Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.16, No.3, 2025

Integrating ICT in Higher Education in Liberia: A Review of Best Practices, Challenges, and Opportunities

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Abstract

The integration of Information and Communication Technology (ICT) in higher education can enhance accessibility, equity, and educational quality, particularly in developing nations like Liberia. However, effective ICT adoption requires strategic planning and investment. This study examined best practices, challenges, and opportunities for ICT integration in higher education, drawing lessons from successful initiatives in Rwanda, Egypt, South Africa, and other emerging economies. These countries have advanced ICT adoption through strategic policy development, infrastructure investments, faculty training, and digital learning content creation. A comprehensive literature review of peer-reviewed studies, policy reports, and case studies was conducted, with thematic analysis identifying key lessons applicable to Liberia. Findings highlight the effectiveness of Rwanda's Smart Rwanda Master Plan, Egypt's public-private partnerships, and South Africa's unified national ICT in education policy in facilitating ICT adoption. However, Liberia faces significant barriers, including inadequate digital infrastructure, financial constraints, faculty resistance, and digital literacy gap, and the absence of a cohesive national ICT in education policy. Despite these challenges, ICT presents opportunities to expand educational access, particularly for marginalized groups such as rural students and individuals with disabilities. To harness ICT's potential, Liberia must develop a comprehensive national ICT in education policy, invest in digital infrastructure, and implement continuous professional development programs for educators and students. By adopting best practices and fostering international collaborations, Liberia can overcome these challenges and position itself as a leader in digital education within West Africa.

Keywords: *Higher education, ICT integration, digital education, Liberia, ICT challenges, education technology*

DOI: 10.7176/JEP/16-3-14
Publication date: March 30th 2025

1. Introduction

Integrating Information and Communication Technology (ICT) into higher education in Liberia presents significant potential to improve educational access, quality, and equity, particularly in a country that has long faced infrastructural deficits and socio-political challenges. Despite the recognition of ICT's transformative potential, Liberia's higher education institutions (HEIs) continue to struggle with outdated infrastructure, limited access to digital tools, and insufficient faculty capacity. However, ICT offers an opportunity to bridge gaps in education, providing more inclusive and flexible learning opportunities that can reach marginalized groups and underserved communities. This review analyzed ICT integration strategies from other African and emerging economies, identifying relevant lessons for Liberia to overcome its barriers and enhance its education system.

While many African nations have advanced in ICT adoption and integration, progress remains inconsistent due to ongoing systemic challenges (Dlamini & Ndzinisa, 2020; Mdiniso et al., 2022; Mhlongo & Dlamini, 2022; Ajani, 2024; Dlamini, 2025). Similarly, Liberia continues to face significant obstacles in adopting digital learning tools. Specifically, poor internet connectivity, inadequate ICT infrastructure, and a lack of trained educators in ICT hinder the widespread implementation of ICT in higher education (Kennedy, 2023). Studies by Kaloostian & Chhetri (2021) and Kennedy (2024a) highlight how these issues severely limit the potential for digital education, exacerbating inequalities, particularly in rural areas. Moreover, the resistance to change from faculty members, the digital literacy gap within institutions, and financial constraints further complicate ICT adoption (Kennedy, 2024b; Ndzinisa et al., 2024). These barriers not only prevent Liberia from harnessing the

full potential of ICT but also perpetuate educational disparities. Therefore, understanding how other countries with similar challenges have integrated ICT into higher education can provide valuable insights for Liberia.

Several African countries have developed national ICT in education frameworks that Liberia could adapt to its context. For example, Rwanda's Smart Rwanda Master Plan, which integrates digital infrastructure, e-learning platforms, and smart classrooms, serves as a model for how a government-led initiative can drive ICT adoption (Twagilimana & Ndayambaje, 2024). Similarly, Egypt and South Africa have utilized public-private partnerships to enhance their ICT infrastructure and integrate digital tools in education (Souter et al., 2012; Yu & Dlamini, 2025). These initiatives demonstrate the importance of government policy and coordinated and sustained collaboration with the private sector in overcoming funding and infrastructure gaps, areas where Liberia could benefit from strategic partnerships. By drawing lessons from these countries, Liberia can create a comprehensive ICT in education strategy that combines technological innovations with pedagogical improvements, promoting not only access but also the quality of education.

Despite the progress made in some African nations, significant challenges remain in effectively adopting technology in higher education institutions. Digital divides, inadequate digital literacy, and insufficient professional development for educators are common barriers. Countries like Eswatini and Indonesia have faced similar issues, where the implementation of Learning Management Systems (LMS) was delayed by poor internet infrastructure and low digital literacy among educators (Hafifah & Sulistyo, 2020; Ndzinisa et al., 2024). These barriers emphasize the importance of high-speed internet, and ongoing training and development opportunities for educators, which are crucial for the effective use of ICT in teaching and learning. Liberia must prioritize addressing these gaps through targeted investments in infrastructure, professional development, and digital literacy initiatives.

In addition to these challenges, the pandemic emphasized the significant function of ICT in maintaining educational continuity, especially for marginalized groups. Students from rural areas, those with disabilities, and other underserved populations are often excluded from traditional educational settings due to physical or socio-economic barriers. ICT has the potential to level the playing field by providing flexible and accessible learning options. Evidence from countries such as Pakistan and Ghana show that ICT can significantly improve engagement and educational outcomes for disadvantaged students (Asad et al., 2021; Abubakari et al., 2023). By investing in e-learning technologies and creating content tailored to the needs of underrepresented groups, Liberia can use ICT to increase access to higher education and reduce educational inequalities.

This review explored practices for ICT integration in higher education, focusing on the lessons Liberia can learn from other countries facing similar infrastructural and educational challenges. Specifically, the review examined the strategies, challenges, and opportunities that other African nations have encountered and how these can be applied or overcome in Liberia. By synthesizing existing literature, the review also identified the barriers to ICT adoption within Liberia's HEIs and explored how government policy and private-sector partnerships can drive ICT integration in the country. Ultimately, this review provides a roadmap for Liberia to harness ICT's potential to improve educational outcomes, increase access, and promote equity in higher education.

Four key research questions guided this review:

1. How have other African countries with similar infrastructural challenges successfully integrated ICT, and what specific lessons can Liberia adopt to overcome its unique barriers?
2. What specific barriers do higher education institutions in Liberia face in adopting ICT, and how have these barriers been addressed elsewhere?
3. How can ICT enhance access to and promote equity in higher education in Liberia, particularly for marginalized or underrepresented groups?
4. What role can government policy and private sector partnerships play in advancing ICT integration in Liberia's higher education institutions?

This literature review filled a critical gap in understanding how ICT can be integrated into Liberia's higher education system. Despite the recognition of ICT's potential, systematic exploration of its adoption in Liberia's universities is lacking. By analyzing practices and identifying relevant strategies, this review offered actionable insights for accelerating Liberia's transformation in education through digital advancements.

2. Methodology

This study employed a selective thematic literature review approach to examine the integration of Information

and Communication Technology (ICT) in higher education, focusing on best practices, challenges, and opportunities for Liberia. Rather than conducting a full systematic review, this research strategically synthesizes insights from peer-reviewed journal articles, policy reports, and case studies relevant to ICT adoption in higher education, particularly in African and emerging economies with comparable infrastructural and socio-political contexts.

2.1. Data sources and literature Search

The literature was sourced from a variety of academic databases, including Google Scholar, ERIC, Scopus, and ResearchGate. Relevant keywords such as "ICT" "higher education" "Africa," "digital education" "challenges," and "ICT policies" "developing countries" were used to search for articles, reports, and case studies.

2.2. Literature Selection Criteria

To ensure a comprehensive and relevant review, the study followed predefined inclusion and exclusion criteria.

2.2.1. Inclusion

This review prioritized studies and reports on ICT integration in higher education from African countries and emerging economies, particularly those facing similar infrastructural and socio-political challenges to Liberia. Relevant research articles, book chapters, policy documents, and case studies were selected if published in peer-reviewed journals between 2020 and 2025 and from government repositories. However, one publication from 2012 was included due to its specific relevance to the topic. The review also focused on literature addressing key themes such as national ICT in education policies, faculty training, digital infrastructure, and access to education for marginalized groups. Furthermore, studies that examined the role of public-private partnerships, government initiatives, and international collaborations in ICT integration were also considered.

2.2.2. Exclusion

Excluded from the review were publications focusing on primary or secondary education, as the scope was limited to higher education. Additionally, studies that did not provide practical evidence or actionable insights for ICT adoption in developing countries or emerging economies were excluded. Sources unrelated to ICT integration, such as those concentrating solely on general educational reforms without addressing digital technologies, were also omitted.

A total of 150 publications were retrieved from various academic databases. After reviewing the abstracts, 80 publications were excluded for not focusing specifically on higher education. Following a thorough assessment of the full texts, 24 additional publications were excluded for not meeting the inclusion criteria. Consequently, 46 publications were included in the final review.

2.3. Data analysis and synthesis

The selected literature was analyzed using thematic analysis following Braun & Clarke's (2006) framework, involving data familiarization, coding, theme identification, review, and synthesis. Four key themes emerged, each with relevant subthemes that further explore various aspects of ICT integration in higher education. (1) ICT's Role in Higher Education – Its impact on teaching, administration, and research, focusing on access, efficiency, and collaboration. (2) Best Practices– Emphasizing policy frameworks, faculty training, and public-private partnerships for successful ICT adoption. (3) Challenges – Highlighting infrastructure deficits, financial constraints, and faculty resistance as barriers. (4) Opportunities – Stressing policy development, infrastructure investment, and digital capacity building for ICT.

3. Emerging themes from literature

3.1. ICT role in higher education

Integrating ICT into higher education has transformed teaching, administration, and research worldwide. This shift highlights ICT's transformative potential, embraced by institutions to improve access, enhance administrative functions, and foster innovation in research. However, despite the widespread recognition of ICT's benefits, its integration varies significantly across regions, with disparities in infrastructure, digital literacy, and policy development shaping its effectiveness.

3.1.1. ICT's impact on teaching and learning

Technology has undeniably transformed education, facilitating flexible, student-centered learning through Learning Management Systems, digital libraries, and e-learning platforms. These tools have expanded access and fostered collaboration, yet their effectiveness remains contingent on contextual factors such as infrastructure,

digital literacy, and institutional readiness (Díaz-Garcia et al., 2023; Mahmudi et al., 2023). The COVID-19 pandemic accelerated the adoption of digital learning, demonstrating both the potential and limitations of technology in maintaining educational continuity (Azaz et al., 2024; Bitar & Davidovich, 2024). However, while digital platforms have become indispensable, do their widespread adoption equate to improved learning outcomes for all students? The assumption that technological integration inherently enhances education warrants deeper scrutiny, as access alone does not guarantee pedagogical effectiveness.

Despite the promise of ICT, critical challenges remain, particularly in regions where infrastructural deficiencies, limited digital resources, and unreliable internet connectivity obstruct integration (Alenezi et al., 2023; Sahni et al., 2024). Sub-Saharan Africa serves as a stark example, where systemic disparities hinder equitable ICT access (Kennedy, 2024b; Jjagwe & Nanteza, 2024). Yet, beyond infrastructure, should more attention be given to the socio-cultural dimensions of digital learning? The literature often emphasizes physical access but underestimates the pedagogical and psychological barriers—such as digital literacy gaps and resistance from educators— which arguably hold equal weight in limiting ICT's transformative potential (Politova et al., 2022). If educators lack the confidence or pedagogical strategies to integrate technology meaningfully, does increased access truly equate to progress?

Efforts to bridge these divides demand a comprehensive strategy that extends beyond infrastructure investment. While initiatives such as UNESCO's Digital Transformation in Education Initiative attempt to close the digital divide, their success depends on context-specific adaptations (Zarei & Mohammadi, 2021). A key question remains: are such global initiatives sufficiently addressing local disparities, or do they risk imposing one-size-fits-all solutions that overlook regional educational ecosystems? Furthermore, while blended learning models show promise in improving accessibility and engagement (Sahni & Kaurav, 2024; Azaz et al., 2024; Bitar & Davidovich, 2024), their efficacy is not universal. How do these models function in under-resourced institutions where face-to-face instruction is already constrained by overcrowding and insufficient teaching materials?

To truly harness ICT's potential in education, it is imperative to move beyond a simplistic narrative of digital access equating to educational equity. Institutions must develop strategic, evidence-based approaches that consider not just technological infrastructure but also teacher preparedness, student engagement, and localized needs. Without a critical, holistic approach, the risk remains that technology, rather than bridging educational gaps, may instead deepen existing inequalities.

3.1.2. Advances in ICT for higher education administration

Globally, ICT integration in higher education has improved administration efficiency, transparency, and service delivery. Digital tools such as Student Information Management Systems (SIMS) and cloud-based solutions have optimized workflows and reduced operational costs, particularly in technologically advanced contexts like Rwanda, where government-driven ICT initiatives have enhanced administrative practices (Twagilimana & Ndayambaje, 2024). However, do these advancements lead to widespread institutional improvements, or do they primarily benefit well-resourced institutions? The statement that ICT enhances efficiency warrants scrutiny, as success depends on institutional capacity and long-term sustainability rather than technology adoption alone.

Despite its potential, ICT integration faces persistent challenges. Outdated software, inadequate technical support, and insufficient staff training hinder effectiveness, especially in lower-income regions (Ukpe, 2023; Abubakari et al., 2023). In Africa, resource limitations exacerbate the digital divide, making administrative services inequitable (Yu & Dlamini, 2025). Yet, beyond infrastructure, these issues reflect deeper systemic shortcomings, such as weak digital governance strategies. Without parallel investments in digital literacy and institutional readiness, does ICT truly improve efficiency, or does it risk increasing bureaucratic complexity and reliance on external expertise? The literature often presents technological adoption as a straightforward solution, yet without adequate training and localized support, ICT can create new inefficiencies rather than resolve existing ones.

Addressing these challenges requires more than financial investment in software and training (Kanyemba, 2023). Without clear policy frameworks, digital tools risk being underutilized or misapplied, particularly in resource-constrained institutions. Collaborations involving governments, private sectors, and educational institutions are frequently proposed to bridge the digital divide (Twagilimana & Ndayambaje, 2024), but do they genuinely promote long-term self-sufficiency, or do they reinforce dependence on external providers and short-term funding? The success of such initiatives depends on localized and coordinated strategies that align ICT solutions with institutional needs rather than imposing one-size-fits-all approaches.

To fully harness ICT's potential in higher education administration, institutions must critically assess not just access to technology, but its effective and sustainable implementation. Without addressing structural challenges—such as digital governance, staff capacity, and long-term sustainability, ICT adoption risks

becoming a superficial intervention rather than a transformative administrative solution.

3.1.3. ICT's role in research for higher education

ICT has revolutionized research in higher education by enhancing collaboration, expanding access to scholarly resources, and enabling advanced data analysis through cloud computing, big data analytics, and artificial intelligence (Zhao & Zhou, 2024). These technologies facilitate large-scale data processing, international collaborations, and faster dissemination of research, fostering a globally interconnected academic community (Azaz et al., 2024). However, does greater technological access equate to equitable research participation, or does it widen disparities between well-funded institutions and resource-constrained settings? Again, is AI improving academic rigidity or weakening originality? These are critical issues to consider.

Despite these advancements, researchers in developing countries face persistent barriers, including limited access to digital tools, financial constraints, and poor internet connectivity (Kennedy, 2023; Zhao & Zhou, 2024). This digital divide restricts participation in global academic discourse, reinforcing existing inequalities rather than democratizing knowledge (Kaloostian & Chhetri, 2021). If ICT adoption is not paired with structural interventions, does it merely amplify exclusion instead of fostering inclusivity?

Addressing these challenges requires sustained investment in digital infrastructure and comprehensive training. While collaborations aim to bridge access gaps (Asad et al., 2021; Oreku, 2021; Azaz et al., 2024), do they create lasting self-sufficiency, or do they perpetuate dependence on external funding and technology providers? Beyond access, are institutions equipping researchers with the skills to navigate ethical, methodological, and security challenges posed by digital tools? Ensuring meaningful participation in global research requires more than technology, it demands policies that promote long-term capacity building.

ICT's potential to transform higher education hinges on addressing digital literacy gaps, infrastructural disparities, and policy inconsistencies (Woyo et al., 2020; Zhao & Zhou, 2024; McDonald et al., 2024). Without inclusive and sustainable ICT strategies, digital transformation risks entrenching academic hierarchies rather than dismantling them. As technology evolves, higher institutions must critically assess its role in fostering equitable and effective research environments rather than assuming its benefits are universally accessible.

3.2. Best practices in ICT integration in higher education

The landscape of ICT adoption reveals several challenges and best practices for integration, with institutions worldwide striving to leverage ICT tools for improved education. From infrastructural development to policy frameworks, the experiences of different countries offer valuable insights into how ICT can be successfully integrated into higher education systems.

3.2.1. *Development of comprehensive policy and strategic frameworks for ICT integration*

Successful ICT integration in higher education requires coherent, institution-wide policies and national strategic frameworks. The absence of coordinated policies hinders adoption, leading to inconsistent implementation and limiting the transformative potential of digital technologies (Jjagwe & Nanteza, 2024; McDonald et al., 2024). In countries like Liberia and Uganda, fragmented ICT strategies have resulted in inadequate infrastructure, insufficient faculty training, and challenges in curriculum integration (Kennedy, 2023; Jjagwe & Nanteza, 2024). Without clear national ICT in education guidelines, institutions struggle to develop sustainable ICT strategies, leaving them unprepared for rapid technological change.

In contrast, countries such as Egypt, Rwanda, and South Africa illustrate how enabling policy environments, cross-sectoral collaboration, and regular policy updates drive successful ICT adoption (Souter et al., 2012). Rwanda's *Smart Rwanda Master Plan* prioritizes smart classrooms, digital libraries, and virtual platforms, but persistent digital divides and faculty training gaps highlight the need for continued efforts (Twagilimana & Ndayambaje, 2024). South Africa has made notable progress, with institutions like the University of Johannesburg implementing robust ICT strategies. However, disparities in infrastructure access remain, particularly in underserved areas (Sithole & Mbukanma, 2024; McDonald et al., 2024; Louw & Yu, 2024).

Effective national ICT in education policies must align with infrastructure development and faculty training to create a unified, equitable approach to technology adoption. While comprehensive frameworks enhance ICT uptake, gaps in faculty training and resource allocation must be addressed to prevent deepening technological inequalities (Jjagwe & Nanteza, 2024). Continuous professional development is essential to equip educators with the necessary digital skills (Ndzinisa et al., 2024; Romaniuk & Łukasiewicz-Wieleba, 2024; Sithole & Mbukanma, 2024).

Sustainable ICT integration requires adaptable and inclusive national strategies prioritizing infrastructure, digital literacy, and professional development (Kanyemba, 2023; Ndibalema, 2025). While Rwanda's model offers a blueprint for digital transformation, Liberia faces critical challenges, including the lack of a national ICT in education policy, low internet penetration, inadequate infrastructure, and bureaucratic inefficiencies (Kennedy, 2023, 2024a; 2024b; 2025). Addressing these barriers is essential to fostering an enabling environment for ICT adoption in higher education.

3.2.2. Digital competency development for educators and students

A key theme in the literature is the necessity of digital competencies for both educators and students. Effective ICT integration requires educators to merge technology, pedagogy, and subject expertise, yet many lack the necessary skills, particularly beyond administrative functions (Fernández-Batanero et al., 2021; Akram et al., 2021; Basilotta-Gómez-Pablos et al., 2022). While digital proficiency enhances teaching quality and student engagement, does mere access to technology translate into improved learning outcomes or does its effectiveness depend on deeper pedagogical shifts? Something higher education institutions should consider when trying to integrate ICT into pedagogy

Moreover, faculty digital competence has been directly linked to better teaching outcomes and increased participation in e-learning (Basilotta-Gómez-Pablos et al., 2022). However, inadequate training, resistance to change, and unequal ICT access limit its potential, particularly in resource-constrained environments (Bitar & Davidovich, 2024). Although professional development programs have been proposed as solutions (Zarei & Mohammadi, 2021) are they truly transformative, or do they serve as temporary interventions that fail to foster long-term adaptability? The literature suggests that without continuous training and institutional support, digital integration risks becoming superficial rather than a sustainable shift in educational practice (Zarei & Mohammadi, 2021).

Additionally, successful ICT integration in education requires not only equipping educators but also fostering student engagement and support. Research underscores that active student participation is essential for effective digital learning (Fareen, 2022; Kanyemba, 2023). While the literature highlights the importance of digital literacy and technical support especially in institutions that have effectively implemented ICT (Murray et al., 2022; Akour & Alenezi, 2022), a deeper examination reveals systemic inequalities that hinder technology adoption, particularly in under-resourced areas (González-Zamar et al., 2020). The assumption that digital literacy training alone can bridge the digital divide may overgeneralize structural barriers such as socioeconomic disparities, infrastructural limitations, and policy shortcomings.

Moreover, the push for inclusive learning environments, while necessary, requires a more nuanced approach beyond accessibility measures (Díaz-Garcia et al., 2023; Ndibalema, 2025). Factors such as cultural contexts, pedagogical adaptability, and institutional readiness must also be critically examined. Institutions must not only provide flexible learning models but also interrogate the effectiveness of these models in fostering meaningful engagement among diverse student populations.

Also, there is a risk of over-reliance on technology as a panacea for educational challenges. While studies advocate for ICT adoption, they often overlook potential drawbacks, such as cognitive overload, digital fatigue, and the erosion of critical thinking due to passive consumption of digital content. Effective integration requires a balanced approach, ensuring that digital tools complement—not replace—pedagogical best practices.

3.2.3. Curriculum transformation for digital integration

Curriculum redesign to meaningfully integrate ICT is essential for modern education, yet its effectiveness depends on several critical factors. While the literature highlights the benefits of ICT-enhanced learning such as increased interactivity and student-centered approaches (Akour & Alenezi, 2022; Chansa et al., 2024), a deeper analysis reveals key challenges and considerations that must be addressed for sustainable implementation.

One of the primary concerns in ICT integration is the risk of it becoming a superficial addition rather than a fundamental pedagogical shift. While digital textbooks, e-learning platforms, and virtual classrooms (Chansa et al., 2024) offer new learning opportunities, their effectiveness depends on how well they are embedded within teaching methodologies. If digital tools merely replace traditional resources without rethinking instructional design, they may not lead to meaningful learning improvements. Thus, redesigning the curriculum requires a pedagogical re-evaluation to ensure that ICT fosters critical thinking, creativity, and deeper engagement.

Although curriculum transformation aims to develop digital skills for the future workforce (Mushimiyimana et al., 2022), its success is limited by structural challenges. In many regions, ICT infrastructure remains inadequate, and the costs of digital resources create disparities in access (Zarei & Mohammadi, 2021; Sengupta & Blessinger,

2022). A critical perspective questions whether curriculum redesign alone can bridge this digital divide or if broader policy interventions—such as public-private partnerships, subsidized technology programs, and community-based ICT initiatives—are necessary to level the playing field. A multi-stakeholder approach is crucial for curriculum redesign (Sahni et al., 2024), but its long-term success depends on ongoing support, evaluation, and adaptability. Without continuous assessment and updates, ICT-integrated curricula risk becoming obsolete due to rapidly evolving technological advancements. Future research should explore adaptive curriculum models that evolve with technological progress while maintaining pedagogical effectiveness.

3.2.4. Institutional infrastructure and support systems

ICT integration in higher education is often discussed as a necessity, yet many institutions, particularly those in underfunded or rural areas, remain significantly disadvantaged. While research highlights the role of strong governance, digital infrastructure, and policy frameworks in fostering ICT adoption (Kanyemba, 2023; AlDreabi et al., 2024), there is a tendency to assume that merely investing in these areas will lead to effective integration. However, this overlooks deeper structural issues, such as policy misalignment, inadequate capacity building, and the digital divide that persists despite infrastructure expansion (Kennedy, 2024a).

Moreover, the rapid evolution of technology creates an ongoing challenge. Institutions with limited resources often struggle to sustain and update digital tools, leading to obsolete or ineffective ICT implementations (Twagilimana & Ndayambaje, 2024). Without a strategic approach that goes beyond infrastructure to include long-term digital literacy programs, institutional adaptability, and context-specific policies, ICT integration risks being shallow. Policymakers must move beyond generalized strategies and adopt targeted interventions that address disparities in access, capacity, and sustainability to create a genuinely inclusive and effective digital learning environment (Kanyemba, 2023; Sumo et al., 2023).

3.2.5. Data-driven decision-making and assessment

The application of data analytics to inform decision-making in higher education has become a widely recognized effective strategy. Institutions are increasingly leveraging technologies such as learning management systems (LMS) and data visualization tools to monitor student engagement, assess learning outcomes, and improve student support services (Liesa-Orús et al., 2020; Azaz et al., 2024). By utilizing these tools, educational institutions can collect and analyze data to enhance resource allocation and provide personalized learning experiences tailored to individual student needs.

Data-driven approaches also enable early interventions for students at risk, improving their chances of success (Dzinoreva et al., 2024). However, fears about information secrecy, safety, and the right use of student data present significant challenges. In addition, developing the necessary analytical capabilities among faculty and administrative staff remains a major hurdle (Sithole & Mbukanma, 2024).

To address these concerns, educational institutions must establish clear policies regarding the use of data and invest in training for staff to interpret and act upon data insights effectively. Moreover, prioritizing ethical guidelines for data collection, privacy, and security is essential to maintaining trust and compliance (Rahimi & Tafazoli, 2022).

Integrating ICT into higher education is an ongoing process that requires collaboration across various levels, from individual institutions to broader global frameworks.

3.2.6. Collaborative efforts for sustainable ICT integration

Collaboration between institutions, governments, and private sector stakeholders plays a crucial role in driving sustainable ICT integration in higher education. Research highlights the significance of partnerships that pool resources, share expertise, and address common challenges (Zarei & Mohammadi, 2021). For instance, public-private partnerships in countries such as Tanzania have successfully facilitated the advancement of ICT facilities and the delivery of digital learning tools (Oreku, 2021). These collaborations are essential for overcoming resource gaps faced by tertiary institutions in developing countries, ensuring that ICT integration is both sustainable and inclusive.

A holistic, multifaceted approach is required to successfully integrate ICT into higher education. Best practices from around the world emphasize the need for coherent national strategies, robust infrastructure, continuous faculty development, and student-centered pedagogies. By prioritizing these areas, higher education institutions can strengthen their digital capabilities, improving access, enhancing quality, and ensuring long-term sustainability.

3.3. Challenges in ICT integration: Insights from the literature

The amalgamation of ICT in higher education has significantly altered teaching, learning, and administration. However, this transformation is not without its challenges, as various barriers hamper the efficient application and sustainability of ICT.

3.3.1. Infrastructure issues

Infrastructure deficiencies remain a major barrier to ICT integration in higher education, particularly in developing regions where unreliable electricity, poor internet connectivity, and limited digital access exacerbate educational inequities (Kanyemba, 2023; Sithole & Mbukanma, 2024; Kennedy, 2024b). In South Asia and the Middle East, universities continue to struggle with basic digital infrastructure, making online learning and research inaccessible for many students (Zarei & Mohammadi, 2021). While makeshift solutions like shared computer labs and internet cafes offer temporary relief, they fail to address systemic disparities and often reinforce digital exclusion (Mushimiyimana et al., 2022).

A critical challenge is the absence of cohesive national and institutional ICT policies, leading to fragmented implementation and inconsistent adoption (Kennedy, 2023; 2025). The lack of strategic planning means infrastructure investments remain sporadic and reactive rather than sustainable**.** Without long-term commitments to high-speed internet, reliable hardware, and technical support, institutions struggle to keep pace with technological advancements, further limiting faculty and student engagement.

Moreover, policy gaps create a digital divide not just between countries but also within institutions, where well-funded universities advance while underfunded ones fall behind. This uneven distribution of resources contradicts the goal of inclusive education and reinforces existing inequalities. To bridge this gap, governments and institutions must prioritize coordinated ICT investment, ensuring that infrastructure development aligns with educational needs rather than being treated as an afterthought. Without a strategic and equitable approach, ICT integration will remain fragmented, limiting its potential to transform higher education meaningfully.

3.3.2. Faculty resistance and the digital literacy gap

Faculty resistance to ICT integration is not merely a matter of digital literacy deficits or inadequate training but is deeply rooted in systemic, institutional, and cultural factors (Hafifah & Sulistyo, 2020; Kennedy, 2023; Dzinoreva et al., 2024). While many educators acknowledge ICT's potential, the assumption that awareness alone ensures adoption is a myth. Resistance is often reinforced by limited access to digital tools, particularly in resource-constrained environments, further widening inequalities in higher education (Ndibalema, 2025; Yu & Dlamini, 2025).

The lack of institutional investment in structured faculty training leads to inconsistent ICT adoption, limiting its transformative potential (Fernández-Batanero et al., 202; Kennedy, 2024a). Without sustained professional development, educators struggle to integrate technology effectively. Karngbeae and Kennedy (2022) highlight the critical role of instructional planning in effective teaching, emphasizing the need for faculty training and institutional support. Addressing gaps in pedagogical preparedness and instructional planning is essential for sustainable ICT integration that enhances education rather than disrupts it.

Beyond technical barriers, entrenched pedagogical traditions pose a significant challenge. In contexts like Liberia, where teacher-centered instruction remains dominant, the shift to technology-driven, student-centered learning is met with skepticism (Kennedy, 2024a). This suggests that ICT strategies must go beyond infrastructure and training to address cultural resistance and pedagogical inertia. Without targeted efforts to reshape teaching philosophies and institutional support structures, ICT adoption risks being fragmented and unsustainable.

3.3.3. Financial constraints

Financial limitations are a crucial factor that restricts the scope of ICT integration in higher education, particularly in developing countries. The costs associated with acquiring ICT infrastructure, maintaining technological systems, and providing faculty training are often prohibitive for many institutions. The literature frequently emphasizes that limited financial resources are a key obstacle to sustainable ICT adoption (Twagilimana & Ndayambaje, 2024). Without sufficient funding, universities are unable to upgrade their technological systems or offer necessary faculty training in new teaching methodologies.

Additionally, the allocation of financial resources often reflects broader policy and governance challenges. In many countries, higher education institutions rely on unpredictable government funding or seek private investment, which leads to inconsistencies in ICT development across institutions (Kanyemba, 2023; Jjagwe & Nanteza, 2024). In regions like Sub-Saharan Africa, the absence of centralized government policies and funding results in a situation where some institutions benefit from donor-driven projects or private sector involvement,

while others lack basic technological resources (Abubakari et al., 2023; Ndibalema, 2025). This disparity in financial investment exacerbates the digital divide between institutions and regions, further entrenching inequalities in educational access and quality.

The integration of ICT in higher education is fraught with significant challenges, many of which are interconnected. Infrastructure issues, faculty resistance, and financial constraints are deeply embedded within the global landscape of digital transformation in education. To overcome these challenges, comprehensive strategies are required, including targeted investments in infrastructure, policy reforms, and faculty training. The literature underscores the importance of institutional and governmental commitment to addressing these obstacles and fostering a culture of digital literacy and innovation. By tackling these obstacles, universities can more effectively prepare for the future of education, ensuring that all students have equal access to digital learning opportunities.

3.4. Opportunities for ICT integration in Liberia's higher education system

Integrating Information and Communication Technology (ICT) into Liberia's higher education system offers transformative opportunities to improve accessibility, quality, and flexibility in education. By using global trends and local conditions, Liberia can reshape its educational landscape, creating a more inclusive, engaging, and innovative learning environment. These opportunities can be grouped into four broad categories: Policy Development and Strategic Frameworks, Infrastructure and Accessibility Enhancements, Faculty and Student Empowerment, and International Collaboration and Partnerships. Each of these areas offers critical opportunities for the effective use of ICT to enhance Liberia's higher education system.

3.4.1. Policy development and strategic frameworks

A key opportunity for Liberia is to develop a comprehensive national ICT in education policy that clearly outlines how ICT should be integrated into education, including higher education. While the country has a national ICT policy, it lacks a clear and detailed framework specifically for ICT integration in the education sector. The literature consistently highlights the value of intentional frameworks in guiding effective ICT incorporation in education. For example, studies from Rwanda, Egypt, and South Africa emphasize the essential role of a unified national policy in establishing consistent standards and fostering collaboration among educational institutions (Jjagwe & Nanteza, 2024; McDonald et al., 2024; Sithole, & Mbukanma, 2024). This kind of policy would allow Liberia to address the fragmented ICT initiatives currently across its universities, enabling a more coordinated approach to digital transformation.

Liberia could develop a national ICT in education policy that mandates ICT integration across universities, with specific targets for digital infrastructure, faculty training, and student access. The policy could prioritize expanding digital infrastructure, developing digital learning platforms, and implementing ongoing faculty development programs. Additionally, aligning the policy with the United Nations' Sustainable Development Goal 4 (Quality Education) would ensure that ICT integration supports broader social and economic development objectives.

As noted by Sahni et al. (2024) and Ajani (2024), a robust digital education policy would address challenges such as the digital divide and insufficient access to technology, ensuring that ICT enhances educational opportunities for all students, irrespective of their background. Thus, policy development is an essential lever for executing ICT in Liberia's higher education system.

3.4.2. Infrastructure and accessibility enhancements

A critical opportunity for Liberia lies in the development of its ICT infrastructure. Several African countries, including Rwanda and Kenya, have made significant strides in enhancing their digital infrastructure to support higher education (Twagilimana & Ndayambaje, 2024; Jjagwe & Nanteza, 2024). Liberia can learn from these examples by investing in high-speed internet, digital libraries, smart classrooms, and mobile learning platforms. Given the growing use of mobile devices in Liberia, mobile-based learning solutions represent a particularly promising approach to expanding educational access, especially in rural and underserved areas.

Improving infrastructure is essential for bridging the digital divide between urban and rural populations, thereby promoting greater digital inclusion. As noted by Kaloostian and Chhetri (2021), many educational institutions in Liberia face issues like unreliable electricity, poor connectivity, and inadequate technological resources. Overcoming these barriers would provide equal access to online educational tools and resources, fostering a more equitable educational environment. Thus, enhancing infrastructure and accessibility is crucial for the widespread adoption of ICT in Liberia's higher education system.

Furthermore, initiatives like investing in rural broadband projects or collaborating with telecom suppliers to offer

economical internet packages for learners could help further narrow the digital gap and help ICT integration across the country.

3.4.3. Faculty and student empowerment through ICT

Empowering both faculty and students through digital literacy and ICT training is another crucial opportunity for Liberia. Research by Hafifah and Sulistyo (2020) and Kennedy (2024b) highlights that faculty development is key to successfully integrating ICT into education. Despite a positive attitude toward ICT adoption, many educators in developing countries, including Liberia, encounter issues such as insufficient training, inadequate technical support, and limited experience in using digital tools for pedagogical purposes. Expanding training programs for faculty that focus on digital skills and the educational use of technology would enhance teaching quality and boost student participation.

Furthermore, offering digital literacy programs for students would equip them with the skills required for the modern job market, where digital expertise is becoming essential. According to Sahni et al. (2024), the use of interactive learning tools, online evaluations, and collaborative digital platforms can greatly improve student involvement and motivation. Investing in training programs for both faculty and students will enable Liberia's higher education institutions to effectively leverage ICT for enhanced learning experiences. This initiative aligns with the trend toward student-centered learning, where technology tailors education to the unique needs and interests of each learner. Thus, equipping both faculty and students with ICT skills is essential for driving digital transformation within Liberia's higher education system.

3.4.4. International collaboration and partnerships

Liberia has a valuable opportunity to foster international collaborations and partnerships to support ICT integration. Global cooperation has been essential for the success of ICT adoption in other African countries, such as Rwanda, which partnered with international tech companies to enhance its digital education infrastructure (Twagilimana & Ndayambaje, 2024). Liberia can leverage similar partnerships to gain access to advanced technologies, expertise, and resources that will accelerate ICT adoption across its universities.

Partnerships with global tech companies, educational organizations, and international development agencies could provide the technical and financial support needed to scale ICT initiatives in Liberia. Collaborative efforts could also include shared digital platforms, e-learning systems, and global online courses, allowing students and faculty in Liberia to access high-quality educational resources from around the world. As Yu and Dlamini (2025) suggest, successful ICT integration in African higher education requires both internal reforms and external collaborations to ensure alignment with local and global educational goals. Through the development of international partnerships, Liberia can strengthen the global competitiveness of its higher education system, better equipping students for success in the digital economy.

4. Conclusion

The integration of Information and Communication Technology (ICT) in Liberia's higher education sector presents both opportunities and significant challenges. While digital education has the potential to enhance accessibility, teaching quality, and institutional efficiency, the process of ICT adoption in Liberia remains hindered by infrastructural deficits, policy inconsistencies, financial constraints, and socio-cultural resistance. The current landscape reflects a misalignment between technological advancements and the realities of Liberia's higher education system, necessitating a more strategic and context-driven approach.

A critical obstacle to ICT adoption is institutional resistance to change, particularly among educators accustomed to traditional pedagogical methods. This reluctance is not solely a matter of preference but is deeply tied to inadequate digital literacy, limited professional development opportunities, and a lack of incentives for faculty to integrate technology into their teaching practices. Moreover, the absence of a unified national ICT in education policy for higher education has resulted in fragmented initiatives, leaving institutions to navigate digital transformation with minimal coordination and inconsistent funding. Without strategic leadership and clear policy direction, digital education risks becoming an underutilized and ineffective tool rather than a transformative force.

From a comparative perspective, the experiences of Rwanda, Egypt, and South Africa offer valuable lessons. Rwanda's success in ICT integration stems from a comprehensive national ICT in education policy, targeted investments in infrastructure, and a commitment to faculty training. Egypt's emphasis on public-private partnerships illustrates how collaborative governance can mobilize resources for digital transformation, while South Africa's blended learning models highlight the importance of pedagogical adaptability in higher education.

However, these models cannot be transplanted wholesale into Liberia's context; instead, they must be critically examined and adapted to address Liberia's unique infrastructural and socio-political challenges.

To bridge the existing digital divide, Liberia must prioritize a long-term, multi-stakeholder approach. Key steps should include the development of a national ICT in education strategy tailored to the education sector with specific aspects related to higher education, investment in broadband infrastructure to improve digital access, and capacity-building initiatives for faculty and students to enhance digital competency. Additionally, sustained public-private partnerships could facilitate resource mobilization, ensuring that ICT adoption is not merely a short-term intervention but a sustainable and evolving educational strategy.

Ultimately, Liberia's higher education institutions must move beyond a rhetoric of digital transformation and address the systemic barriers impeding ICT adoption. A failure to critically engage with these challenges risks deepening existing educational inequalities rather than mitigating them. By addressing governance inefficiencies, fostering institutional readiness, and aligning ICT strategies with national development goals, Liberia can create an inclusive and technologically empowered higher education system capable of meeting the demands of the digital age.

5. Limitations

Despite its contributions, this study has certain limitations**.** As a non-systematic review, there may be a potential selection bias, as sources were chosen based on their relevance rather than through exhaustive methodological rigidity. Additionally, the study relies primarily on secondary sources, lacking empirical data such as interviews or surveys from Liberian educators and policymakers. Given the rapid evolution of digital education technologies, some findings may also become outdated as new ICT policies and innovations emerge. Future research should build on this review by conducting empirical studies**,** including field surveys, case studies, and stakeholder interviews, to provide more localized and data-driven insights into Liberia's ICT adoption landscape.

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