience, inclusion, and innovation.

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Rethinking Roles of Open-Source Platforms in Equipping Ghanaian Graduates for the Future of Work

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ABSTRACT

Open-source platforms (OSPs) hold untapped potential to equip Ghanaian graduates with the skills demanded by the future of work. Yet in Ghana's higher education system, the impact of open-source platforms such as Sakai learning management software (LMS), Moodle LMS, GitHub, and Sentence-BERT models remains limited by fragmented strategies and poor institutional coordination. In fact, existing studies have failed to assess how these platforms contribute to employability. Guided by Connectivism, the review draws on evidence from eighteen relevant studies that demonstrate how open-source platforms have strong potential to support collaboration, digital problem-solving, and continuous learning. The value of OSPs remains untapped because most universities rely on them for content delivery rather than skill development. The analysis reveals limited curricular integration, weak faculty capacity, unreliable infrastructure, and fragmented digital policy structures, which restrict graduates' opportunities to engage with these platforms as learning networks. The review establishes that current practices provide only partial support for the acquisition of future-oriented competencies. It also shows that institutional systems must shift from access provision to intentional, skill-focused design. The synthesis provides a clearer understanding of the structural and instructional reforms

required to embed open-source platforms in higher education and offers practical insights for strengthening graduate readiness in Ghana and similar contexts.

Keywords: *Open-source platforms, skill development, Connectivism, future of work, higher education*

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Introduction

Open-source platforms (OSPs) have gained renewed attention as universities seek practical ways to prepare graduates for fast-shifting forms of work driven by automation, data intelligence and distributed innovation. Open-source platforms refer to digital systems whose underlying code is publicly available for use, modification, and redistribution (Beattie et al. 2020), which sets them apart from closed-source or proprietary platforms that restrict access to source code and limit user control through paid licences. OSPs span operating systems, learning management systems, database tools, design software and emerging artificial intelligence applications such as Llama 2-Chat and Sentence Bert (Boateng et al. 2022), and they draw contributors from both technical and non-technical fields. Their openness supports collaboration, knowledge sharing and self-directed skill development, yet higher education institutions often do not realise the full value of these platforms because of limited investment in training, insufficient technical support and uneven institutional adoption (Beattie et al., 2020; Longe et al., 2021).

There is growing interest in open-source platforms solutions as enablers of workforce readiness, especially where universities seek practice-oriented digital skills through experiential learning and close industry engagement (Chakraborty et al. 2024). Many institutions in North America, Europe and Asia integrate open-source platforms into project-based modules that strengthen problem-solving and applied technological competencies (Beattie et al. 2020). In Africa, researchers report that open-source adoption helps institutions reduce costs and widen access to learning materials, although progress remains uneven due to infrastructure gaps, limited faculty preparedness and weak policy alignment (Sarpong 2023; Loglo 2024). Countries such as Kenya and South Africa show promising use of open-source learning management systems (Sims 2024; Maluleke and Maake 2025), yet large-scale integration remains constrained.

Ghana reflects this wider continental pattern. Policy frameworks such as the ICT4AD Policy and the ICT in Education Policy encourage technology use across tertiary institutions (Adarkwah & Huang 2023), and universities have introduced platforms such as Moodle and Sakai to support blended and distance learning (Sarpong, 2023). Local innovations such as the iBox system further demonstrate potential for context-responsive open-source solutions that address bandwidth and device limitations (Mallet et al., 2022). Although these initiatives point to steady progress, research indicates that adoption remains inconsistent

because of connectivity challenges, limited staff capacity and the absence of targeted measures that promote future-oriented digital skill development (Loglo, 2024). Understanding how open-source platforms equip Ghanaian graduates for emerging forms of work therefore remains essential for strengthening institutional strategies and informing policy decisions.

OSPs promise strong contributions to future-oriented skills, yet existing research does not provide a clear assessment of how these platforms shape graduate readiness in Ghana. Studies in Ghanaian higher education focus on ICT access and emergency remote teaching rather than systematic engagement with open-source platforms for employability. Aryeh-Adjei *et al.* (2023) investigated online learning experiences of students with special needs through qualitative interviews and centred their analysis on accessibility challenges within an uncustomised learning management system, but they do not assess skill development for future work. While Mallet *et al.* (2022) examined the iBox offline system as a response to infrastructure barriers and document its strengths for content delivery, their conference paper has a descriptive design that limits evaluation of long-term skills acquisition. Longe *et al.* (2021) further described AI education reforms through an institutional case of an emerging AI degree and presented programme-level intentions without empirical evidence on outcomes. Beattie *et al.* (2020) advance a global argument for open-source STEM tools through a conceptual exposition rather than field-based analysis, while Zhang *et al.* (2025) evaluate GeoGebra supported professional development through a qualitative dominant mixed design centred on one preservice teacher, which restricts its transferability. These studies diverge in scope, methods and theoretical frames, yet they converge on the absence of rigorous examination of open-source platforms as mechanisms for structured skills training.

Research outside Ghana indicates that open-source adoption supports readiness for emerging work when platforms integrate with industry informed curricula and when institutions provide sustained technical support (Sarpong, 2023). However, reviews show scattered implementation across African universities and limited evidence on how students engage open-source platforms for self-directed learning or applied problem solving (Loglo, 2024). Current scholarship (Loglo 2024; Longe *et al.* 2021; Zhang *et al.* 2025; Beattie *et al.* 2020) therefore lacks a consolidated analysis that compares educational intentions with actual graduate preparation and that aligns open-source practices with national workforce priorities. This review offers a needed contribution through a Meta synthesis of academic and policy literature that clarifies how open-source platforms contribute to skill development that leads to employment, identifies structural constraints that restrict their uptake and establishes an evidence base that supports coherent institutional planning in Ghanaian higher institutions. More specifically, this study seeks to:

- (1) assess how open-source platforms contribute to the preparedness of Ghanaian graduates for the future of work,
- (2) explore how these platforms are being used among Ghanaian graduates,
- (3) examine some institutional implementation gaps that hinder full integration of these platforms.

Reviewing relevant studies in this area, holds practical value because a meta synthesis can consolidate dispersed evidence across institutional reports, policy documents and empirical studies in ways a single case study cannot achieve, thereby offering a broader

foundation for decision making. The urgency stems from rapid shifts in work driven by automation and AI that require universities to align digital learning systems with industry expectations. A synthesis of this scope will support higher education leaders seeking credible guidance on scalable adoption models, inform policymakers who design national skills frameworks and assist curriculum planners and faculty who integrate open-source platforms into teaching and assessment.

Related Works

Research across higher education shows strong interest in open-source platforms as cost-effective tools that expand access to digital resources and support skill formation for fast-changing work environments, yet evidence remains scattered and methodologically uneven. International contributions view open-source platforms as enablers of digital literacy and collaborative problem solving, although many rely on conceptual reasoning rather than empirical analysis (Beattie et al., 2020; Chakraborty et al., 2024). African studies document their potential for widening access to learning materials but often employ descriptive designs that limit explanations of long-term employability outcomes (Sarpong, 2023).

Most studies from Ghana focus more on online learning experiences, distance education outcomes and assistive technologies rather than systematic assessment of open-source ecosystems for graduate readiness (Aryeh-Adjei et al. 2023; Ofosuhen 2023; Odame et al. 2021). These differences reveal a fragmented body of work that does not fully examine how open-source platforms shape graduate preparation. This review therefore consolidates diverse strands of evidence to establish a clearer basis for understanding their role in future-oriented skills development.

Open-Source Platforms and Graduate Preparedness

Evidence from international and African research indicates that open-source platforms can strengthen graduate preparedness through experiential learning, industry collaboration and cost-efficient access to digital training, although studies vary in scope and methodological rigour. Forshaw et al. (2016) present one of the few practice-based cases where structured engagement with open-source technologies and industry partners improved employment outcomes, yet their design focuses on a single programme in a developed context. Ebom-Jebose (2025) argues that open-source platforms expand digital skills in low-income settings, but the analysis remains descriptive and does not examine institutional or behavioural factors that shape adoption. Platforms such as GitHub, Moodle and Sakai embody several connectivist learning affordances, including collaborative content creation, peer interaction and iterative knowledge updating, which can facilitate networked learning communities that extend beyond traditional classroom boundaries.

In the context of the fourth industrial revolution, some studies of employability among Nigerian graduates offer quantitative evidence on student readiness but does not investigate the role of specific open-source platforms (Opesemowo et al. 2025). While Ghanaian studies on distance education and disability inclusion confirm that university programmes develop some employability attributes, they do not evaluate how open-source platforms influence these capabilities (Ofosuhen, 2023; Odame et al., 2021). This review

extends current literature through an integrative assessment that links platform use, skill development and changing work requirements.

Application of Open-Source Platforms

Research on actual use of open-source platforms among graduates remains thin and fragmented across sector-specific case studies. For instance, Mallet et al. (2022) document how the iBox offline system supports flexible learning in low-connectivity areas, although their analysis emphasises content delivery rather than applied skill development. While Boateng et al. (2022) demonstrate how KwameAI draws on open-source S-BERT models and supports data-driven problem solving in STEM competitions, this example remains limited to high-achieving student groups. Studies on health worker development show how open-source mobile platforms support continuous professional learning among rural nurses, although they do not address graduate transition into broader labour markets (Mwaikambo and Dolphyne 2025).

Moreover, Peterson and Finn (2025) reveal strong faculty-led adoption of free and open-source platforms but limited institutional support, which affects student engagement and continuity of use. These findings show that adoption exists across various domains but lacks systematic integration into graduate preparation pathways, an issue this review addresses through cross-sector analysis.

Institutional Implementation Gaps

Institutional constraints remain a central barrier to the full integration of open-source platforms in Ghanaian higher education, as studies repeatedly identify gaps in infrastructure, governance, and staff capacity. Loglo (2024) reports inconsistent implementation across universities due to connectivity challenges, inadequate technical support, and weak policy alignment. Khelifi et al. (2009) argue that open-source adoption reduces costs and increases customization, yet their case study from a Gulf context emphasises initial development rather than long-term sustainability. Midha and Bhattacharjee (2012) examine governance structures in open-source projects and show how participation and responsibility management influence maintenance outcomes, a dimension absent in Ghanaian institutional practices. Peterson and Finn (2025) identify faculty willingness but limited institutional frameworks for integrating free and open-source applications with existing learning management systems.

Across Ghana, resistance to change, limited pedagogical training and isolated innovation constrain progress even where promising initiatives exist such as AI-focused programmes at Academic City (Longe et al., 2021). This review advances the literature through a focused synthesis that links institutional conditions with platform functionality and assesses how these constraints shape graduate readiness.

Theoretical Framework

Learning within digital environments increasingly reflects the principles of George Siemens's Connectivism (Siemens, 2004), which conceptualises knowledge as distributed across networks of people, digital tools and information sources. Rather than being

confined to individual cognition, learning occurs through the ability to form connections, access diverse knowledge nodes and continuously update information within dynamic digital environments (Siemens, 2004). Open-source platforms (OSPs) provide practical infrastructures that align with these principles. For instance, collaborative repositories such as GitHub enable distributed knowledge construction through version control systems that track contributions, revisions and collective problem-solving among networked users. Similarly, learning management systems such as Moodle incorporate discussion forums, peer review modules and collaborative workspaces that allow learners to engage in shared knowledge production and iterative feedback. These features support connectivist processes of network creation, knowledge exchange and continuous learning, where learners actively participate in digital communities rather than passively receiving content (Hendricks, 2019). In the context of higher education, such environments have the potential to help students develop competencies associated with the future of work, including collaborative problem-solving, digital literacy and adaptive learning practices. However, as this review later demonstrates, the integration of these platforms in many Ghanaian universities has not yet fully leveraged their connectivist potential for graduate employability development.

Empirical studies affirm its utility in technology-integrated education. For example, Longe et al. (2021) demonstrate how AI-driven education in Ghana fosters future-ready skills through networked learning principles, aligning with connectivism's emphasis on adaptability and connectivity. Likewise, Bekele et al. (2023) advocate for culturally grounded strategies to integrate technology effectively, echoing connectivism's call for contextualized networks that respect local realities. These insights strengthen the argument that OSPs, when intentionally designed, can move beyond content delivery toward skill-focused learning ecosystems.

Connectivism has also been applied in studies exploring personal learning environments and digital pedagogy. Conradie (2013) shows that connectivist approaches support self-directed learning and critical thinking, while Plueger (2024) highlights their role in expanding theoretical bases for educational technology in higher education. Reviews by Utecht and Keller (2019) further emphasize its transformative potential for designing learner-centred, technology-integrated curricula.

Despite its promise, connectivism faces notable limitations. Scholars such as Clarà and Barberà (2014) question its theoretical rigor, citing conceptual ambiguities and insufficient explanation of deep learning processes like concept formation. Others argue that its reliance on technology risks exacerbating digital divides, particularly in resource-constrained contexts (Şahin & Abu Safieh, 2012). Furthermore, Dennis (2024) critiques its under-theorization of interaction and overemphasis on connectivity without adequately addressing pedagogical structure. These limitations underscore the need for complementary frameworks and robust institutional support when applying connectivism in higher education.

By framing OSPs as nodes within a learning network, connectivism provides a powerful lens for analyzing structural and instructional reforms needed to embed digital platforms in Ghanaian universities. It offers a theoretical foundation for shifting from mere access provision to intentional, skill-focused design, ensuring graduates acquire future-oriented competencies. This perspective is critical for strengthening graduate readiness in Ghana and similar contexts where technology integration remains fragmented.

Research Design

This qualitative inquiry adopted an interpretivist orientation and an inductive approach because these positions support exploratory work that seeks to understand patterns in published evidence rather than test predetermined hypotheses. A systematic review design guided the process since it enables transparent and rigorous synthesis across diverse sources and reduces bias through structured screening procedures. The review followed PRISMA guidelines to ensure methodological clarity and reproducibility (Moher et al. 2009). Database searches covered ProQuest, Scopus, ERIC, Google Scholar and Springer Nature Link, focusing on publications from 2010 to 2025 to capture contemporary discussions on digital transformation and workforce readiness. Boolean search strings from Table 1 targeted the following research question that addressed open-source platforms graduate preparation and skills development.

- (1) To what extent do open-source platforms contribute to preparing Ghanaian graduates for the future of work?

Table 1: Search equation keyed into academic databases

Connector	Keywords
	('open-source' OR 'open-source platforms' OR 'non-proprietary platforms' OR 'open educational technologies' OR Moodle OR Sakai OR GitHub OR 'OpenAI' OR 'Sentence-BERT')
AND	('higher education' OR university* OR 'graduate education')
AND	('skills development' OR 'future of work' OR employability OR 'work readiness')
AND	Ghana* AND (2010:2025).

After thorough academic database searches, 11,254 records were produced, which were screened through eligibility criteria that emphasised peer-reviewed studies, policy analyses and project evaluations relevant to higher education in Africa. Eighteen studies were retained for full-text synthesis after assessing relevance, methodological coherence and thematic alignment. The review applied a two-stage screening and appraisal process to ensure the credibility of retained evidence. Initial filtering removed duplicates and excluded studies outside the defined period or unrelated to higher education in Africa. The critical appraisal skills programme provided a structured framework for assessing validity, rigour and methodological transparency across qualitative, quantitative and mixed methods designs (Critical Appraisal Skills Programme [CASP] 2025). This appraisal helped identify strengths and limitations in research designs, including reliance on descriptive case studies, absence of theoretical framing in some contributions and limited generalisability of single-institution investigations. Applying a uniform appraisal tool strengthened the

reliability of the synthesis and enabled consistent comparison across studies that varied widely in scope and methodological orientation.

Table 2: Summary of Selected Studies

Ref. ID	Author Details	Paper Source
1	Amos et al. (2025)	ERIC
2	Annan-Brew et al. (2024)	ERIC
3	Asamoah (2021)	ERIC
4	Asiedu et al. (2024)	ERIC
5	Solís et al. (2022)	ERIC
6	Sarpong-Nyantakyi et al. (2021)	ERIC
7	Nkansah and Oldac (2024)	ERIC & Springer Nature Link
8	Oppong and Maluleka (2022)	Scopus
9	Dampson et al. (2020)	Scopus
10	Dei (2024)	Scopus
11	Alhassan et al. (2021)	ProQuest
12	Segbenya et al. (2023)	Google Scholar, ERIC & Scopus
13	Shaban et al. (2024)	Google Scholar
14	Atadika et al. (2024)	Google Scholar
15	Ofosu-Ampomg et al. (2020)	Springer Nature Link
16	Asamoah and Amarteifio (2025)	Springer Nature Link
17	Pittri et al. (2025)	ProQuest
18	Asravor et al. (2024)	ProQuest

Thematic synthesis, using Creswell and Poth's Data Analysis Spiral, supported interpretive work through iterative engagement with the eighteen selected studies from Table 2 (Creswell and Poth 2018; Omega Graduate School, 2023). The process began with preparing and organising extracts from the retained studies, followed by repeated reading and analytic note taking that captured early conceptual patterns. Inductive coding enabled themes to emerge from the reviewed literature, while deductive coding combined theoretical considerations relevant to digital learning and workforce development.

Further, three reviewers cross-checked coding decisions to strengthen trustworthiness, and disagreements were resolved through discussion and reference to the review protocol. The final phase involved deriving interpretive themes that captured the contribution of open-source platforms, patterns of use among Ghanaian graduates, and institutional barriers that affect integration. This structured process provided a clear analytic foundation for drawing conclusions on the role of open-source platforms in preparing Ghanaian graduates for the future of work.

Results

Higher education hosts a growing portfolio of digital and open-source platforms, yet these tools rarely translate into stronger graduate readiness for the future of work. Although the studies address e-learning, digital literacy, analytics readiness, virtual learning environments, gamification, ITS, LMS deployment and employability strategies, they seldom investigate how open-source platforms such as Moodle, Sakai, GitHub or Sentence-BERT strengthen work-relevant skills. This omission leaves a clear gap because universities invest heavily in digital systems but seldom connect these systems to employability outcomes.

Connectivism provides a sharper interpretive lens because it positions open-source platforms as distributed networks where learners build knowledge through connections with digital resources. Only a few studies, such as Mukhlis et al. (2024), recognise this potential and none explore how graduates in resource-constrained contexts use open-source platforms to develop adaptable skills. The present review therefore foregrounds how institutional fragmentation, inconsistent digital policies and limited pedagogical integration weaken the transformative potential of open-source platforms.

Developing Skills and Collaboration with OSPs

Several studies document pockets of skill development and collaborative learning enabled by digital platforms, yet they stop short of proving that open-source platforms deliver sustained employability gains. Youth Mappers and mapping initiatives show that student-led, faculty-mentored projects build practical geospatial skills, teamwork, and external networking, but the case study centres on movement dynamics rather than on formal adoption of open-source repositories or version control systems that employers value. Solís et al.'s (2022) work indicates capacity for project-based, open collaboration but does not measure whether participants translate those experiences into measurable job outcomes. Studies on AI-driven virtual learning environments and intelligent tutoring systems identify personalised learning and improved engagement as potential benefits. However, authors report infrastructure, equity and digital literacy barriers that prevent broad uptake and assessment of labour market relevance (Shaban et al. 2024; Asamoah and Amarteifio 2025). These observations point to pilot successes without longitudinal evidence that open-source platforms such as GitHub or open NLP models form part of graduates' professional portfolios.

Empirical comparisons reveal methodological and theoretical gaps that weaken claims about platform effectiveness. Quantitative studies on analytics readiness and AI

antecedents use Unified Theory of Acceptance and Use of Technology (UTAUT) and related models to predict adoption, but they typically focus on attitudes and intentions rather than on observable skill transfer to workplaces (Amos et al. 2025). Qualitative accounts of curriculum misalignment in commercial art and teacher training identify curriculum rigidity and insufficient industry engagement. They rarely test interventions that embed open-source workflows into assessment or internship tasks (Sarpong-Nyantakyi et al. 2021). Mixed-methods evaluations of e-learning pilots show high usage for assessments and low usage for interactive features, but they omit measures of students' capacity to use open-source toolchains for collaboration, code management or data-driven problem solving (Alhassan et al. 2021). Across these approaches, the same pattern emerges. Researchers measure readiness, perceptions, or pilot usage without tracing causal pathways from platform features to employability metrics.

Underutilization of OSPs for Graduate Preparedness

Digital tools appear across many of the reviewed studies, yet they are primarily implemented as instructional delivery systems rather than mechanisms for skill development. For example, Alhassan et al. (2021) examine an e-learning system for health trainees and report high use for assessments but limited engagement with interactive functions. Their mixed-methods design identifies infrastructural constraints and low faculty capacity but does not examine how LMS features translate into digital competencies required in technology-mediated workplaces. A similar pattern appears in Dampson et al. (2020), who analyse LMS usage at the University of Education, Winneba using strengths, weaknesses, opportunities, and threats (SWOT) analytical framework. While the study highlights system reliability and user competence issues, it does not evaluate whether LMS tools cultivate transferable digital skills. Dei (2024) similarly reports that institutions adopted several open and proprietary platforms during the COVID-19 transition, though these systems were used mainly for content access and assessment rather than collaborative digital practice. Taken together, these studies illustrate that platform adoption frequently prioritises instructional continuity instead of structured skill formation.

Other studies indirectly highlight the consequences of this limited pedagogical integration by documenting broader digital readiness challenges. Amos et al. (2025) show that students possess only foundational capacities for analytics adoption, suggesting that existing digital ecosystems do not sufficiently cultivate advanced digital competencies. Nkansah and Oldac (2024) similarly attribute digital literacy gaps to personal, institutional, and governmental factors that shape students' exposure to digital learning environments. Although these studies do not explicitly examine open-source platforms, their findings imply that students rarely encounter open and collaborative digital practices that mirror contemporary workplace environments.

Oppong and Maluleka (2022) further demonstrate that institutional digital resources can remain underused despite significant investment, as students seldom engage online research support platforms beyond basic functions. When these findings are compared with Asamoah's (2021) interviews with ICT officials, a clearer pattern emerges: universities report substantial investments in systems such as Moodle and Sakai, yet persistent user-training gaps and uneven deployment across faculties limit their educational impact.

Collectively, these observations suggest that many Ghanaian universities possess open-source platforms but have yet to embed them into learning activities that foster collaboration, problem-solving and portfolio-ready digital practice.

What this review contributes is a reframing of digital adoption in Ghanaian higher education as a missed opportunity for future-of-work preparation. The eighteen studies collectively show that institutions often treat open-source platforms as administrative or instructional tools rather than as environments where students can develop collaboration, problem-solving, data literacy and adaptive learning skills. The review adds theoretical grounding through Connectivism, positioning open-source platforms as networked learning spaces capable of linking learners to global knowledge communities in ways that proprietary systems may not afford. This perspective exposes the gap between adoption and meaningful use. It also clarifies that Ghana's challenge is not the absence of open-source technologies but the absence of strategies that link these platforms to skill development, industry expectations and continuous digital adaptation.

Institutional Barriers and Policy Gaps on OSP Use

A consistent finding across the reviewed studies concerns institutional and governance constraints that limit the systematic integration of open-source platforms in Ghanaian universities. ICT officials report investments in systems such as Sakai and Moodle but highlight uneven deployment, inadequate training structures and limited support for pedagogical redesign (Asamoah 2021). Studies on analytics readiness similarly point to institutional, personal, and governmental factors that shape students' ability to participate in digital learning environments (Amos et al. 2025). Research beyond the education sector, such as Pittri et al. (2025), identifies comparable structural barriers including financial limitations, regulatory constraints, and insufficient knowledge systems. These findings suggest that challenges in OSP integration extend beyond classroom practice and reflect broader institutional capacity issues.

Taken together, the evidence indicates the need for coordinated institutional strategies rather than isolated technology initiatives. Universities must strengthen faculty training structures, align digital investment with curriculum reform and establish partnerships with industry to clarify the digital competencies required in entry-level roles. Reliable connectivity infrastructure and monitoring systems that track graduates' digital skill outcomes would further support sustainable integration of open-source platforms across academic programmes.

Mismatches between Academia and Industry

Across the studies, a clear misalignment emerges between pedagogical practices and the digital competencies that graduates need. Segbenya et al. (2023) show that learner centred teaching and summative assessment predict employability skills. However, there was no evidence that open-source platforms support these methods despite their capacity for collaborative tasks and authentic assessment. Annan-Brew et al. (2024) report that pre-service teachers integrate technology more often than critical thinking or creativity, which

signals an environment where platform exposure does not equate to deeper skill formation. Their cross-sectional design confirms uneven skill application but offers no mechanisms for integrating open-source platforms into teacher preparation programmes. Sarpong-Nyantakyi et al. (2021) identify weak practical instruction in commercial art education and note that graduates lack industry-standard competencies. The authors do not examine whether open-source creative tools could expand access and skill acquisition in resource-limited settings or not. Atadika et al. (2024) demonstrate that demographic characteristics shape AI usage, benefits, and challenges among graduate students. For them also, their explanatory design does not address whether institutional structures can support equitable adoption of open-source platforms that reduce proprietary dependency. Together these findings show an education system that values employability outcomes but relies on methods and tools that do not foster the networked, collaborative and adaptive skills demanded in technology-driven work environments.

Institutional responses in the reviewed works further demonstrate a recurring gap where universities focus on delivery systems rather than on sustained skill building. Dei (2024) documents widespread adoption of blended systems during COVID-19. This study shows that these tools serve content transmission rather than project-based or industry-linked digital practice. Oppong and Maluleka (2022) find underuse of online research support platforms, suggesting that students encounter digital resources without structured pathways that connect them to inquiry, collaboration or problem solving. Gamification research presented by Ofosu-Ampong et al. (2020) demonstrates interest in engaging students through enriched LMS environments. However, the authors do not assess whether gamified features, when hosted on open-source platforms, can support skill transfer to workplace tasks. The barriers identified across AI-driven VLE research, ITS implementation and circular economy digital systems point to a shared constraint in infrastructure, training and policy coordination that affects both platform adoption and skill development. These converging findings indicate that institutions enable access to digital systems but rarely scaffold digital practice in ways that prepare graduates for the future of work.

It should be noted that across the eighteen studies, authors use diverse methods ranging from systematic reviews, phenomenological interviews, descriptive surveys, mixed methods designs and structural equation modelling. They rely on theories such as UTAUT, diffusion of innovations, ecological theory, and planned behaviour, though few apply learning theories that capture how students build digital skills through distributed networks. Their findings converge on infrastructural deficits, limited user competence, curriculum rigidity and weak institutional support. None investigates how open-source platforms foster scalable employability outcomes. Studies that examine LMS deployment, analytics readiness, AI adoption, digital literacy or blended learning provide partial insights but do not connect these systems to graduates' ability to carry out tasks that modern workplaces assign through open collaboration, version control, digital data handling or computational reasoning. This review contributes a needed shift by positioning connectivism as a suitable frame for understanding how open-source platforms can help Ghanaian graduates form adaptive knowledge networks. It identifies a persistent gap where universities invest in tools without leveraging their open and participatory affordances to develop job relevant competencies. The review therefore offers a policy and research agenda that calls for structured integration of open-source platforms into teaching, assessment, internships, and industry partnerships so that graduates acquire evidence of practical digital capability rather than mere exposure to institutional technologies.

Discussion

The synthesis indicates that although digital platforms are increasingly available in Ghanaian universities, their pedagogical use often remains limited to basic instructional functions rather than networked learning practices. For example, studies examining learning management systems report that platforms such as Moodle are primarily used to upload lecture slides, distribute assignments, and administer quizzes. In Dampson et al.'s (2020) examination of LMS adoption at the University of Education, Winneba, lecturers reported relying mainly on the system for course announcements and assessment submissions, with limited use of discussion forums or collaborative tools. Similarly, Alhassan et al. (2021) found that e-learning platforms supporting health training programmes were frequently used to host learning materials and conduct assessments, while interactive features such as peer discussion boards or collaborative problem-solving activities remained underutilized. During the COVID-19 transition, Dei (2024) also observed that several universities adopted platforms such as Moodle and Sakai to maintain instructional continuity, yet their use largely centred on content delivery rather than collaborative knowledge creation.

From a connectivist perspective, these practices represent only a partial realization of the affordances offered by open-source platforms. According to the principles articulated by George Siemens, learning emerges through the formation of networks that enable individuals to share, update and collectively construct knowledge. Many of the platforms identified in the reviewed studies contain features that could support such processes. For instance, discussion forums can enable peer-to-peer dialogue around real-world problems, collaborative wikis can support joint project development, and open repositories can allow students to document and refine digital work over time. When used in this manner, open-source platforms can function as digital knowledge networks where students interact with peers, instructors and external knowledge communities, thereby cultivating the collaborative and adaptive competencies associated with the future of work. However, the reviewed studies suggest that such practices remain relatively uncommon within current institutional implementations.

The results of the eighteen studies show a higher education environment where digital tools exist but rarely foster the strong learning networks that Connectivism requires. Studies on LMS use, analytics readiness, blended systems, registrars' experiences, and AI supported environments confirm that Ghanaian universities invest in open and proprietary platforms. However, students seldom form the sustained connections that drive knowledge development and employability. These findings support SDG 4.3 and SDG 4.4, which aim to ensure equal access to affordable, quality technical, vocational, and tertiary education, and significantly increase the number of youth and adults with relevant skills for employment, decent work, and entrepreneurship by 2030 (Saini et al. 2023).

Research on LMS deployment revealed high access but minimal collaborative engagement, which contradicts Connectivism's emphasis on maintaining information pathways and building distributed knowledge. This underuse of platform affordances aligns with concerns raised in the literature on higher education in Africa, which stresses infrastructural constraints and weak digital pedagogies (Bekele et al., 2023). The results also echo SDG

Target 4.5 since the studies identify gaps across learner groups that reflect unequal access to meaningful digital learning opportunities. These combined patterns show that institutions create access to digital tools but fail to extend that access into effective skill formation.

The results further confirm that most digital practices in the reviewed studies support transmission of information rather than the formation of adaptive learning networks. Studies on e-learning in health training, LMS use in Winneba and blended systems in Ghanaian universities describe environments where students consume content but rarely connect to external peers, global repositories or open project spaces that expand their learning networks. Mukhlis et al. (2024) present Connectivism as a viable digital pedagogy. However, the review of Ghanaian studies shows limited attempts to cultivate distributed knowledge spaces that reflect this theory. This gap aligns with concerns raised in SDG 4.1 and 4.6 (ensure all children complete free, equitable, quality primary and secondary education with effective learning outcomes, and guarantee that all youth and a substantial proportion of adults achieve literacy and numeracy). This calls for relevant learning outcomes and strong literacy foundations, because weak digital engagement limits students' capacity to acquire digital reading, analysis, and knowledge-seeking skills that modern work requires. Studies on digital literacy and analytics readiness reveal low competence in sourcing and connecting to digital information. This matches the concerns in SDG literature that emphasize strong foundational cognitive skills for future learning (Hanemann, 2019). These results collectively show that Ghanaian universities secure access to systems but not to the deeper skill sets that support continuous learning in fast-changing knowledge environments.

Several studies in the dataset confirm a serious misalignment between curricula, assessment practices, and the digital skills that SDG 4.4 prioritizes for decent employment and entrepreneurship. Studies on commercial art education, teacher education preparedness and AI usage patterns show that programmes often stress theoretical knowledge while workplace skills remain weak. This gap reflects the disconnect between institutional teaching methods and the practical digital competencies identified in SDG 4.4, which calls for technical, vocational and transferable skills such as collaboration, innovation, and logical analysis (Hamburg, 2020). The absence of structured engagement with open-source platforms such as Moodle, Sakai, Git-based environments or Sentence-BERT pipelines prevent students from forming the connections that Connectivism treats as central to learning. The reviewed studies show that students perform isolated tasks within institutional systems rather than engage in open, networked problem solving. This pattern aligns with research on African higher education digitalisation, which stresses that weak institutional coordination disrupts students' ability to develop sustained digital habits (Longe et al., 2021). The results therefore show that Ghanaian universities have not aligned teaching and assessment with the practices that Connectivism identifies as essential for continuous digital competence.

The overall synthesis reveals a higher education system that meets some conditions of SDG 4.3 through increased access to tertiary systems, yet falls short of SDG 4.4, which requires strong technical and transferable skills for employment. The review of the eighteen studies shows that open-source platforms possess substantial potential to support these SDG expectations because they offer the environments needed for collaboration, inquiry, creation and network building. However, the studies also show that institutions seldom treat these platforms as learning networks. Instead, they treat them as delivery tools that

support administrative efficiency rather than skill development. This review advances the field by demonstrating that the missing link is not the existence of technology but the absence of connectivist learning conditions. Students do not consistently connect to diverse information sources, maintain digital relationships, update their knowledge, or participate in distributed knowledge building. By applying Connectivism to Ghanaian higher education, the review explains why current practices do not yield employability outcomes despite digital investment and why the absence of strong learning networks contradicts the aims of SDG 4.1, 4.3, 4.4 and 4.5. The discussion, therefore, positions open-source platforms as essential networking spaces and calls for deliberate pedagogical redesign so that Ghanaian graduates gain the adaptive, connected and future-ready skills that both SDG 4 and connectivist theory require.

Policy Implications

The findings point to a need for national and institutional policies that treat open-source platforms as strategic learning infrastructures rather than optional support systems. Government agencies and university councils should align digital investment plans with curriculum reform and staff development so that open-source platforms strengthen the acquisition of technical and transferable skills required under SDG 4.4. Policies that support stable connectivity, faculty incentives for digital pedagogy, cross departmental coordination and systematic monitoring of digital skill outcomes would correct the fragmented adoption patterns reported in the reviewed studies. Stronger alignment between higher education policy, industry skill needs, and institutional accountability frameworks would ensure that open-source platforms contribute directly to graduate preparedness for emerging forms of work.

Conclusion

This review demonstrates that open-source platforms possess significant potential to support the development of digital competencies required for the future of work. However, the synthesis shows that this potential remains only partially realised within Ghanaian higher education. The reviewed studies indicate that institutions have introduced a range of digital systems, yet these tools are rarely embedded in learning designs that cultivate collaborative problem-solving, open knowledge creation or sustained digital practice. Addressing this gap requires coordinated institutional reforms that align digital infrastructure, faculty capacity and curriculum design with the networked learning environments envisioned in connectivist theory.

The reviewed studies reveal that students encounter these platforms mainly as delivery systems rather than as environments that build competencies required in modern workplaces. The review establishes that open-source platforms can contribute meaningfully to graduate preparedness when institutions embed them in project-based learning, practical assessment and industry aligned instruction. OSPs contribute only to a limited extent under current practices, not because the tools lack capacity but because institutional systems do not activate their affordances.

Furthermore, usage of OSPs remains narrow, often restricted to accessing content, submitting assignments, or engaging in basic virtual communication, which does not support the formation of the broader digital networks that Connectivism emphasises. Institutional gaps such as weak digital policy coordination, limited faculty capacity, unreliable infrastructure and absence of structured digital skill pathways restrict the expansion of open-source practices across programmes. The review provides a practical pathway forward by showing that stronger curriculum alignment, targeted faculty development, coordinated policy support and structured integration of open-source platforms can convert access into skill development. Through this synthesis, the review delivers clear answers to the research objectives and clarifies that Ghanaian graduates can benefit from open-source platforms only when universities treat these tools as learning networks that support continuous skill growth rather than as peripheral technologies.

Recommendations

Universities should embed open-source platforms in teaching, assessment, and internship structures so that students form the continuous learning networks described in Connectivism. Faculty should receive training that supports the design of project-based instruction where students use Moodle, Sakai, GitHub, open AI models and other open systems to solve authentic problems. Institutions should establish partnerships with employers to define the specific digital competencies required for entry level roles and integrate those expectations into course outcomes. Monitoring systems should track how students use open-source platforms across programmes to identify gaps and refine instructional strategies. Researchers should conduct intervention-based studies that measure how sustained engagement with open-source platforms strengthens the higher order skills required for decent work, entrepreneurship, and lifelong learning under SDG 4. Policymakers should establish measurable benchmarks for AI integration within tertiary curricula. Universities should institutionalise the use of open-source AI platforms through faculty training, student workshops, and credit-bearing coursework. Further, national ICT policies must include explicit targets for AI-supported pedagogy and allocate budget lines for implementation. Collaborative platforms between Ghanaian universities and global AI communities should be formalised to foster peer learning and innovation.

Limitations

This review draws evidence from eighteen studies that vary in methods, focus and quality, which restricts the consistency of comparisons across institutional settings. Most of the included studies examine digital adoption, user readiness or instructional practices without measuring long-term outcomes, which limits the assessment of how open-source platforms influence sustained digital competence. Several studies rely on self-reported data, which introduces reporting bias and weakens conclusions about students' actual skill performance. The review also depends on published work that gives uneven attention to graduate employability, which narrows the scope for drawing strong inferences about how open-source platforms shape job relevant skills. These limitations narrow the scope of conclusions and highlight the need for focused empirical studies that track how students acquire, apply, and sustain digital skills within open-source environments over time.

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Authors jointly wrote and edited the final manuscript.

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An AI tool was used in the development of this paper. Specifically, Microsoft Copilot was employed to assist with tasks such as language refinement, summarising literature, generating initial outlines, and formatting references. All outputs from the AI tool were critically reviewed, edited, and validated by the authors to ensure accuracy, originality, and compliance with academic standards. The authors take full responsibility for the content of this manuscript.

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Factors Influencing Perceptions of Learning Management System Effectiveness in Ghanaian Universities: A Systematic Review

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Abstract

This research systematically evaluates empirical studies about the determinants affecting perceptions of learning management system (LMS) efficiency among Ghanaian university students and teachers. The paper analyses LMS perspectives among students and teachers, addressing at least one of the following aspects, such as usability, institutional support, socio-cultural influence, or human factors. The research integrates literature regarding human, technological, socio-cultural, and institutional factors influencing LMS uptake and perceived utility, predominantly contextualised within the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). The review encompassed empirical peer-reviewed research published from 2012 to 2024, mostly concentrating on Ghanaian higher education and similar developing countries. A total of 121 usable papers were retrieved, out of which 47 were relevant. The reviewed studies employed qualitative, quantitative, or hybrid methodologies. Exclusion criteria were based on non-empirical research, grey literature, conference abstracts without full text, and studies that did not explicitly examine views of LMS effectiveness. The review synthesises thematic and comparative studies to elucidate similarities and differences among user groups, methodological advantages and disadvantages, and practical ramifications for policy and pedagogy. The results show that perceived ease of use, self-efficacy, and technical support are important for adoption, but socio-cultural hurdles and problems with infrastructure remain insufficiently theorised and inconsistently measured across studies, representing a significant gap in literature. These findings carry significant implications for institutional policymakers, LMS administrators, and academic developers seeking to design contextually responsive and equitable digital learning environments in Ghanaian higher education.

Keywords: Learning Management Systems (LMSs), faculty and students' perception, higher education, Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology

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Introduction

Research on the factors affecting perceptions of learning management system (LMS) effectiveness among Ghanaian university students and faculty has become a crucial area of study due to the increasing reliance on digital platforms for educational delivery, especially following the COVID-19 pandemic (Adu & Biljon, 2023; Agbaglo & Bonsu, 2022; Attiogbe et al., 2025). Consistent with this growing emphasis on digital education, the progression of LMS adoption in higher education has transitioned from basic use to extensive integration, with Ghanaian institutions increasingly adopting LMS to facilitate blended and online learning (Asabere et al., 2021; Tanye et al., 2019). This development has crucial social and practical repercussions because LMS platforms make it simpler to find educational resources, enhance teaching methods, and may contribute to better grades (Mutanga et al., 2023; Samson & Yango, 2023). Research shows that more than 80% of universities in Ghana use LMS, which shows how important the system is in modern education (Alumona & Akinseinde, 2023; Darko-Adjei & Ankrah, 2018). Despite these gains, challenges persist in understanding the specific factors that shape perceptions of LMS effectiveness among students and staff in Ghana (Antwi-Boampong, 2021; Asamoah & Oheneba-Sakyi, 2024).

Challenges like inadequate ICT skills, infrastructural deficiencies, and variable degrees of technical support had previously been identified (Chasubuta et al., 2024; Dlalisa & Govender, 2020; Qua-Enoo et al., 2021). Moreover, a knowledge gap persists about the interplay of human, technological, and institutional elements that influence these perceptions. Some studies have concentrated on usability and self-efficacy (Adu & Biljon, 2023; Fearnley & Amora, 2020), whereas others highlight cultural and motivational dimensions (Amankwah et al., 2024; Asunka, 2012). Differing perspectives emerge about the relative impact of perceived ease of use versus perceived utility on LMS adoption (Asamoah, Oheneba-Sakyi & Tagoe, 2024; Prakarsa et al., 2023). This gap has real-world repercussions because not knowing enough about LMS may make it difficult to utilise and limit the educational benefits it offers (Chasokela et al., 2024).

This review is grounded in a conceptual framework that integrates key constructs from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), including perceived usefulness, perceived ease of use, facilitating conditions, social influence, and self-efficacy (Adu & Biljon, 2023; Fearnley & Amora, 2020; Quiban, 2024). These constructs are interrelated and collectively shape attitudes and behavioural intentions regarding LMS utilisation, thereby influencing actual adoption and perceived effectiveness (Hussein et al., 2024; Osman & Yatam, 2024). While TAM and UTAUT provide a widely validated theoretical foundation, it is important to acknowledge their limitations when applied to sub-Saharan African contexts. Both models were developed and predominantly validated in Western, technology-rich settings, and their core constructs may not fully capture the socio-cultural dynamics, digital infrastructure inequalities, and relational learning norms characteristic of Ghanaian higher education (Tanye et al., 2019). Accordingly, this review supplements these frameworks with socio-cultural and institutional lenses to more comprehensively account for the contextual realities shaping LMS perceptions in Ghana.

Although Learning Management Systems are increasingly adopted in Ghanaian universities to support digital and blended learning, their effective implementation remains uneven. The success of these systems depends not only on technological availability but also on how students and faculty perceive their usefulness, usability, and relevance to teaching and learning. Despite growing research on LMS adoption in Ghana, existing studies are fragmented and focus on isolated institutional contexts, making it difficult to develop a comprehensive understanding of the factors that shape perceptions of LMS effectiveness. Moreover, most research on LMS effectiveness has been conducted in non-Ghanaian or broader international contexts, which may not adequately capture the technological infrastructure, pedagogical practices, and socio-cultural factors influencing LMS use within Ghanaian higher education. Consequently, policymakers, university administrators, and educators lack a consolidated evidence base to guide effective LMS implementation and improvement.

This gap highlights the need for a systematic synthesis of empirical studies that examine the factors influencing perceptions of LMS effectiveness among Ghanaian university students and faculty. Without such a comprehensive review, efforts to enhance LMS adoption and optimise digital learning outcomes in Ghanaian universities may remain inconsistent and inadequately informed. Therefore, this study seeks to systematically review the existing literature (2012–2024) to identify the key factors influencing the perceptions of LMS effectiveness in Ghanaian universities. While the primary focus is on Ghanaian higher education, the review deliberately incorporates empirical studies from comparable developing-country contexts (including Zimbabwe, Tanzania, South Africa, Sri Lanka, and Indonesia) where findings offer theoretical or contextual insights relevant to the Ghanaian situation. This comparative scope enriches the synthesis and is reflected in the study's inclusion criteria; however, conclusions are oriented towards implications for Ghanaian universities specifically. In doing this, the study will provide evidence-based recommendations for improving LMS implementation and utilisation in Ghanaian higher education. The specific objectives are to

- examine the technological factors influencing LMS effectiveness, including perceived usefulness, perceived ease of use, system quality, and technical support;
- evaluate the influence of human factors such as self-efficacy, digital literacy, training, and behavioural intention on LMS adoption and sustained use;
- analyse the institutional and infrastructural conditions affecting LMS implementation, including internet connectivity, institutional support, and organisational readiness;
- investigate the socio-cultural and pedagogical factors shaping students' and faculty perceptions of LMS effectiveness in higher education;
- synthesise the differences and similarities in students' and faculty experiences, attitudes, and perceptions regarding LMS usefulness and educational effectiveness;

The study employs a rigorous systematic review methodology following PRISMA guidelines, selecting peer-reviewed publications that examine LMS attitudes in Ghanaian higher education and certain underdeveloped nations. Inclusion standards underscore empirical research that investigates technical, human, and institutional dimensions, assessed using thematic and quantitative frameworks. The results are organised to show how LMS adoption has changed over time, what problems and benefits it has brought, and what it means for all the people involved, to guide future research and practice.

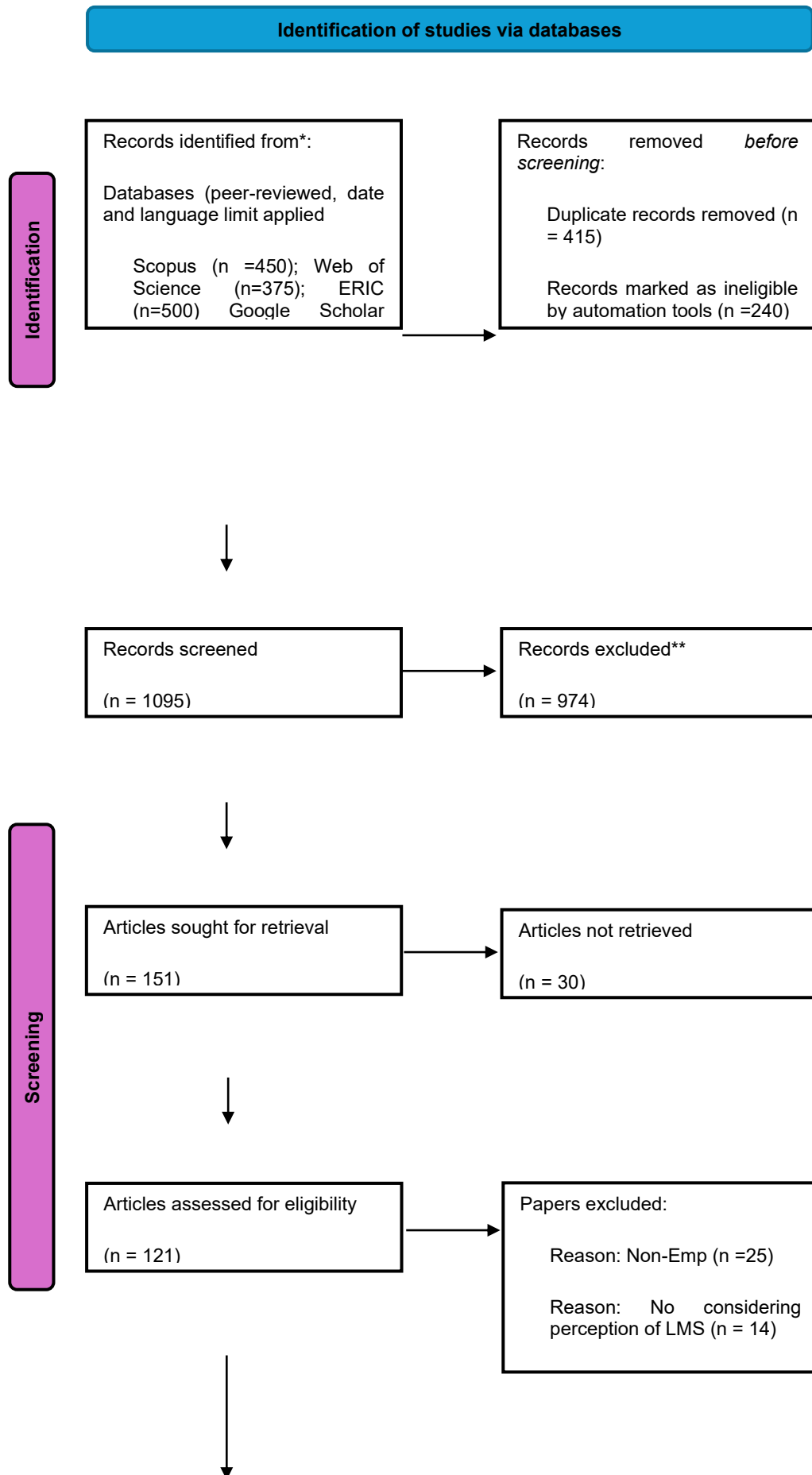
Research Design

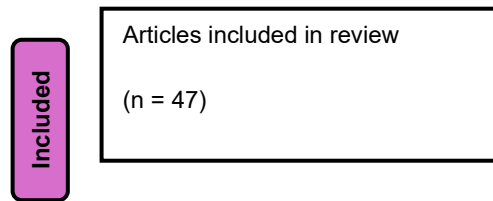
This study employed a systematic review methodology to investigate and evaluate the available literature concerning the perceptions of Ghanaian university students and teachers regarding the efficacy of Learning Management Systems (LMS). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach by Page et al. (2021), was selected because it provides a structured framework that enables researchers to present the review process in a clear and systematic manner, thereby enhancing the transparency, rigour, and credibility of the study.

Search plan

The database search comprised Google Scholar, Scopus, Web of Science, and ERIC. Search terms included both keywords and Boolean operators. For example, "Learning Management System" AND "Ghana" AND ("perception" OR "acceptance" OR "effectiveness"). The inclusion requirements mandated the examination of all empirical works published between 2012 to 2024, as this period spans the widespread adoption and integration of LMS in Ghanaian higher education, beginning with early institutional uptake and extending through the post-pandemic digital transformation. The studies needed to be peer-reviewed, focused on higher education in Ghana and other developing countries, and looked at how students and/or teachers felt about LMS. The software should explore at least one determinant, including usability, institutional support, socio-cultural influence, or human aspects, in accordance with the research objectives. Non-empirical research, grey literature, conference abstracts without full text, and studies that didn't explicitly look at how people thought LMS worked were excluded. The research used SciSpace software to create a relevance rating, which moved the most relevant studies to the top of the table.

Thus, using the PRISMA (Page et al., 2021) systematic review design, a total number of 1,750 records were identified from the databases (peer-reviewed, date and language limit applied). These were Scopus (n=450); Web of Science (n=375); ERIC (n=500) and Google Scholar (n=425). The search terms combined LMS, Ghana, perception, acceptance, and effectiveness. Out of 121 papers eligible, only 47 met the inclusion criteria. These were empirical, peer-reviewed studies published between 2012 and 2024, focusing on Ghanaian higher education (see Figure 1). Non-empirical papers, abstracts without full texts and grey literature were excluded.

Figure 1: THE PRISMA MODEL



Thematic analysis

The thematic analysis in this systematic review followed an inductive-deductive process grounded in the PRISMA framework. From 47 empirical studies, recurring patterns were identified across the literature and organised into 13 themes. Coding was driven primarily by the Technology Acceptance Model (TAM) and UTAUT, which guided initial deductive categories, while additional themes emerged inductively from the data. The dominant theme, *Perceived Usefulness and Ease of Use*, appeared in 32 of 47 papers, affirming TAM's centrality in LMS adoption discourse. Subsequent themes such as *Technical Support and Infrastructure* (29/47), *Human Factors* (27/47), and *Socio-Cultural and Institutional Influences* (23/47) were constructed by clustering conceptually related findings across studies. Lesser-frequency themes such as *COVID-19's Impact* and *Pedagogical Integration* captured contextual and emergent patterns not fully accounted for by existing frameworks. Comparative analysis across themes revealed tensions between student and faculty perceptions, underscoring the need for stakeholder-differentiated LMS strategies. This structured thematic synthesis enabled the identification of research gaps, particularly around socio-cultural variables and longitudinal outcomes, informing both theoretical and practical implications.

Results

Critical examination and integration of the literature

The literature on determinants of LMS effectiveness perceptions among Ghanaian university students and faculty reveals a multi-dimensional picture shaped by intersecting technological, human, and institutional forces. Usability and technical support consistently emerge as significant predictors of adoption and sustained use; however, their operationalisation and measurement vary considerably across studies, making cross-study comparisons difficult and limiting cumulative theoretical development. Socio-cultural factors are acknowledged as influential yet remain unevenly examined: some studies investigate their effects on faculty attitudes and resistance, while others treat them as peripheral variables. Methodologically, the review is dominated by quantitative survey designs employing TAM and UTAUT frameworks, which provide robust predictive models but tend to underrepresent the contextual and experiential dimensions of LMS engagement. Importantly, discrepancies between student and faculty perceptions are documented across studies, yet direct comparative analyses within the same institutional settings remain scarce. Significant gaps persist in addressing infrastructural constraints and the interplay between socio-cultural factors and technology adoption in the Ghanaian context. Table 1 below illustrates.

Table 1: Analysis of strengths and weaknesses in the studies reviewed

Aspect	Strengths	Weaknesses
Methodological Approaches	The employment of validated quantitative instruments and structural equation modelling (SEM) in various studies yields comprehensive statistical analysis and model testing, thereby augmenting the reliability of findings pertaining to LMS adoption and perceptions (Adu & Biljon, 2023; Asamoah, Oheneba-Sakyi & Tagoe, 2024; Fearnley & Amora, 2020). Some studies use mixed methods approaches to provide. This helps to better understand the experiences of staff and students (Antwi-Boampong, 2021; Brenya, 2024).	A predominant reliance on cross-sectional survey methodologies constrains the capacity to infer causality or to document longitudinal shifts in attitudes and usage patterns. Qualitative samples are frequently limited in size and scope (Antwi-Boampong, 2021; Asamoah & Oheneba-Sakyi, 2024). Moreover, certain studies exhibit insufficient reporting on sample methodologies and response rates, which may compromise representativeness (Akwene, 2024).
Support for Usability and Technology	Research consistently identifies perceived ease of use and technical assistance as critical determinants affecting LMS uptake and efficacy perceptions among both students and teachers (Adu & Biljon, 2023; Asamoah, Oheneba-Sakyi & Tagoe, 2024; Caratiquit & Caratiquit, 2022). Combining usability elements with technology acceptance models gives a more detailed picture of how system design affects user engagement (Revythi & Tselios, 2019).	Even though people know how important technical assistance is, there hasn't been much research into the quality and responsiveness of support services and how these differ from one institution to another. Some data indicate that the categories of usability and perceived usefulness conceptually overlap, hence complicating model interpretations (Adu & Biljon, 2023). In addition, infrastructural issues like internet connectivity are recognised but not consistently tackled (Brenya, 2024; Darko-Adjei & Ankrah, 2018).
Social and Cultural Influences	Research recognises social impact and cultural aspects as critical determinants of LMS adoption, especially among faculty, emphasising the significance of peer norms and institutional culture (Adu & Biljon, 2023; Asunka, 2012). Participatory action research methodologies yield significant insights into cultural impediments and tactics for surmounting opposition and resistance (Asunka, 2012).	The investigation of socio-cultural dynamics is still in its infancy, as there are limited studies utilising theoretical frameworks specifically designed for cultural contexts. People often think of social influence as a general idea without breaking it down into its parts or looking at how other parts of society affect how people use technology (Asamoah & Oheneba-Sakyi, 2024; Bayaga & du Plessis, 2024).

Perceptions of Faculty and Students	Comparative research indicates disparities in attitudes and adoption behaviours between staff and students, with faculty frequently demonstrating greater reluctance regarding pedagogical integration and workload (Asamoah & Oheneba-Sakyi, 2024; Lasanthika & Tennakoon, 2019; Tanye et al., 2019). Some studies show that teachers need ongoing training and incentive to use LMS more effectively (Asamoah, Oheneba-Sakyi & Tagoe, 2024; Tanye et al., 2019).	Few studies systematically analyse how faculty and students see things in the same institutional environment, which makes it hard to fully comprehend where they agree and where they disagree. Moreover, faculty apprehensions regarding pedagogical transformation and workload are occasionally lightly addressed without comprehensive qualitative investigation (Antwi-Boampong, 2021; Dlalisa & Govender, 2020).
Integration in teaching Effectiveness	Evidence indicates that the utilisation of LMS can promote pedagogical transformation and enhance educational outcomes when properly integrated, with faculty techno-pedagogical competencies being essential (Samson & Yango, 2023; Tanye et al., 2019). Research correlates the efficacy of LMS with student engagement and satisfaction, underscoring the significance of instructional design (Hussein et al., 2024; Toring et al., 2022).	Though there are promising signs, it is still not apparent how much LMS adoption really changes the way teachers teach. Numerous research emphasise perceptions over objective assessments of learning results. The congruence of LMS features with instructional objectives is insufficiently analysed, and obstacles in faculty adoption impede the complete actualisation of LMS potential (Mutanga et al., 2023; Tanye et al., 2019).
Infrastructural and Institutional Contexts	Research identified infrastructural challenges such as insufficient internet connection, inadequate hardware, and institutional support deficits as key hurdles to LMS implementation and efficacy in Ghanaian universities (Antwi-Boampong, 2021; Brenya, 2024; Darko-Adjei & Ankrah, 2018). Institutional accountability for delivering ICT infrastructure and training is underscored as crucial for effective LMS integration (Asamoah, Oheneba-Sakyi & Tagoe, 2024).	There is a deficiency of thorough, system-wide evaluations of infrastructural issues, as numerous research concentrates on singular factors. Institutional policies and resource allocation techniques are inadequately examined, and their effects on LMS sustainability and scalability remain insufficiently investigated (Antwi-Boampong, 2021; Brenya, 2024). Furthermore, the interaction between infrastructural constraints and socio-cultural elements is hardly examined comprehensively.
Theoretical Frameworks and Model Application	Utilising existing frameworks such as TAM, UTAUT, and Innovation Diffusion Theory provides a robust theoretical foundation for analysing LMS adoption, enabling comparability among research (Adu & Biljon, 2023; Asamoah, Oheneba-Sakyi & Tagoe, 2024;)	Excessive dependence on these models may limit the investigation of context-specific elements exclusive to Ghanaian higher education. Some research indicates overlapping constructs and uneven operational definitions, potentially impacting construct validity. Moreover, the inadequate integration of

	Bayaga & du Plessis, 2024). Integrating factors such as self-efficacy and system quality into these models increases their explanatory value (Fearnley & Amora, 2020; Quiban, 2024).	socio-cultural theories hinders a thorough comprehension of LMS perspectives within the local environment (Adu & Biljon, 2023; Bayaga & du Plessis, 2024).
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Thematic Review of Literature

In Table 2, significant themes were identified in the literature that focused on technological usability, technical support, and socio-cultural and institutional effects. Research consistently highlighted the significance of perceived simplicity of use, perceived utility, and system quality as essential factors influencing LMS uptake and user satisfaction. Other emerging issues include pedagogical integration and cultural factors, which highlight the difficulty of getting people to use LMS in different educational and social settings. The effects of technological infrastructure, digital literacy, and training support are also spoken about in depth, pointing out the things that make LMS integration easier or harder.

Table 2: Themes constructed from the literature review

Theme	Shows up in	Description of the theme
How useful and easy it is to use (PU/PEOU)	32/47 Papers	Perceived usefulness and perceived ease of use regularly emerge as the principal factors driving LMS uptake among students and staff in Ghanaian universities. These constructs are fundamental to Technology Acceptance Model (TAM) studies, demonstrating substantial beneficial impacts on attitude, behavioural intention, and actual utilisation of LMS platforms (Adu & Biljon, 2023; Asamoah, Oheneba-Sakyi & Tagoe, 2024; Fearnley & Amora, 2020; Prakarsa et al., 2023; Quiban, 2024).
Technical Support and Infrastructure	29/47 Papers	The availability of technical assistance and the quality of ICT infrastructure have a considerable effect on how users view and use LMSs effectively. Studies show that problems like inconsistent internet, lack of training, and limited technical help make LMS less effective (Adu & Biljon, 2023; Agbaglo & Bonsu, 2022; Asamoah & Oheneba-Sakyi, 2024; Caratiquit & Caratiquit, 2022; Darko-Adjei & Ankrah, 2018). Facilitating conditions, such as continuous training and technical support, are underscored as essential for the enduring adoption of LMS (Asamoah, Oheneba-Sakyi & Tagoe, 2024; Caratiquit & Caratiquit, 2022; Fearnley & Amora, 2020).
Human Factors: Self-Efficacy, Digital Literacy, and Training	27/47 Papers	Individual competencies, including computer self-efficacy and digital literacy, significantly impact opinions of LMS usefulness and uptake. Research emphasises the significance of past ICT experience and training programs to promote staff and student proficiency with LMS utilisation (Adu & Biljon, 2023; Asamoah & Oheneba-Sakyi, 2024; Chasubuta et al., 2024; Quiban, 2024; Riyath & Rijah, 2022). Self-efficacy acts as a mediator between perceived usefulness and ease of use, underscoring the necessity for capacity-building activities (Bayaga & du Plessis, 2024; Fearnley & Amora, 2020; Riyath & Rijah, 2022).

Socio-Cultural and Institutional Influences	23/47 Papers	Cultural norms, social impact, and institutional policies shape LMS perceptions and usage habits. Research delineates cultural impediments and diminished motivation among faculty as obstacles to LMS adoption, whereas social facilitation and administrative assistance function as facilitators (Adu & Biljon, 2023; Amankwah et al., 2024; Asunka, 2012; Bayaga & du Plessis, 2024; Brenya, 2024). Management commitment, incentive structures, and organisational preparation are institutional elements that affect LMS uptake (Antwi-Boampong, 2021; Asunka, 2012; Riyath & Rijah, 2022).
Pedagogical Integration and Faculty Attitudes	18/47 Papers	The compatibility of LMS features with teaching methods has an impact on how faculty members embrace and use them. Research indicates that LMS features impact pedagogical strategies and student involvement, with alignment between LMS functionalities and educational objectives augmenting perceived utility (Asamaoah, Oheneba-Sakyi & Tagoe, 2024; Mutanga et al., 2023; Riyath & Rijah, 2022; Su & Chen, 2025; Tanye et al., 2019). Faculty opinions towards LMS are associated with pedagogical beliefs and the perceived ability to innovate instructional delivery (Su & Chen, 2025; Tanye et al., 2019).
Quality of the system and usability	16/47 Papers	The quality of a system, including how well it works, how easy it is to use, and how well it is designed, has a big impact on how satisfied users are and how likely they are to use LMSs. Research indicates that excellent system quality is associated with enhanced views of use and utility (Fearnley & Amora, 2020; Nurdin et al., 2023; Prakarsa et al., 2023; Sánchez et al., 2023). Usability assessments reveal that LMS platforms require ongoing improvements to fulfil user expectations and promote participation (Manasrah et al., 2024; Revyathi & Tselios, 2019).
Barriers to LMS Adoption	15/47 Papers	Some of the most common problems are: not having enough infrastructure, not wanting to change, not having enough digital skills, and having technical problems. These barriers diminish the willingness of both staff and students to include LMS into educational practices (Antwi-Boampong, 2021; Asamoah & Oheneba-Sakyi, 2024; Asunka, 2012; Darko-Adjei & Ankrah, 2018; Dlalisa & Govender, 2020). To get rid of these barriers, we need to come up with all-encompassing plans that focus on raising awareness, motivating people, and providing resources (Asamoah & Oheneba-Sakyi, 2024; Asunka, 2012).
Differences in how students and faculty see things	12/47 Papers	Comparative studies show that students and teachers have quite different ideas about the pros and cons of LMS. Faculty generally perceive LMS as more beneficial, although they also encounter greater difficulties with technical assistance and pedagogical adaption (Adu & Biljon, 2023; Alumona & Akinseinde, 2023; Lasanthika & Tennakoon, 2019). To make LMS implementation tactics work better, it's important to understand these differences.
Impact of COVID-19 on LMS Adoption and Digital Transformation	11/47 Papers	The COVID-19 epidemic sped up the use of LMS, showing both the good and bad sides of digital education. Research shows that there are big gaps in infrastructure, readiness, and digital skills as more and more people move to online and blended learning (Agbaglo & Bonsu, 2022; Attiogbe et al., 2024; Butakor, Kakutia, Shah & Hunt, 2022). The epidemic has made the need for good

		LMS integration and institutional support systems even greater (Osman & Yatam, 2024).
Behavioral Intention and Actual Use	10/47 Papers	Behavioural intention is a major predictor of actual LMS use, with attitudes towards technology and perceived usefulness acting as mediators. Studies using structural equation modelling show that having a good attitude towards LMS directly makes it more likely that people will embrace and keep using it (Fearnley & Amora, 2020; Caratiquit & Caratiquit, 2022; Quiban, 2024). This method shows how important it is to create positive attitudes in order to get people involved.
Personalized and Interactive Features	8/47 Papers	Personalisation and interaction in LMS design improve student motivation and academic performance. Research indicates that tailoring LMS settings to student requirements enhances engagement and perceived efficacy (Mutanga et al., 2023; Shaame et al., 2023). Nevertheless, infrastructural challenges frequently impede the complete actualisation of these advantages (Shaame et al., 2023).
Digital Development Curriculum	6/47 Papers	There is an increasing focus on integrating digital literacy and skills development into academic programs to enhance the effectiveness of Learning Management Systems (LMS). Evidence shows that there is a gap between digital initiatives and how well they are really used in disciplinary teaching (Armah & Westhuizen, 2020; Chasubuta et al., 2024). Improving digital skills is very important for getting the most out of LMS in higher education.
System Usability Scale and Extended Theoretical Models	5/47 Papers	Some studies employ expanded TAM frameworks that incorporate system usability scores to evaluate behavioural intention and acceptability more thoroughly. These models validate the influence of system access, self-efficacy, and social norms on LMS adoption (Caratiquit & Caratiquit, 2022; Revythi & Tselios, 2019; Quiban, 2024). These methodological breakthroughs enhance comprehension of LMS acceptance dynamics.
Comparisons across cultural and regions	4/47 Papers	Comparative studies examining Ghana alongside other developing nations (e.g., South Africa, Sri Lanka, Malaysia) demonstrate contextual variances in factors influencing LMS adoption, including infrastructure gaps and cultural effects (Bayaga & du Plessis, 2024; Chasokela et al., 2024; Riyath & Rijah, 2022). These results underscore the imperative for regionally customised methods while leveraging global theoretical frameworks.

Comparison between studies

There is a broad consensus across the examined studies that human factors, self-efficacy, digital literacy, and attitudes significantly influence views of LMS effectiveness. Technological factors, particularly perceived ease of use and system quality, are equally important in encouraging use. There is a lot of disagreement about how important social and cultural factors are, such as support from peers and institutions. Some studies focus on cultural barriers, including hierarchical norms and aversion to change, while others ignore them. There are clear discrepancies between how faculty and students see things. Faculty frequently emphasise difficulties related to pedagogy and

infrastructure, whereas students concentrate on access, connectivity, and interface usability. These disparities could be due to changes in the design of the research, the characteristics of the sample, and the context of the institution. In the end, the adoption of LMS is influenced by a combination of human aptitude, system design, and the socio-cultural milieu. However, the importance of these elements varies based on the user's perspective.

Discussion

This systematic review synthesised previous evidence on the factors influencing perceptions of LMS effectiveness in Ghanaian higher education, revealing a multi-layered interplay between human, technological, institutional, and socio-cultural dimensions. The following findings are discussed based on the objectives.

Technological factors influencing LMS effectiveness

This review demonstrates that technological factors remain central to perceptions of Learning Management System (LMS) effectiveness in Ghanaian higher education. Across the reviewed studies, perceived usefulness, perceived ease of use, system quality, and technical support consistently emerged as major predictors of LMS adoption and sustained utilisation. These findings strongly support the assumptions of the Technology Acceptance Model (TAM), which posits that users are more likely to adopt technologies they perceive as useful and easy to use. Studies included in the review consistently reported that reliable platforms, user-friendly interfaces, and accessible LMS functionalities positively influenced user satisfaction and behavioural intention toward LMS use (Adu & Biljon, 2023; Revythi & Tselios, 2019; Quiban, 2024). However, the review also identified conceptual overlaps between usability and perceived usefulness, with some studies treating the constructs interchangeably, thereby weakening theoretical precision. Furthermore, infrastructural deficiencies such as unstable internet connectivity, low bandwidth, and inconsistent access to digital devices continue to undermine the practical effectiveness of LMS implementation in Ghanaian universities despite positive perceptions of usability.

Human factors and user readiness

The findings further indicate that human factors significantly shape perceptions of LMS effectiveness. Self-efficacy, digital literacy, prior ICT experience, and training opportunities emerged as important determinants of LMS acceptance and sustained engagement. Students and faculty with stronger digital competencies were more likely to perceive LMS platforms as useful, accessible, and beneficial to teaching and learning processes. These findings align with TAM and extended acceptance models that position self-efficacy as an important mediator between perceived ease of use and behavioural intention (Adu & Biljon, 2023; Fearnley & Amora, 2020). However, the review also reveals persistent disparities in digital competencies among users, particularly among faculty members who may have limited exposure to digital pedagogies. The evidence suggests that inadequate training and insufficient institutional support continue to constrain meaningful LMS utilisation. Consequently, digital readiness should not be viewed solely

as an individual characteristic but as a capacity shaped by institutional investment in continuous professional development and digital skills training.

Institutional and infrastructural conditions affecting LMS implementation

Institutional and infrastructural conditions emerged as major contextual determinants influencing LMS effectiveness in Ghanaian universities. The review identified inadequate internet connectivity, limited access to ICT infrastructure, insufficient technical support, and weak institutional policies as recurring barriers affecting both adoption and sustained LMS use which aligns with studies by Antwi-Boampong (2021) and Darko-Adjei and Ankrah (2018). While many institutions have adopted LMS platforms in response to increasing digitalisation and post-pandemic educational demands, implementation remains uneven due to disparities in institutional preparedness and resource allocation. The findings further suggest that facilitating conditions alone are insufficient unless accompanied by effective administrative commitment, sustainable funding, and institutional strategies that support long-term digital transformation. Importantly, the interaction between infrastructural limitations and user attitudes indicates that poor institutional environments can negatively affect confidence, motivation, and perceptions of system usefulness.

Socio-cultural and pedagogical influences on LMS perceptions

The review also demonstrates that socio-cultural and pedagogical factors significantly influence perceptions of LMS effectiveness, although these dimensions remain underexplored in many studies. This is consistent with some studies that highlight the impact of cultural norms, resistance to change, and hierarchical academic structures on faculty engagement with LMS platforms (Amankwah et al., 2024; Asunka, 2012;). Cultural norms, resistance to change, institutional culture, and traditional pedagogical practices affect both faculty and student engagement with LMS platforms. Faculty resistance to LMS adoption is often linked to concerns about increased workload, disruption of established teaching methods, and uncertainty regarding pedagogical effectiveness. Similarly, hierarchical educational structures and preferences for face-to-face interaction may limit willingness to integrate LMS tools into instructional practices. The findings further show that LMS platforms are more positively perceived when their functionalities align with instructional goals, student engagement strategies, and pedagogical needs. These findings suggest that LMS effectiveness is not solely dependent on technological functionality but also on the extent to which systems accommodate local educational cultures and teaching philosophies.

Differences between faculty and student perceptions

An important finding across the reviewed studies is the existence of significant differences between student and faculty perceptions regarding LMS usefulness and effectiveness. Students generally perceive LMS platforms positively due to their convenience, accessibility, flexibility, and ability to support independent learning (Attigbo et al., 2025). Their concerns primarily focus on usability, connectivity, and ease of access to learning materials. In contrast, faculty perceptions are more strongly influenced by pedagogical integration, workload management, institutional support, and technical reliability. While faculty often acknowledge the pedagogical potential of LMS platforms for improving engagement and instructional innovation, they simultaneously express concerns regarding digital adaptation, course redesign, and increased administrative responsibilities (Asamoah & Oheneba-Sakyi, 2024). These differences reflect the distinct roles

and expectations of each stakeholder group within higher education environments and suggest the need for differentiated implementation and support strategies.

Applicability of theoretical frameworks in the Ghanaian context

The review reaffirms the relevance of dominant theoretical models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) in explaining LMS adoption and perceived effectiveness. Constructs such as perceived usefulness, perceived ease of use, facilitating conditions, social influence, and self-efficacy consistently demonstrated explanatory value across many studies. However, the findings also reveal limitations in the applicability of these frameworks within Ghanaian higher education contexts. Many studies rely heavily on technologically deterministic models that insufficiently account for socio-cultural realities, institutional inequalities, and infrastructural constraints that shape LMS adoption in developing contexts (Adu & Biljon, 2023; Tanye et al., 2019). Furthermore, inconsistencies in construct operationalisation and overlapping variables reduce theoretical clarity across studies. The review, therefore, suggests the need for more context-sensitive theoretical frameworks that integrate technological, institutional, pedagogical, and socio-cultural dimensions in explaining LMS effectiveness in Ghanaian universities.

Theoretical Implications

This synthesis of findings reaffirms, and, in some respects, extends, the enduring relevance of dominant technology acceptance frameworks such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) in accounting for patterns of Learning Management System (LMS) adoption and perceived effectiveness within the Ghanaian higher education landscape. In various empirical settings, constructs such as perceived usefulness, perceived ease of use, and self-efficacy consistently serve as statistically significant predictors of user acceptance, highlighting the explanatory strength of these models in contexts characterised by varied institutional capacities and digital readiness (Adu & Biljon, 2023; Bayaga & du Plessis, 2024; Fearnley & Amora, 2020; Quiban, 2024). Nonetheless, the theoretical discourse becomes increasingly complex when analysing the subtle interactions between usability components and technology adoption theories. Although perceived usability and perceived usefulness exhibit a robust conceptual and empirical correlation, they must not be regarded as interchangeable. This conceptual distinction indicates the necessity for advanced acceptance models that explicitly incorporate usability effectiveness, not solely as a mediating factor, but as an equivalent dimension affecting adoption trajectories (Adu & Biljon, 2023).

The socio-cultural variables that influence adoption behaviours are equally significant. Social impact, cultural norms, and resistance stemming from established academic practices serve as significant factors influencing LMS perception and utilisation, hence challenging the adequacy of technologically deterministic models. Evidence from participatory action research demonstrates that cultural factors, such as hierarchical teaching cultures or a preference for face-to-face interaction, can significantly influence faculty participation with LMS platforms (Akwene, 2024; Asunka, 2012). The function of facilitating conditions within these frameworks is also dependent on the situation. Some studies identify infrastructure quality, institutional readiness, and technical support as direct facilitators of adoption, while others demonstrate inconsistent or statistically insignificant effects. This indicates that these enabling conditions may exert their theoretical

influence solely when integrated within a comprehensive ecosystem of organisational preparedness.

Additionally, the results highlight the significance of pedagogical alignment. The epistemological orientations and teaching philosophies of instructors significantly influence LMS integration patterns; platforms are most effectively embraced when their functionalities align with educators' chosen methods of information dissemination. This expands existing acceptance theories beyond their technological foundation, establishing pedagogical compatibility as an essential theoretical aspect (Mutanga et al., 2023; Su & Chen, 2025). The COVID-19 pandemic has ultimately tested existing theoretical frameworks by presenting an external shock that necessitated swift adoption in circumstances that were previously resistive. This crisis-driven uptake highlights the imperative to incorporate adaptability, resilience, and scalability into forthcoming iterations of technology acceptance models, transcending gradualist adoption trajectories to accommodate expedited digital transformation amid institutional and societal upheaval.

Conclusion

This study demonstrates that the perceptions of Ghanaian university students and professors on the efficacy of LMS are influenced by a combination of human, technological, social, institutional, and contextual factors. Users' confidence in technology, digital abilities, and attitudes have a big impact on whether or not they use LMSs effectively. Those who believe in their own abilities tend to find LMSs more useful and interesting. However, disparities in digital skills, especially among students, show that better training is needed. The quality of the technology is equally important. Systems that are reliable, easy to use, well-designed, and have useful features leads to satisfaction. Contrarily, systems that have bugs, slow connections, and complicated interfaces make users less satisfied. Similarly, simplicity of use is not equal to usefulness, as opinions of users depend on their level of experience. Social and cultural elements, such as peer support and institutional culture, also have an effect. Cultural opposition to changes in teaching can make it harder for teachers to adopt them, especially for faculty. But interactive and culturally sensitive methods can help. Institutional support, such as infrastructure, training, and clear policies, is very important. Lack of professional development and bad internet connectivity are still issues. Faculty frequently see enhanced pedagogical advantages yet encounter increased workloads and infrastructural obstacles, whilst students emphasise usability and accessibility concerns. TAM and UTAUT are two examples of current adoption models that are helpful; however, they often lack consideration of the unique circumstances in Ghana.

Recommendations

From a pragmatic perspective, the findings of this analysis have significant ramifications for policy, institutional strategy, and system design in Ghanaian higher education. First, universities must invest in ongoing, focused capacity-building programs to improve the digital literacy and self-efficacy of both faculty and students. Second, institutions must prioritise robust infrastructure investment, including reliable high-speed internet connectivity, adequate bandwidth, and responsive technical support services. Without such infrastructure assurance, users are likely to perceive the system as inaccessible and unreliable. Third, policy frameworks should clearly include socio-cultural factors in plans for deploying LMS. Fourth, LMS designs that are both pedagogically responsive and customisable should be at the top of the list for system developers and institutional procurement teams. Fifth, institutions should adopt a genuinely holistic approach to implementation that aligns technical ability with the preparedness of people and institutions.

The COVID-19 pandemic sped up the digital transformation, which taught us an important lesson: higher education systems need LMS solutions that are flexible and adaptable and can easily switch between face-to-face, blended, and fully remote modes. Such adaptability is fundamental to institutional resilience, guaranteeing educational continuity and equitable access during crises, while concurrently shaping long-term digital strategy.

Limitations

This systematic review provides important insights into LMS effectiveness in Ghanaian higher education; however, several limitations must be acknowledged. First, the inclusion of studies from non-Ghanaian contexts (including Zimbabwe, Tanzania, South Africa, Sri Lanka, and Indonesia) may reduce the local specificity of conclusions and warrants careful interpretation when drawing implications exclusively for Ghanaian institutions. Second, the review is limited to studies published in English, which may introduce language bias and exclude relevant scholarly contributions published in other languages. Third, the search was confined to four databases (Google Scholar, Scopus, Web of Science, and ERIC), and potentially relevant studies indexed in other repositories may have been omitted, introducing a degree of database selection bias. Fourth, the predominant focus on perceptions and attitudes rather than objectively measured learning outcomes limits the conclusions that can be drawn about the actual educational effectiveness of LMS platforms. Fifth, the reliance on SciSpace for relevance ranking, while pragmatically useful, introduces a degree of algorithmic subjectivity that was not independently validated through inter-rater reliability assessment. Future research should adopt longitudinal and mixed-methods designs to capture changes in LMS use and perceptions over time, providing deeper contextual insights. In addition, future work should employ dual-reviewer screening with inter-rater reliability coefficients. Studies that directly measure learning outcomes, rather than relying solely on self-reported perceptions, are particularly needed to assess the real educational impact of LMS adoption in Ghanaian higher education.

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