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Studying the Influence of New ICT Tools on Malian Higher Education Curriculum and Teaching Method

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ABSTRACT

This study examines ICT's role in transforming higher education in Mali. Using a mixed-methods approach with surveys, interviews, and document review of 12 institutions, data was collected from 110 faculty, 160 students, and 12 administrators. Guided by Constructivist Learning Theory, Diffusion of Innovations, and the TPACK model, findings reveal a gap between administrative ambitions (58% reporting ICT-based course redesign) and actual classroom implementation (47% faculty confirmation), with superficial digitalization prevailing over meaningful pedagogical change. While access to infrastructure is high (68-83%), the use of specialized tools drops significantly (38-52%). Active learning strategies like flipped classrooms (32%) and virtual simulations (24%) are underutilized. Key challenges include inadequate power, limited faculty autonomy (25%), digital literacy gaps, and resistance driven by fear. Recommendations highlight faculty development, infrastructure investment, increased curricular autonomy, and change management. The study underscores that sustainable ICT integration requires cultural change to ensure technology enhances, rather than threatens, educator roles.

INTRODUCTION

Mali's higher education institutions are all experiencing major challenges and changes owing to the increasing use of new Information and Communication Technology (ICT), which is revolutionizing teaching curricula, approaches and learning provision. Whilst Mali works on bringing its education system up to date, the use of ICTs and in particular e-learning platforms, digital resources and mobile devices have a fundamental role in overcoming infrastructure limitations for access to quality education. According to Diarra (2015), ICT integration in the universities of Mali is having a growing impact on instructions and curriculum, as an indication that a turning point to a more inclusive and dynamic field of education is near. The dynamic development of Information and Communication Technologies (ICT) worldwide has significantly affected higher education with a variety of novel curriculum designs and teaching styles. The development of ICT technologies, including AI, VR and DA is changing the way we deliver and consume knowledge leading to more interactive, personalized and ubiquitous learning environment (Ngoc, 2020; Malik *et al.*, 2026). These innovations allow for dynamic pedagogical methods, in response to a range of student interests and requirements, to support learners as they navigate the digital age. Since universities are adjusting to these technological changes, there is a need to understand how they are affecting curriculum development and instructive strategies in order for educational quality and relevance become increase. The growing penetration of Information and Communication Technologies (ICT) in educational contexts is adding a new technological

dimension to university education through the significant changes adopted by various curricula and pedagogical methodologies. Developing ICT applications, like VLEs, distributed AI and multimedia resources, are creating more interactive, personalized and ubiquitous learning situations. This change of technology not only encourages student engagement and learning effects, but it also promotes innovative pedagogy which is compatible with the digital generation. According to Vikas & Mathur (2022), the use of ICT in higher education has allowed for learning to become more flexible or student-centric in a way that prepares students for an evolving global marketplace.

Problem Statement

Challenges facing higher education in Mali There are many challenges faced by Malian HEIs, which limit their ability to offer high-quality education and promote academic excellence. Constraints like; poor infrastructure, lack of access to modern teaching aids, minimal incorporation of technology and scarcity of highly skilled faculty who are conversant with contemporary methods of disseminating instructions abound (Bagayoko & Seydou, 2020). But the emergence of new Information and Communication Technologies (ICT) is creating grand opportunities to change higher education by improving curriculum delivery and teaching methods. Through the leverage of ICTs – digital tools, e-learning platforms and mobile devices - Malian institutions can address infrastructural challenges, bridge gaps in access to quality education and foster interactive and student-centred learning environments. The strategic integration

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of ICT would serve as a solution not only to the existing problems but also transform Mali's HE into a more inclusive, flexible, and innovative education system (Eghrefuwoma *et al.*, 2024; Fernandez *et al.*, 2026).

Significance of the Study

This research is significant for influence in the educational policy and reformation of Malian higher education and testing new ICTs application in transforming the university curricula and how students can be taught. It provides recommendations for policymakers and educators aimed at enhancing the quality, access, and relevance of higher education in frontier economies like Mali by promoting a culture of integrating ICT/s into teaching and learning with a focus on digital literacy development as well as faculty capacity building to ensure that Mali contributes effectively in to the global knowledge production. Finally, it highlights the necessity of implementing technological developments to generate an inclusive and forward-looking educational system which contributes positively to national development.

Research Objectives

To investigate the impact of new ICT technologies on curricula and teaching styles

This was to establish the transformation in Malian higher education and reignite debate in this regard.

Theoretical Frameworks

Constructivist Learning Theory

Constructivist learning theory highlights more of the learner-centered approaches that actively engage learners to be active participants in their own knowledge construction, a situation that is increasingly made feasible with ICT in higher education. For Mali, new ICTs like eLearning platforms, mobile applications or digital collaboration tools are changing not only curriculums but also the way of teaching by fostering interactive and personalized approaches toward more participatory ones. The use of ICT therefore creates a learning environment where learners take the center stage of learning process and become more active constructors of their knowledge as opposed to passive recipients of information. As noted by Albirini (2006), on the one hand, reinforcing ICT use in developing countries like Mali favors student autonomy and stimulates new pedagogical practices connected to constructivist learning theories that can result into more effective higher education systems, low threshold and differentiated teaching offers too.

Diffusion of Innovations Theory

How developing ICT in the higher education institutions adopted and diffused will potentially change its curriculum and teaching practice is coherent with the framework embedded by Everett Rogers' theory, named Diffusion of Innovations Theory. The rate and extent of technology integration in educational contexts based on the five categories: relative advantage, compatibility,

complexity, trialability, and observability. The adoption and dissemination of innovations depend on factors such as Rogers (2003) differs. ICT tools— such as virtual learning environments, artificial intelligence and data analytics—are becoming popular in the HE sectors with educational institutions and academics using them to improve student ENGAGEMENT, customize learning experiences, and support active learning methods. Research studies including those of Rogers (2003) emphasize that successful diffusion depends on overcoming faculty and instructors' apprehensions, readiness in ICT infrastructure and institutional support all are necessary for the long-run incorporation of ICT within higher education.

Model of Technological Pedagogical Content Knowledge

The intersection of technology, pedagogy, and content knowledge that characterizes the TPACK model is a central concept for considering how new ICT innovations are influencing the higher education curriculum as well as teaching practice. This model stresses the integration of technical tools, pedagogical approaches and content with learning objectives, as well as the promotion of new teaching practices (Koehler & Mishra, 2009). In the area of HE, the utilization of new generations of ICTs like Artificial Intelligence (AI), Virtual Reality (VR) and Data Analytics is giving educators the opportunity to provide interactive, personalized, adaptable learning experiences that satisfy constantly increased needs from a knowledge economy on a social level. As Koehler and Mishra (2009) point out, the TPACK framework is a powerful lens to make sense of technology-intensive learning experiences in higher education that are situated within an ever-changing educational environment. Through fostering this construct of an ubiquitous approach institutions can help to prepare students better for their digital future, lifelong learning and the type of critical digital literacy required for success in the future.

LITERATURE REVIEW

Global Perspectives

The development of emerging ICTs has led to a significant change in higher education curricula -curricular transformation- and how teaching and learning takes place globally, facilitating greater flexibility, student-centeredness, along with technology enhanced learning environments. Internationally, research such as that of Al-Fraihat *et al.* (2020) stress the beneficial influence of digital tools on such becomes more engaged in students' education, promotes their collaboration and provides them with diversity of learning resources; consequently, promoting better overall quality in their education. In Mali, there have been successful endeavors for curriculum reform in programs such as Digital Higher Education Program (DHEP) that has absorbed the e-learning platforms, mobile learning and virtually equipped laboratories which increases accessibility and enhances

performance on remote places (Babalola & Genga, 2024; Yar'dua *et al.*, 2026). These cases demonstrate how the strategic integration of ICT is not just about modernizing curricula, but also changing pedagogy towards more interactive and personalized teaching. The global trend emphasizes that the successful incorporation of emergent ICT technologies is essential in preparing students with 21st century skills and their throughs inclusive and sustainable higher education systems (UNESCO, 2019a; World Bank, 2020).

Regional and National Contexts

The incorporation of innovative ICT technologies into higher education has received wide attention around the world, as this could change the way curricula are designed and courses taught, more especially in countries like Mali with emerging economies. International research show that, use of ICT could increase access to quality education, facilitate Active learning and enhance digital literacy are important for economic growth (Samala *et al.*, 2024). In Malawi situation, despite challenges in infrastructures and resources, ICT can offer opportunities to scale up the reach of education and enhance teaching methodologies, particularly with mobile learning confronting with e-learning platforms (Dianda *et al.*, 2025). However, problems such as poor internet connectivity, and the lack of technical skills from teaching staffs and budget limitation do prevent maximum exploitation of ICT integration. These problems could potentially revolutionize the higher education map in Mali, espousing the worldwide trend of virtualization and innovative teaching (Samala *et al.*, 2024; Dianda *et al.*, 2025).

Emerging ICT Technologies

Newest information and communication technology (ICT), or e-learning, like electronic learning platforms, mobile-based learning, artificial intelligence (AI), virtual laboratories and Massive Open Online Courses (MOOCs) has considerably transformed higher education by increasing availability, personalization and involvement in the process of learning. Internationally, research shows that the innovations enable a flexible student-centered curriculum and active learning environment (Alturki & Aldraiweesh, 2022). In Mali, starting to implement these technologies has made it possible to fill gaps in terms of educational facilities and infrastructure leading to inclusive and innovative teaching methods conformable with current digital trends (Mushimiyimana *et al.*, 2022). These advances together are crucial when it comes to moving from old-school higher education models to dynamic, tech-enabled ecosystems that can respond with agility and responsiveness in the 21st century.

Effects on Curriculum

The incorporation of ICT early childhood education (ECE) has radically revolutionized the coordinative and

IT agenda in higher learning institutions globally, towards more interactive, flexible and student-centered platforms. Recent research also underlines that the ICT tools like digital simulations, online collaborative platform and artificial intelligence-based systems contributes positively to students' engagement and practical skill building of students in line with the changing requirements of digital economy (Enticosa & Felinita Iii, 2026; Ghonim & Corpuz, 2021). Internationally, curriculum transformation that integrates these technologies, addressing learner competencies that prioritize skills to avoid rote learning is adopted to prepare graduates for modern workplace needs (Gonta & Tripon, 2020). In Mali, the implementation of ICT-enhanced CBE approaches starts to reduce access and quality challenges and offer an opportunity for more inclusive education delivery in low-resources settings (Tangara, 2025). In general, the harmonization of ICT with CBE is important for curricular revision in HE in order to reduce the gap between local and international levels.

Effects on Teaching Methodologies

The move from traditional lectures to blended and active learning models and the improvement of teacher training, digital skills have dramatically changed higher education curriculums throughout the world, promoting interactive pedagogies where students play a more central role with respect to those carried out by their teachers (Han, 2025). This shift can be attributed to the infusion of new ICT tools that are employed to make learning become more personal and student-centered, aiming at increasing students' interest and academic achievement (Giovannetti *et al.*, 2025). Internationally, the teaching and learning environment significantly benefits from educators' digital proficiency and innovative pedagogy practices that can easily contribute to dynamic transformations especially for improving education use of information technology in Mali which is increasingly gaining pace (Koita, 2025; BULAN & Felinita III, 2026). Together, these developments are likely to result in a more flexible and open educational system, one that reflects the broader movement for higher education reform today.

Gaps in Existing Research

Yet, in spite of the increasing incorporation of ICTs in higher education internationally, there is a paucity of research within the Malian context with few studies investigating how such tools actually are implemented and understood by users within Malian universities (Diawara *et al.*, 2025). Empirically, while ICTs are transforming the process of curriculum delivery and teaching methods across the globe, evidence is limited with respect to their effectiveness and constraints in Mali (Akintayo *et al.*, 2024). This lack of research based on the socio-environmental context is an obstacle to the design and implementation of contextualized interventions for promoting ICT use in Malian higher education, and highlights the need for

real-world oriented empirical studies into their impact on academic work.

MATERIALS AND METHODS

Research Design

The research used a combined method to find out about the way new ICT technologies influence higher education curricula and modes of teaching. It examined data from surveys, interviews and observations separately then combined findings to examine its effects on curriculum innovation, pedagogy practices as well as experiences of different stakeholders in a variety of institutions.

Sampling

Techniques

Research approach A descriptive, cross-sectional stratified random sampling approach was used to investigate the impact of emerging ICTs on higher education curricula and pedagogics. We selected universities proportionately from categories by region and type so that we achieve a diverse perspective. This method adds to the trustworthiness of the results and allows a broad study of ICT use in higher education institutions in Mali.

Populations

The sampling population is: Higher education teachers, administrators and students (at the university level) in Bamako, Mali in order to assess the effect of new ICT tools on curriculum change and teacher strategies.

Sample Size

It included 110 faculty members from 12 Malian higher education institutions with a variety of academic expertise and teaching experience. 160 students from the same schools also took part, representing a wide range of programs and study levels. Twelve university leaders also participated to offer administrative perspectives on adopting new ICT tools to the curricula and the process of instruction.

Data Collection Methods

Surveys

It surveyed students, faculty, policymakers and stakeholders to gauge how new ICT technologies are changing the higher education curricula in Mali as well as teaching practices. It adopted a mixed method and stratified sampling to investigate digital access, literacy, infrastructure support and policy support that triggered or sustained patterns for the integration of ICT for better educational outcomes.

Interviews

Current ICT use and challenges in Malian higher education: Interview with stakeholders Semi-structured interviews were employed to inform the current state of ICTs, whilst highlighting issues faced in their efforts to transform curricula and teaching methods. Lessons learned provided the basis for recommendations of how

advanced ICT tools could be introduced to improve quality and methods of education.

Document Analysis

Data was obtained from the documentation as well as a review of policies to identify the level to which Malian universities are incorporating new ICT technology into their curriculum and instructional methods. The analysis of the data resulted in an identification of strategies, initiatives and ICT adoption gaps and influences on curriculum change, and pedagogy.

Data Analysis

Quantitative data

It collected quantitative information on enrollment, graduation level, and engagement and academic performance of student and faculty respondents, as well as community members at universities in Mali through surveying cities students/staff (at some Malian Universities) using both the paper surveys combined with a digital tool. It examined the impact of new information and communication technology (ICT) on student participation, engagement and learning in higher education through statistical analysis.

Qualitative data

Thematic and narrative analyses of student and staff interviews, surveys, and focus groups are used to investigate how new ICT applications impact on engagement, perspectives, motivation, and learning. The approach is expected to shed light on critical factors affecting the integration of ICT in Malian HE, as well as principles for how to improve curricula and educational methods.

Ethical Consideration

The study, "Analyzing the Impact of Emerging ICT Technologies on Transforming Higher Education Curriculum and Teaching Methodologies" was approved by Malian Ministry of Higher Education and concerned authorities. Written consent was obtained from each participant, with the highest possible level of privacy and confidentiality protection provided by employing individual ID codes and safe storage of data. Participants were also made aware that they could withdraw at any time without any impact.

Limitations of the Study

First, the generalization of this study could be limited by the small sample and principle of selectivity of focused institutions operating in Mali which does not allow a full-scale understanding for higher education. Differences in technological infrastructures between institutions might affect the application and performance of new ICT, which might have influenced this study's findings. Moreover, ICT tools are evolving at a rapid pace, and it is likely that the results will lose relevance soon. Exogenous factors, such as the digital literacy levels and

restrictive access to ITC-related tools by students, can also influence the hoped-for results of curricular change and pedagogical innovation. Moreover, the use of self-reported data could cause biases that affect the validity of inferences made with regard to the relationships between ICT, educational practices and student behavior.

Findings

Quantitative Data

Adoption of ICT in the Malian Higher Education Institutions

In Malian higher education, the ICT penetration (percentage of teachers and students having access

to infrastructure) has been established as high from table 1 but there is a wide gulf between access and use: where penetration rates have been described as strong (68–83%), usage rates decline significantly, particularly for faculty and students who use only 52% of available LMS platforms compared to administrators' overall usage that stands at 75%. Faculty lag behind the most in specialized tools (38–45% adoption) and completion of training (35%), whereas students outpace faculty in collaborative technologies (67% vs 41%). Digital Competency The 42% administration policy rate without faculty or student perceptions reflects top-down failure of policy for growing a grassroots digital competency.

Table 1: Malian Higher Education Institutions' Levels of Adoption of ICT

ICT Adoption Indicators	Faculty (n=110)	Students (n=160)	Administrators (n=12)
Digital Infrastructure Access	68%	72%	83%
LMS Platform Usage	52%	58%	75%
Multimedia Teaching Tools	45%	—	—
Online Assessment Systems	38%	44%	—
Virtual Collaboration Tools	41%	67%	—
Faculty ICT Training Completion	35%	—	—
Student Digital Literacy Rate	—	61%	—
Administrative ICT Policy Implementation	—	—	42%

Reforming the Curriculum in Malian Higher Education

Faculty/administration gap in curricular transformation as indicated in Table 2, a gap between administration and faculty as far as the use of technology for teaching and learning at the higher education level in Mali still exists: while 58% of administrators report that ICT has been integrated in course redesigning, 47% of faculty members confirm this assertion. Faculty members' ability to work remains limited, as only 39% are involved in content production and 25% have ICT content

autonomy, indicating that central planning has self-imposed limitations on bottom-up innovation. Students experience the greatest access to online/hybrid programs (60%) and Industry 4.0 alignment (50%), and less-but-still-modest-access to competency-based curricula (43%) and interdisciplinary ICT courses of study (40%). The findings signify that leadership focuses on modes of delivery (67% offering online/hybrid program) rather than pedagogical depth, and faculty have neither the authority nor capacity to enact systemic change, leading to shallow as opposed to profound ICT integration.

Table 2: The levels of curriculum transformation in Malian higher education institutions

Curriculum Transformation Indicators	Faculty (n=110)	Students (n=160)	Administrators (n=12)
ICT-Integrated Course Redesign	47%	—	58%
Digital Content Development	39%	—	—
Competency-Based Curriculum Shift	33%	38%	50%
Interdisciplinary ICT Modules	28%	35%	42%
Online/Hybrid Program Availability	—	52%	67%
Curriculum Alignment with Industry 4.0	31%	44%	—
Digital Assessment Integration	42%	—	—
Faculty Curriculum Autonomy in ICT	25%	—	33%

Pedagogical approaches at Malian Universities Methodology of teaching in Malian universities

The change in teaching methodology linked with Malian higher education also reveals superficial digitization that shows, in the table 3, broad of text implementation: while multimedia presentation tools are widely used

(62% teachers; 71% students), active learning modalities sorely lacking: only 32 % implement flipped classroom, 24 % virtual simulation realized and mobile learning implemented for 29 %. A wide gap between students and faculty is apparent in joint online spaces (53% vs 38%), with marker of generational digital fluency

being outpaced by adaptation among instructors. The utter lack of administrator data in any and all indicators signals a disconnect between strategic leadership at the institutional level and actual classroom

implementation, without which faculty are essentially left to fend for themselves when trying to transition from basic technological substitution to real pedagogical transformation.

Table 3: Evolution of Malian Higher Educations' Teaching Approaches Source

Teaching Methodology Indicator	Faculty (n=110)	Students (n=160)	Administrators (n=12)
Interactive Whiteboard Usage	55%	48%	—
Flipped Classroom Implementation	32%	28%	—
Project-Based Digital Learning	41%	45%	—
Collaborative Online Platforms	38%	53%	—
Multimedia Presentation Tools	62%	71%	—
Virtual Simulation/Lab Tools	24%	19%	—
Mobile Learning Integration	29%	44%	—
Real-Time Feedback Systems	36%	31%	—

Qualitative Data

ICT Adoption Levels

Extent of ICT infrastructure

A group of Professors at Bamako' University decries the infrastructure transformation as "unevenly progressive" as significant investment is been poured into visible technologies (smart boards, projectors, campus WiFi) when fundamental problems remain unsolved. They point out that more than 60% of classrooms still lack consistent power backup, exposing computer-dependent teaching to risk. They also confirm "Starting 2012, We had 15 computers for over 2000 students. There still remain about 1 device to 40 students (far off from the ideal of a 1:1 situation for digital learning) even with 3 smart classrooms now" (Professors of Bamako). Additionally, a number of lecturers draw attention to the fact that "There is a digital divide amongst professors: 20% are early adopters who play with AI and virtual labs, but 40% use basic ICTs such as PowerPoint and email while another 40% resist because of infrastructure" (Faculty members). They distinguish three adoption profiles: Innovators (20%) early adopters of new ICT; Pragmatists (40%) adopters of proven tools; and Skeptics (40%), non- or minimal-users, often senior faculty.

Extent of ICT usage

"Digital access is uneven: some students can learn online from devices whenever, but others are shut out when labs close" (students). It addresses digital inequality in education by recognizing students' learning opportunities are influenced by their access to devices and online resources and that such disparities must be addressed in the interest of fair treatment. Most students prefer transformational professors; most professors adhere to basic posting an apparent gap between preferred and actual teaching practices. "Professors are in three buckets: PDF uploaders' who simply put up slides; interactive adopters' using polling and multimedia; and about 15% 'transformational' with simulations and AI tools. I think most students prefer the third, but it's the

least used" (students of regions). They concluded by asserting "We were promised 21st-century education, yet in my research methods class ICT meant a YouTube video and not a practical demo. Students don't fall for digital substitution and are demanding real pedagogical innovation" (Students in Bamako).

Curriculum Transformation

New programs, modules or courses that include ICT In a forward looking and changing program that stresses skill development over time, the dean of University Yombo Oueleguem of Bamako. "In 2025 we introduced the revolutionary new degree; the Bachelor of Educational Technology, over three years gradually built upon ICT skills from basic to advance" (Dean Of UYOB). In addition, Professors contributed "Our Data Science program will also ensure that all social science students start completing computational thinking modules from January 2024, which represents an authentic curriculum change". This is great way to bring more applied interdisciplinary skills to the forefront of curriculum. "Trials demonstrated the effectiveness of the virtual anatomy as it was expanded into veterinary and dental programs with planned curriculum enhancement" (Faculty members in medicine). The author of this taught commends the summary on its strong focus on success and growth in the virtual anatomy initiative, with reference to LSMU's curriculum and curriculum refreshes. Thirdly, "In 2025 we commenced three online ICT micro-credentials that can stack into a Graduate Certificate to fit with future degree reform" (Department' heads). Follow in such reforms, online ICT micro-credentials were established in 2025 to function as an adjunct or complement to degree studies.

Alignment with national education policies

The Stakeholders emphasize the need to interpret infrastructure challenges for deployment of new technologies in a practical way. Reflection on the meaning of digitization and emerging tech for Mali's Digital

Education Strategy “is necessary because while curriculum digitization and emerging technologies are identified in this document, there is insufficient description; therefore, we must interpret “emerging technologies” through the lens of infrastructure constraints” (Stakeholders).

“In 2024, new accreditation standards required that it be shown how ICT was integrated. A 3-level rubric was no-3 levels; discussion for a more levels were desired in which all programs was initiated, but failure to reach three new (Level 3) could confidently achieve level would result zero influence on 2 and higher on the Performance Level student test performance grade.” This approach demonstrates how well the summary articulates both the new standards and rubric levels, program requirements, and the high mark of our Tech Program/ Data Science programs.

Teaching Methodologies

Online Blended Student-Centered Shift away from the Traditional Lectures-based Approach.

The rapid pivot to online learning in 2020 by the university’s faculty members showed its potential for flexible, asynchronous learning and set off a transformative shift. “In March 2024, we rapidly shifted 847 courses online with existing tools and moved from crisis teaching to catalytic change. It dismantled resistance... it proved to faculty that students can learn asynchronously, , sparking our transformation” (Faculty Members). “The discourse has since moved from how much online learning to the selection of the most appropriate mode for each learning outcome, and choosing pedagogical choices over convenience” (Lectures). The concept is a reminder to focus on the best teaching methods for what students will learn, rather than the volume of materials online.

Teacher training and capacity building

Training had spent time being tool-focused, but transitioning to pedagogy-first helped improve teaching. “Preliminary training was tool-based rather than pedagogy-based, but a move to a pedagogy-first model resulted in practical teaching impact”. They also added “Training needs support; we have developed Pedagogy Partners, Innovation Grants, and Teaching Commons to create community and structure growth”. This simple concept effectively demonstrates the significance of support in training and promotes the programs that will help individuals connect and continue to grow. “One-off training doesn’t work; without follow-up specific support peer observation, student feedback driving practice skills diminish. We require designers to be of the wood, and a culture of ongoing improvement” (Rectors). They stress good professional development relies on long-term support and collaboration, feedback, and building a culture of continuous improvement.

Challenges Faced

Infrastructure deficits

The predominant challenge is lack of reliable electricity despite investment and this inhibits ICT use in education,

suggesting the need for alternate, more scalable energy solutions. “The most important obstacle here is the undependable electricity supply, there remains poor grid service and massive investment in back-up solutions and still 34 % of the classrooms are without reliable power for teaching by ICT” (Rectors, Vice-rectors). “There is only so much bandwidth to go around, and our campus in Segou must use USB sticks to receive materials materializing digital divides” (Segou Universities’ Stakeholders). This quote emphasizes that the narrow band of Ségou campus needs institutions to sale towards outdated manner for digital education.

Different levels of resistance to change and digital illiteracy

A number of leading law professors told me right to my face “My value is best demonstrated by what goes on in my classroom. Why do I have a job if kids can learn on YouTube? This isn’t ignorance it’s existential fear. We have not dealt with ‘identity change’ in our rollout of ICT” (Professors). It records teachers’ fears of obsolescence on account of digital resources, accuses the absence of indoctrination in the ICT revolution and asserts that technology should liberate rather than supersede teachers. Faculty generally possess low level of digital expertise and are not equipped with advanced teaching and critical digital literacy which need be improved to enhance technology use and increase digital competence. Professors and Students highlight “Most faculty are operationally digital literate but have little pedagogical ability let alone critical digital literacy”.

Impact on Learning Outcomes

Student engagement and skills development

Moving the Focus from Anecdotes to Analytics: Quantified benefits, Provocative Questions and Comprehensive Evaluation. “We leveraged analytics to quantify engagement rather than rely on anecdotal data, observed considerable enhancement post-ICT integration and advocated for more robust assessment strategies” (Faculty members). Moreover, “ICT affordances allow for scalable higher-order thinking activities that not all students as might happen with just a few in lectures” (Professors). They point out that ICT democratizes active learning such that all students can work with complex material, thus providing an inclusive and enriched learning environment

Academic performance

Effects Participants Remarks The participants claim that one of the reasons to study at master program is just curiosity and influence of ICT education; and they perceive education as life-long activities due to pursuing education related their passion not credentials. “We are studying in postgraduation because of our interest, and we got motivation for continuous learning and contribution toward knowledge from ICT education” (Students). “The centerpiece presents leading edge ICT research, community outcomes, and professional creative works in

a wider sense than typical reviews of what others have done to make a difference” (Stakeholders). It illustrates compliments how by emphasizing technology, impact and professionalism of the project, it breaks away from old-fashion reviews in an eloquent and well-organized manner.

RESULTS AND DISCUSSION

Effect of ICT on curriculum design and delivery methods

The integration of Information and Communication Technology (ICT) into higher education has significantly transformed curriculum design and delivery methods in Mali, fostering more interactive, flexible, and student-centered learning environments. ICT tools such as online platforms, multimedia resources, and e-learning applications enable educators to develop curricula that are more aligned with modern technological advancements and the needs of digital-native students (Tshukudu *et al.*, 2022). These tools facilitate diverse pedagogical approaches, including blended learning and remote instruction, thus overcoming geographic and infrastructural barriers prevalent in Mali. Consequently, ICT enhances engagement, accessibility, and the quality of education, ultimately contributing to improved learning outcomes and the relevance of curricula in a rapidly evolving global context. The adoption of ICT in curriculum design also allows for continuous updates and customization, making education more adaptable to societal and technological changes (Zezeza & Okanda, 2021; OLVIDADO & FELINITA III, 2026). As Mali continues to integrate ICT into higher education, understanding its influence on teaching methodologies and curriculum development becomes crucial for policy formulation and institutional planning to ensure sustainable educational progress.

Changes in teaching styles due to ICT integration

The integration of ICT tools has profoundly transformed teaching styles within Malian higher education by fostering more interactive, student-centered, and flexible learning environments. The adoption of digital platforms, multimedia resources, and online collaboration tools has shifted traditional lecture-based approaches towards participatory learning, encouraging critical thinking and autonomy among students. This pedagogical shift is evidenced by increased engagement and accessibility, especially in remote or underserved regions of Mali (Keita *et al.*, 2021). Moreover, ICT integration has enabled educators to tailor their teaching methods to accommodate diverse learning styles and facilitate the continuous assessment of student progress, thereby enhancing overall educational quality. As Mali continues to adapt to technological advancements, these changes in teaching styles are essential for preparing students to thrive in a digitalized global landscape (Ahmed *et al.*, 2025; Serrano & Felinita Iii, 2026).

Broader impact of ICT on Malian higher education reform and debate

The integration of new ICT tools has significantly influenced the landscape of higher education in Mali, fostering opportunities for curriculum reform and innovative teaching methodologies. These technological advancements facilitate access to a broader range of educational resources, promote active learning, and support the development of digital literacy among students and educators. In the Malian context, ICT integration can bridge geographical and infrastructural challenges, enabling more inclusive and flexible learning environments (Yidana *et al.*, 2023). However, debates persist regarding the effective implementation, sustainability, and potential disparities caused by unequal access to technology. Critics argue that without adequate infrastructure, training, and policy support, the transformative potential of ICT remains limited, potentially exacerbating existing educational inequalities (Diawara *et al.*, 2025). Thus, while ICT offers promising avenues for curriculum enhancement and pedagogical innovation, its successful impact depends on comprehensive strategies that address infrastructural, pedagogical, and socio-economic barriers within Malian higher education.

Comparison with Global and Regional Perspectives

In this regard, the comparison with global tendencies and Malian trends of the effect of emerging ICTs on higher education is instructive. Internationally, there is an increasing use of digital-related tools like AI, VR and online-learning platforms to promote curriculum relevance and teaching approaches due to the demands for flexible mode of education during COVID-19 (Hesse *et al.*, 2022). Mali has likewise embarked on incorporating these technologies in order to address infrastructural difficulties and enhance access through mobile learning and digital infrastructure, particularly in outlying areas (Radovanović *et al.*, 2020). Yet, in the current global scenario of innovative pedagogies and digital integration, Mali has specific challenges due to restrictions in terms of technological infrastructure and digital literacy retracting from full adoption. This dichotomy further emphasizes the requirement for bespoke approaches which take into account regional infrastructural situations, while remaining in harmony with global digital transformation trends.

Implications for Policy and Practice

Scaling successful ICT integration practices

Towards a successful scaling of ICT integration in HEIs, policy makers should design enabling frameworks focusing on infrastructure development, faculty capacity building and ICT diffusion. Focusing on capacity building and continuing professional development enable teachers to have the appropriate skills required for integrating ICT resources into the process of teaching. Also, the setting of clear regulations that encourage the use of digital learning

platforms can create a culture of constant improvement and innovation in institutions (UNESCO, 2019b). These strategic practices are particularly important for maximizing the opportunities offered by new ICTs to contribute to a relevant and student-centered curriculum in differing educational contexts such as those found in Mali and other developing world settings.

Strategies to overcome barriers

Tackling the impediments to ICT integration needs tailored strategies that deal with infrastructural, pedagogical and socio-cultural constraints. Governments and institutions must prioritize investments in reliable internet connectivity, inexpensive digital devices, and localized content to close the digital gap. Further, the policy framework should be conducive toward active partnerships between the educators and students on one hand and stakeholder representatives from the private sector and policymaking bodies on the other to ensure that there is a climate which would stimulate digital transformation. Resistance towards change can also be addressed through awareness-raising programs, and demonstrating the concrete advantages of ICT-enhanced teaching may help to encourage acceptance and engagement. Internationally, research indicates that policy maneuvers with very specific support structures have the potential to reduce obstacles and sustain ICT implementations in higher education (Giovannetti *et al.*, 2025; Abdelkrim *et al.*, 2026).

Recommendations

Bridge the Infrastructure Gap

Solve the enduring problems of electricity, connectivity and sectioning off spaces on campus by investing in trusted back-up power sources; increase bandwidth, particularly to campuses like Ségou out in the rural areas. Advanced ICT tools can hardly be used efficiently in the absence of a stable groundwork infrastructure

Implement Pedagogy-First Faculty Training

Move from tool-based to pedagogical training resulting in better learning through ICT. Create lasting support mechanisms like Pedagogy Partners, Innovation Grants, and a Teaching Commons to support continual learning instead of the one-and-done workshop.

Empower Faculty with Curriculum Autonomy

Raise the autonomy of teachers in ICT curriculum development (presently 25%) and on that basis help them develop digital content. This opportunity focuses on the current cyberspace between 58% redesign in ICT-integration reported by administrators and a less than 47% actual implementation level by faculty.

Address Digital Identity and Resistance

Develop change management plans that accommodate faculty anxieties related to technical obsolescence. Position ICT as adding value to rather than competing

with educators, mentoring for identity transformation as well as technical development.

Scale Active Learning Modalities

Move beyond just replacing the lectures through text and video (62% penetration) towards real pedagogical development by expanding flipped classrooms (32%), virtual simulations (24%) and mobile learning use (29%). Concentrate on marrying ICT modality to particular learning goals rather than opportunistic digitalization.

CONCLUSION

Conclusion In their examination of the impact of emerging ICT technologies on Malian higher education, we find that significant progress has indeed occurred with respect to infrastructural development and administrative policy, it also becomes clear that a large 'technological capacity' divides the vision in board rooms from pedagogical reality within classrooms. The data also show that real change comes from transcending merely digitally transforming—in which simple multimedia tools get implemented at 62% while active learning methods such as flipped classrooms and virtual simulators still sit below the line to pedagogy-first models, where faculty have both the independence and support to build growth into their own classrooms. An overarching vision of equitable, sustainable ICT integration in the Malian higher education system implicates addressing core infrastructure deficiencies, narrowing digital literacy gaps through consistent professional learning experiences, and fostering a cultural perspective that views technology as augmenting rather than replacing teacher capacity for an inclusive, future-ready educational context aligned with national development imperatives and global trends of digital metamorphosis.

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