



CENTRE FOR DIGITAL DEVELOPMENT
AND INNOVATION RESEARCH

Artificial Intelligence (AI) for Education in Africa:

Challenges, Opportunities and Key Enablers

A DIAGNOSTIC ANALYSIS



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About Us

Centre for Digital Development and Innovation Research (CDDIR)

is a leading do-think tank that creating a supercluster of digital innovation, expertise, and skills development for the consistent use of robust evidence to inform policy formulation, resource allocation, and program implementation to digital education. We seek to develop digital transformation initiatives in close cooperation with the industry and academia, while simultaneously being committed to preparing students and professionals for the integration and application of digital technologies for the advancement of learning and teaching.

We also leverage structured, data-intensive, and contextualized applications of artificial intelligence, machine learning, and geospatial data to achieve a digitally competent society where all people use knowledge and skills in digital technologies to improve their livelihoods. We support governments across Africa to design state-led capacity development initiatives towards realizing the digital capacities of its institutions, boost digital literacy and skills of its citizens, and develop knowledge resources that enable digital transformation from the grassroots.

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Foreword



Gideon Olanrewaju,

Founding Principal Partner &
Senior Research Analyst

It is with great enthusiasm that I present this diagnostic study on the application of Artificial Intelligence (AI) in education across Africa. As the continent navigates an era of rapid technological transformation, AI presents unprecedented opportunities to enhance learning outcomes, expand access to education, and empower teachers and policymakers with real-time insights. At the same time, the introduction of AI into African education systems brings complex challenges, including infrastructure gaps, limited digital skills, inequities in access, and the need for robust governance and ethical safeguards.

This study seeks to provide a comprehensive and evidence-informed overview of the current landscape, highlighting practical examples of AI applications—from adaptive learning platforms supporting foundational literacy in Kenya and Malawi, to generative AI pilots in Nigeria that enhance classroom instruction. Beyond these innovations, it examines the structural enablers required for responsible and inclusive adoption, including policy frameworks, teacher capacity development, and collaborative partnerships with EdTech startups, civil society, and international development actors. By presenting both the opportunities and challenges, this diagnostic aims to guide policymakers, educators, and innovators in making strategic decisions that maximize the benefits of AI while safeguarding equity, ethics, and local relevance. I hope this study will serve as a catalyst for informed dialogue, evidence-based policy, and transformative action across African education systems.

- Gideon Olanrewaju



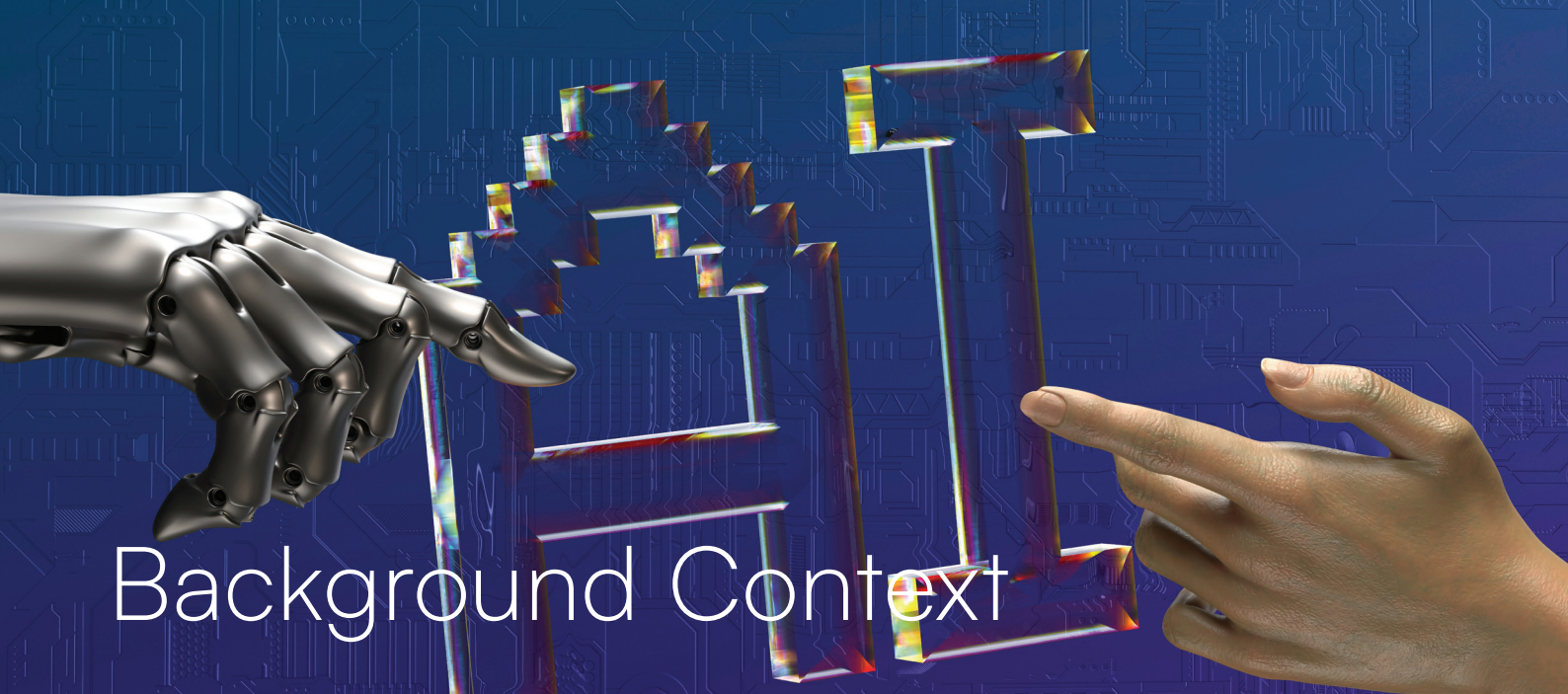
Executive Summary

This diagnostic study examines the emerging landscape of Artificial Intelligence (AI) in education across Africa, identifying its current applications, systemic challenges, opportunities for scale, and enabling conditions for sustainable adoption. While global discourse on AI in education is advancing rapidly, African countries are only beginning to define context-specific pathways that respond to their infrastructure realities, policy environments, and pressing educational needs. Evidence from across the continent illustrates the breadth of experimentation already underway.

Adaptive learning platforms such as **M-Shule in Kenya** and **onebillion in Malawi** demonstrate how AI-enabled tools can strengthen foundational literacy and numeracy, while pilots in **Nigeria's Edo State** highlight the potential of generative AI to support both learners and teachers at low cost. AI is also being applied in teacher support, lesson planning, classroom analytics, and education data management, reflecting a gradual expansion beyond pilot projects. However, the study identifies significant structural **constraints**:

weak connectivity and power infrastructure, limited availability of localized datasets, gaps in teacher digital competence, and fragmented or underdeveloped regulatory frameworks. These barriers, if unaddressed, risk reinforcing existing inequities and undermining the inclusive potential of AI. At the same time, AI offers **strategic opportunities** to advance Sustainable Development Goal 4 (SDG4) by extending access to quality education in underserved areas, enabling personalized learning at scale, and equipping policymakers with real-time insights for system reform.

The African Union's Continental AI Strategy (2024) and **UNESCO's guidance on AI in education** provide important policy anchors for countries seeking to balance innovation with ethics, equity, and data protection. The findings suggest that Africa's task is not whether to adopt AI in education, but how to do so responsibly, inclusively, and effectively. This requires targeted investments in infrastructure, teacher professional development, the creation of African language content, and cross-sector partnerships that bring together governments, EdTech innovators, civil society, and development partners.



Background Context

Artificial Intelligence (AI) is rapidly emerging as a transformative force with the potential to profoundly impact global education systems. This advanced technology, characterized by its ability to simulate human intelligence through algorithms and computing power, offers unprecedented opportunities to revolutionize teaching and learning practices, ultimately accelerating progress towards Sustainable Development Goal 4 (SDG 4) — ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. In the African context, the integration of AI in education is particularly urgent given the continent's persistent educational challenges, including disparities in access, quality, and infrastructure.

While AI education is a relatively new field globally, with limited research, especially in African settings, its adoption is seen as a catalyst for change, offering innovative solutions to long-standing problems and preparing future generations for an increasingly AI-powered society and workforce. No doubt, the landscape of education in Africa is undergoing a profound transformation driven by advancements in AI. Globally, the AI in education market is projected to reach \$6 billion by 2024, highlighting its significant impact.

While AI has been applied in education since the 1970s for personalized learning and assessment, recent advancements in generative AI, such as ChatGPT, Synthesia, DALL-E2, and Bard, are disrupting traditional skills and curricula by mimicking human logic, writing, and creativity. This disruption raises concerns among educators regarding student cheating and data privacy when AI-driven tools are used for assignments and assessments.

In Africa, research and development activities focusing on AI are limited. Consequently, many AI applications deployed on the continent originate from outside and often lack contextual and cultural relevance. Despite this, there's growing recognition that building robust African AI policymaking capacity necessitates the development of AI skills. AI is emerging as a potent tool to address educational challenges, enhance learning outcomes, and bridge existing gaps across the continent. Africa faces unique educational challenges, including uneven access to resources, diverse linguistic landscapes, and disparities in learning outcomes, which AI promises to overcome through customized educational experiences and adaptive learning. However, very few African countries have government-endorsed K-12 AI curricula, unlike other regions, with UNESCO reports indicating none from Africa among those with existing or developing curricula.

This diagnostic analysis aims to provide a detailed examination of the application of AI for education in Africa. It will explore the current landscape of AI integration, delineate the significant challenges hindering its effective deployment, highlight the vast opportunities it presents, and identify the key enablers necessary for its successful, ethical, and sustainable implementation across the continent. Drawing extensively from available sources, this report seeks to enhance understanding and provide insights that can guide policymakers and stakeholders in harnessing AI's potential for Africa's educational transformation.

The analytical study is particularly timely for several reasons. Firstly, it aligns with Sustainable Development Goal 4 (SDG 4), which emphasizes ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. AI has the potential to accelerate progress towards this goal.

Secondly, it addresses the urgent global AI skills gap crisis, advocating for the democratization of AI education to younger generations to prepare them for an AI-powered society. Early exposure to AI helps children develop a thoughtful and nuanced understanding of intelligent devices and can inspire future AI researchers and developers.

Thirdly, it is crucial for workforce preparation, as education systems must adapt to equip young people with the cognitive (analytical, creative thinking), technology (AI, big data, technological literacy), and interpersonal skills (leadership, empathy) needed for future technology-driven economies and human-AI collaboration.

Fourthly, it is vital for combating information pollution, where the rise of social media and AI technologies, especially generative AI, has facilitated the widespread dissemination of misinformation, disinformation, hate speech, and deepfakes in regions like West Africa, leading to insecurity and undermining democratic processes.

Generative AI's ability to create new content that can be easily mistaken for human-authored material makes it a powerful tool for spreading such pollution.

Lastly, it addresses the need for AI applications to be contextually and culturally relevant for Africa, moving beyond imported solutions that may not align with local values and infrastructure.

Current Applications of AI in African Education Systems

Landscape of AI in Education in Africa

The educational landscape in Africa is marked by diverse cultures, languages, and socio-economic conditions, creating a complex environment for technological integration. Despite significant improvements in education over the past decade, challenges such as uneven access to educational resources, varying linguistic landscapes, and disparities in learning outcomes persist. African governments have focused on improving access and quality, yet inadequate funding, poor infrastructure, and a lack of qualified teachers remain critical obstacles.

Against this backdrop, AI is emerging as a potent tool to address these issues, although its presence in K-12 education in Africa is still limited. Most research and development activities related to AI in Africa have historically focused on higher education, leaving a notable gap in understanding its effective integration at the primary and secondary school levels.

However, there is a growing recognition that building robust African AI policymaking capacity requires the development of AI skills across all educational stages. Below are few examples of ways Artificial intelligence is being leveraged to improve learning and teaching outcomes across the continent.

1

Adaptive learning systems (personalized tutoring, language learning)

Kenya — M-Shule (SMS-adaptive learning): Early case studies highlight M-Shule as an adaptive SMS platform delivering individualized exercises and feedback to K-12 learners with basic phones—an approach designed for low-bandwidth contexts.

Kenya — Angaza Elimu: Backed by UNICEF and selected for Google’s AI for Education cohort, Angaza reports engine upgrades that “enhance student adaptation” and teacher interventions, with claimed time savings for teachers and learning gains for students.

Malawi — onebillion/onecourse tablets: Malawi’s large-scale deployment (140,000 devices) uses adaptive software for foundational literacy and numeracy, targeting 4.6m children nationally. While not all features are “AI,” the system continuously adjusts difficulty and content to the child.

Nigeria — Generative AI pilots: A World Bank—documented experiment in Edo State used free gen-AI tools (e.g., Copilot) to support secondary students’ English learning, suggesting promise for scalable, low-cost AI tutoring support in public schools.

2

AI for foundational literacy and numeracy

Adaptive early-grades instruction: Programs like onebillion in Malawi and Angaza Elimu in Kenya focus squarely on early literacy/numeracy with adaptive progressions and frequent formative checks—an approach aligned with evidence on “teaching at the right level.”

Policy and guidance: UNESCO’s AI-in-education guidance underscores using AI to personalize learning and improve assessment, a frame many African implementers cite when designing foundational skills programs.

3

AI-driven teacher support (lesson planning, grading, analytics)

AI applications are influencing teaching practices and administrative tasks by automating mundane duties such as grading assignments, tracking student progress, and providing individualized feedback. This frees up teachers’ time to focus on more complex pedagogical aspects and human interaction. AI is also being used for education management and delivery, including admissions, timetabling, attendance monitoring, and policy-making through data analytics. For example, there is widespread use of AI tools for

A. Teacher time savings & insights: Angaza Elimu reports teachers save time (≈15%) and gain classroom analytics to target support; UNICEF’s Venture Fund notes the platform’s “advanced engines” for adaptation and teacher interventions.

B. Lesson/assessment assistants: A growing set of tools (local and global) support lesson planning, question generation, and grading; although many are global products, Nigerian and Kenyan teachers increasingly adopt gen-AI-assisted planning and grading workflows.

C. Low-cost gen-AI pilots: The Edo State pilot shows how freely available assistants can augment teachers and learners without bespoke procurement.

4

AI for administration and education data management

Learning analytics & EMIS-adjacent work: UNICEF's Data Must Speak (DMS) uses administrative datasets and ML-style analytics (positive deviance) with ministries (e.g., Ghana), surfacing “what works” at school level to inform resource allocation and improvement plans. Future-ready EMIS: UNESCO and UIS outline pathways to move EMIS beyond headcounts toward analytics that can support inclusive, effective learning—precursors for AI-enabled dashboards and decision support as data quality improves.



Challenges in Applying AI for Education in Africa

The application of AI in education in Africa, while promising, faces a unique set of multifaceted challenges rooted in socio-economic, infrastructural, pedagogical, and ethical complexities.

1 Digital Divide and Inadequate Infrastructure:

- **Limited Access:** Significant disparities exist in access to educational resources, technology, and the internet, particularly in rural and marginalized communities. Nearly 40% of 15-year-olds from disadvantaged backgrounds in Latin America and the Caribbean, for instance, lack internet access at school, with 20% having no access to computers for student use. This “digital divide” is pronounced in Africa, exacerbated by a lack of telecommunications infrastructure, absence of electricity in some regions, and the high cost of digital devices. This directly limits the effectiveness of e-learning initiatives and AI-powered solutions.

- **Inequalities:** Digital and mark inequalities between rural-urban and private-public schools in Africa hinder the integration of digital learning tools. Without concerted efforts, AI could widen these existing educational disparities, with benefits accruing primarily to already privileged communities.

2 Teacher-Related Challenges:

- **Shortages and Inadequate Training:** Africa faces a severe shortage of qualified teachers, and many existing teachers lack the necessary skills and resources to deliver effective instruction, particularly concerning new technologies like AI. Introducing AI places new demands on teachers, who often experience uncertainty regarding content and pedagogical knowledge.

- **Resistance to Change:** Teachers may be resistant to adopting new technologies or fear job displacement, highlighting the need for robust professional development that emphasizes AI as a complementary tool rather than a replacement.

3 Curriculum Development and Relevance:

- **Emerging Field:** AI education is a new and emerging field, and research in this area is limited in African settings. There is a lack of clear national curricula, with existing initiatives often being standalone or extensions of computer science rather than context-specific integrations.

- **Contextualization:** Designing AI education for K-12 in African contexts requires unique needs and considerations, including contextual and cultural values, which are essential to shape educational objectives and inform beliefs about technology use. The absence of contextually sensitive AI ethical curricula is a significant gap.

4 Ethical Concerns and Algorithmic Bias:

- **Data Privacy and Ownership:** The widespread deployment of AI technologies in education raises profound ethical and legal issues related to data ownership, consent, and privacy. Continuous monitoring of student actions, gestures, and emotions through AI can be intrusive and dehumanizing.

- **Algorithmic Bias:** AI applications can impose different kinds of bias inherent in the training data, processes, and algorithms. This can lead to unfair or discriminatory decisions, particularly against minority students or those from diverse linguistic backgrounds. The case of the UK government's algorithm for secondary leaving examinations, which favored elite schools, illustrates the dangers of deploying AI without fully understanding its biases.

- **Digital Colonization:** There is a concern that AI could become a tool for “cyber colonization” of the continent, with applications deployed in Africa often originating from outside and lacking contextual relevance.

- **Misinformation and Disinformation:** Generative AI has the potential to proliferate misinformation and disinformation, which can have harmful and lasting effects on political, economic, and social spheres. Children and young learners are particularly vulnerable, necessitating a focus on AI literacy to critically analyze content.

5 Limited Research and Evidence Base:

- **Lack of Efficacy Studies:** Despite decades of research into AI in education, there is still limited robust evidence of its efficacy at scale, especially in K-12 settings. Many claims of AI's revolutionary potential are based on conjecture and optimism.

- **Focus on Technical Capacity:** Much of the existing “evidence-based” research relates to how AI can work in education in a technical capacity, rather than comprehensively answering whether AI is truly needed or how it impacts learning outcomes.

- **Insufficient African Perspectives:** To our knowledge, research related to K-12 AI education in the African continent is lacking. Studies are needed from students' perspectives, across different age groups, and in diverse African regions to enrich the scientific discussion.

6 Funding and Investment Deficiencies:

- **Inadequate Public and Private Funding:** Underinvestment in Research and Development (R&D) in Africa is a major obstacle to AI innovation growth on the continent. Financial resources, both public and private, are limited, hindering cutting-edge research and the development of innovative applications relevant to Africa's specific AI needs.

- **Resource Constraints:** Teaching computer science or ICT in African schools has been plagued by challenges related to resources, such as infrastructure and equipment.

7 Policy and Regulatory Gaps:

- **Slow Policy Development:** Rapid technological developments in AI have outpaced policy debates and regulatory frameworks globally, and particularly in Africa. Only a few African countries have comprehensive data protection laws, and even fewer have government-endorsed AI curricula for K-12 education.

- **Lack of Institutional Capacity:** There is a need for institutional capacity and AI fluency among decision-makers to effectively deploy AI without succumbing to biases or unintended consequences.

- **Plagiarism:** The generative capabilities of AI tools accessible to students create significant opportunities for plagiarism, especially in unmonitored settings. Policymakers and teachers need clear strategies to address this issue and adapt assignments.



Generative Artificial Intelligence (AI) for Education in Africa: Opportunities & Potential

Africa presents unique opportunities for AI-powered educational transformation that can address systemic challenges while leveraging the continent's demographic dividend and growing digital infrastructure. With over 400 million school-age children and a rapidly expanding EdTech ecosystem, AI offers pathways to improve educational access, quality, and equity across diverse contexts. The continent's potential to leapfrog traditional educational bottlenecks through strategic AI implementation positions it as a global leader in innovative, culturally-responsive educational technology.

1

Personalized and Adaptive Learning Experiences:

Current Context and Challenges Africa's educational landscape is characterized by significant disparities in access, with marginalized communities—including rural populations, girls, children with disabilities, and linguistic minorities—facing substantial barriers to quality education. Traditional educational systems often fail to accommodate diverse learning needs, cultural contexts, and linguistic diversity, perpetuating cycles of exclusion.

2

- **Tailored Instruction:** AI-powered adaptive learning platforms can tailor educational content to individual students' needs, learning styles, and pace, fostering personalized learning experiences. This is particularly impactful in addressing diverse learning abilities and preferences prevalent across Africa.
- **Virtual Tutors and Chatbots:** AI-driven virtual tutors and chatbots can provide continuous, customized practice and short lessons, delivering additional support to students, especially in remote or underserved areas where access to qualified teachers is limited. Platforms like WhatsApp can disseminate these lessons widely, making personalized content accessible through common technologies.
- **Real-time Feedback:** AI can offer immediate and personalized feedback on student performance, fostering a deeper understanding of the material and allowing for quick identification of areas needing further attention.

Enhanced Access and Equity:

- **Bridging the Digital Divide:** AI can facilitate platforms that encourage continuous learning, supporting lifelong education and skill development. Leveraging AI for mobile learning initiatives can help bridge the digital divide by reaching students in remote areas with limited access to traditional educational resources.
- **Multilingual Support:** AI's language processing capabilities can help overcome linguistic barriers by providing multilingual support and adapting content to local languages, enhancing accessibility for students whose primary languages may not be widely represented in traditional educational materials. This is crucial in Africa's linguistically diverse context.
- **Inclusive Education:** AI can help students with special needs by providing personalized learning experiences and assistive technologies. For example, AI-enabled tools can caption classroom lessons for students with auditory impairments or produce text-to-speech for visually impaired learners. Typical assistive technologies for learners can include Text-to-speech and automated captioning systems that supports learners with visual and hearing impairments, improving participation rates in mainstream education, OR adaptive interfaces that adjust to individual learning disabilities, cognitive differences, and physical limitations enable personalized access to educational content and AI-powered assessment tools can identify learning difficulties early and recommend targeted interventions, reducing dropout rates among vulnerable populations.
- **Reaching Underserved Populations:** AI-based technology has the potential to unlock new opportunities for education systems to reach traditionally underserved or disadvantaged populations, including older people, refugees, and marginalized communities.

Personalized Learning at Scale

African classrooms often face severe overcrowding, with teacher-to-student ratios frequently exceeding 1:40 in primary education. This reality makes individualized instruction nearly impossible through traditional methods, creating opportunities for AI-powered personalization at scale. AI-Driven Personalization Technologies can be diverse and have distinct functionalities as well as noted below;

A. Intelligent Tutoring Systems

- Adaptive learning platforms that adjust difficulty levels, pacing, and content presentation based on individual learner progress and preferences.
- AI tutors capable of providing 24/7 support in multiple languages, offering explanations, practice problems, and feedback tailored to each student's learning style.
- Gamified learning environments that use AI to maintain engagement while adapting challenges to individual skill levels and cultural preferences.

B. Learning Analytics and Predictive Modeling

- Real-time learning analytics that identify struggling students early and recommend targeted interventions before academic failure occurs.
- Predictive models that forecast learning outcomes and suggest optimal learning pathways based on individual characteristics, prior knowledge, and contextual factors.
- Competency mapping systems that track skill development across multiple domains and suggest personalized learning sequences.

C. Multimodal Learning Approaches

- AI-powered content recommendation engines that suggest learning materials based on individual preferences, learning styles, and performance patterns.
- Adaptive assessment systems that adjust question difficulty and format in real-time, providing accurate skill measurement while reducing test anxiety.
- Collaborative learning platforms that use AI to form optimal study groups and peer learning partnerships based on complementary skills and learning goals.

D. Classroom Management and Support

- AI teaching assistants that can answer routine student questions, freeing teachers to focus on complex instructional tasks and individual support.
- Automated attendance and engagement tracking using computer vision and natural language processing to monitor student participation and alert teachers to disengagement.
- Real-time translation and interpretation services that support multilingual classrooms and enable inclusive participation.

E. Differentiated Instruction at Scale

- Content adaptation engines that automatically generate multiple versions of lessons, assignments, and assessments to accommodate different skill levels within the same classroom.
- AI-powered peer tutoring systems that identify students who can effectively support their classmates and facilitate structured peer learning opportunities.
- Flexible pacing systems that allow students to progress through curricula at optimal speeds while maintaining class cohesion and social learning benefits.

Teacher Empowerment and Operational Efficiency

African teachers often spend 40-60% of their time on administrative tasks including attendance tracking, grade recording, report generation, and compliance documentation, leaving limited time for actual instruction and student support. **The various application of Ai for teachers ranges towards reducing administrative burden, supporting pedagogy, enabling continuous professional development and are listed:**

A. Automated Assessment and Grading

- AI-powered automated essay scoring that can evaluate written responses in multiple languages while providing detailed feedback to students.
- Intelligent test generation systems that create assessments aligned with curriculum standards and individual student needs.
- Automated attendance tracking using facial recognition or mobile check-in systems that reduce time spent on routine data collection.

B. Streamlined Reporting and Documentation

- AI-generated progress reports that synthesize student performance data into comprehensive, personalized narratives for parents and administrators.
- Automated compliance reporting that ensures schools meet regulatory requirements without manual data compilation.
- Intelligent scheduling systems that optimize class timetables, resource allocation, and teacher assignments based on constraints and preferences.

C. Data Management and Analytics

- Student information systems enhanced with AI that automatically update records, flag inconsistencies, and generate insights about student progress and needs.
- Resource management platforms that predict material needs, optimize inventory, and suggest cost-effective procurement strategies.
- Communication automation that sends personalized updates to parents and stakeholders based on student progress and important events.

D. Pedagogical Enhancement Tools

- AI-powered lesson planning assistants that suggest activities, resources, and assessments aligned with curriculum standards and student needs.
- Real-time classroom analytics that provide teachers with immediate feedback on student engagement, comprehension, and participation levels.
- Adaptive content recommendation systems that suggest supplementary materials, remediation resources, and enrichment activities based on class performance.

E. Personalized Learning Pathways for Teachers

- AI-driven professional development platforms that assess teacher skills, identify growth areas, and recommend targeted training opportunities.
- Micro-credentialing systems that use AI to verify skill acquisition and provide stackable credentials for career advancement.
- Peer learning networks facilitated by AI matching algorithms that connect teachers with similar challenges and complementary expertise.

F. Mentorship and Support Systems

- Virtual mentoring platforms that pair novice teachers with experienced educators based on subject area, teaching context, and professional goals.
- AI coaching systems that analyze teaching practices through classroom observation data and provide personalized feedback and improvement suggestions.
- Collaborative planning tools that enable teachers to co-create lessons, share resources, and learn from each other's expertise.

G. Evidence-Based Practice Integration

- Research-to-practice platforms that use AI to identify relevant educational research and translate findings into actionable classroom strategies.
- Action research support tools that help teachers design, implement, and analyze small-scale studies to improve their practice.
- Reflective practice platforms that use AI to analyze teaching journals and provide insights for professional growth.

5

Improved Assessment and Data-Driven Decision-Making

- **Adaptive and Continuous Assessment:** AI enables adaptive assessments that adjust difficulty based on student responses, ensuring personalized evaluation. It can facilitate continuous formative assessments, providing regular updates for teachers, students, and parents, and allowing for timely adjustments to teaching strategies.
- **Early Warning Systems:** Automated machine learning and data analytics can power “early warning systems” to identify students at risk of dropping out or needing additional support, enabling targeted interventions.
- **Comprehensive Insights:** AI analyzes large datasets of student performance, engagement, and learning patterns, empowering educators and policymakers with comprehensive insights to make informed decisions and interventions.
- **Exam Proctoring and Integrity:** AI can assist in exam proctoring by detecting cheating, enhancing the integrity and security of online assessments through plagiarism detection and facial recognition.

6

Preparation for the Future Workforce and AI Literacy

- **Future Skills Development:** Teaching AI concepts in the curriculum can inspire the next generation of AI researchers and developers. AI can help prepare learners for future challenges by developing essential skills such as critical thinking, communication, collaboration, and creativity, which are necessary in an evolving world.
- **AI Literacy:** Education systems can integrate AI literacy into curricula, teaching students how AI works, its development, applications, ethical considerations, and how to critically evaluate AI-generated content. This prepares them to be informed and capable participants in the digital age.

7

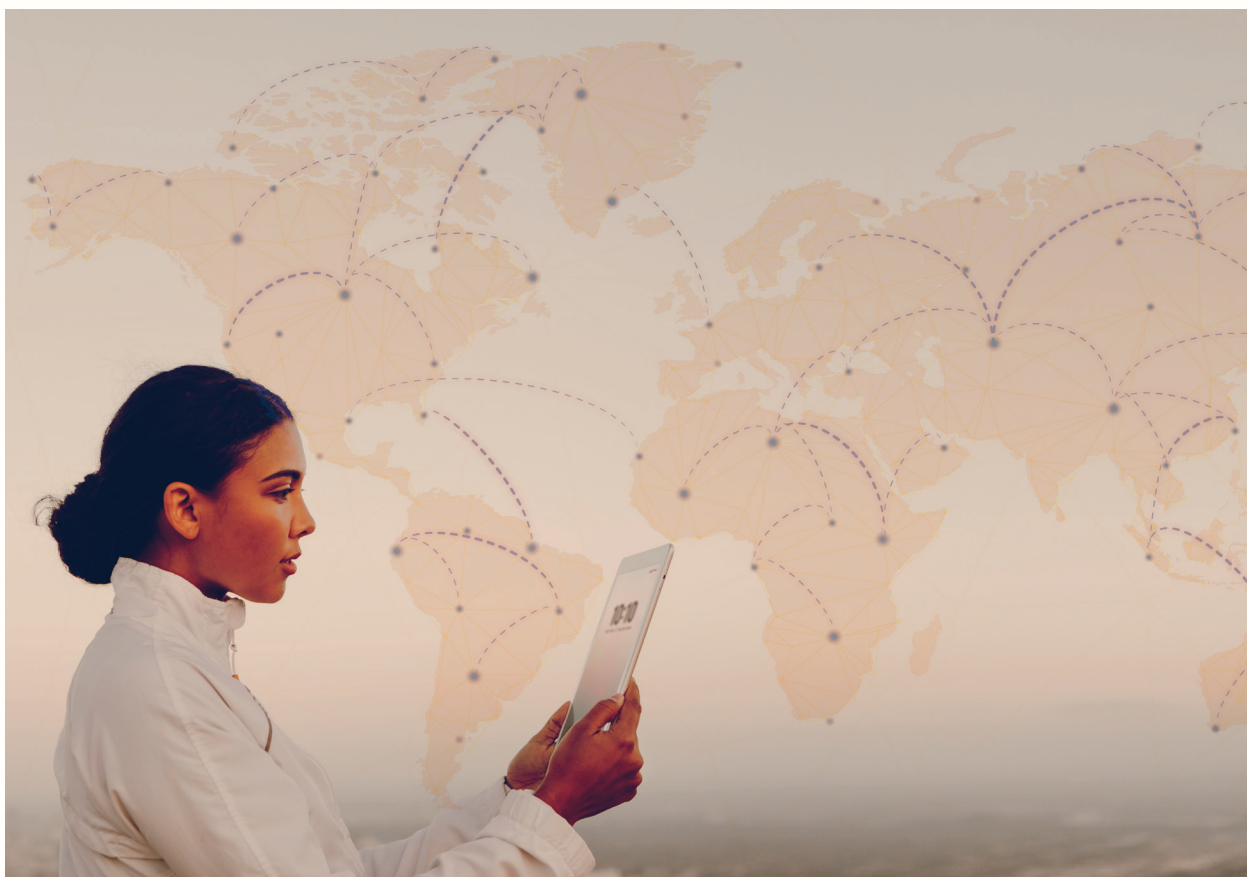
Economic Growth and Innovation

- AI technologies can be leveraged to address several development problems on the continent, with PwC estimating an added value of \$1.2 trillion in Africa. This includes optimizing accuracy and efficiency in medical diagnoses (e.g., Mpharma in Ghana) and facilitating access to crucial information for farmers (e.g., Zenvus in Nigeria). Supporting local AI research and innovation can lead to the development of solutions tailored to African contexts and needs.



Key Enablers for Effective AI in Education

The successful, ethical, and sustainable integration of AI in education across Africa hinges on the development and strategic deployment of several key enablers. These foundational elements are critical to maximizing AI's benefits and mitigating its risks within the diverse socio-economic and cultural contexts of the continent.



1. Robust Digital Infrastructure and Connectivity

Universal Access to Devices

To truly leverage the potential of artificial intelligence within educational systems, a foundational requirement is **universal, frequent, and reliable access to adequate digital devices** for both students and teachers. This goes beyond simply having a few computers in a school library; it means ensuring every student and educator has their own dedicated device, whether it's a computer, smartphone, or tablet, that they can use consistently for learning and teaching purposes.

This level of access is crucial for several reasons. For students, having their own device allows them to engage with **AI-powered learning platforms** anytime, anywhere. These platforms can offer personalized learning paths, provide instant feedback on assignments, and adapt to each student's pace and style of learning. Without consistent device access, the benefits of these AI tools—such as adaptive tutorials, virtual labs, and real-time assessments—cannot be fully realized.

For teachers, ubiquitous access to digital tools is equally important. It empowers them to integrate AI into their curriculum effectively, manage AI-driven learning tools, and use data analytics generated by AI to gain insights into student performance.

Teachers can use AI to automate administrative tasks, such as grading and lesson planning, freeing up more time to focus on individualized student support and creative instruction. Without a reliable device, a teacher's ability to utilize these powerful AI assistants is severely limited, hindering the overall modernization of the classroom.

Ultimately, equitable access to digital devices is not just a technological challenge but a matter of educational equity. Without it, the “digital divide” widens, leaving students from under-resourced communities behind in an increasingly technology-driven world. Ensuring that every member of the educational community has the necessary tools is the essential first step toward building a truly inclusive and effective AI-enhanced learning environment.

Meaningful Educational Connectivity

To effectively use AI in education, consistent and ample internet access at schools and homes is just as crucial as having the devices themselves. This connectivity is the lifeline for cloud-based AI solutions, online learning platforms, and a vast array of digital resources. For many regions in Africa, however, this essential access is often hindered by a more fundamental issue: reliable electricity supply.

The Role of Connectivity

Internet access is the bridge that connects students and teachers to the wealth of information and tools available online. AI-powered platforms, for example, rely on this connection to provide personalized learning experiences, offer real-time feedback, and collect data that helps educators understand student progress. Without this connectivity, the devices themselves become little more than expensive, offline tools.

The lack of consistent internet can also prevent students from completing assignments, accessing digital textbooks, or collaborating on projects with their peers. During events like the COVID-19 pandemic, where remote learning became a necessity, the digital divide was starkly highlighted, leaving students in unconnected areas at a significant disadvantage.

In many African regions, the most pressing barrier to digital education is not internet affordability, but the lack of stable electricity. This is a major issue; a significant percentage of schools in sub-Saharan Africa, particularly in rural areas, lack access to the power grid. A school with computers and a fast internet connection is useless if there's no power to run them.



Unstable electricity also means frequent power outages, which disrupt classes and can damage sensitive electronic equipment. While some solutions like solar power are being implemented to provide a sustainable energy source for schools, the problem remains widespread.

Addressing this challenge requires a multi-pronged approach that goes beyond just providing devices. It must include:

- **Infrastructure Investment:** Expanding and modernizing power grids and telecommunications networks.
- **Sustainable Solutions:** Deploying renewable energy sources like solar power to provide reliable, off-grid electricity to schools and communities.
- **Policy and Partnerships:** Government policies that prioritize digital and energy infrastructure, coupled with public-private partnerships to lower costs and accelerate development.

Meaningful educational connectivity is a holistic concept. It's not just about the internet, but also about the foundational infrastructure—especially electricity—that makes digital learning possible. Without addressing this fundamental issue, the promise of AI and digital resources in education will remain out of reach for millions of students.

2. Teacher Training and Competency Development

Digital and Pedagogical Competencies

- Equipping teachers with the necessary digital and pedagogical skills to effectively use AI tools, understand their potential and limitations, and integrate them into instructional practices is paramount. For teachers to effectively use AI, their training must cover three main areas: digital proficiency, pedagogical integration, and ethical considerations.

- **Digital Proficiency:** This involves the foundational skills needed to operate various digital devices and software, as well as an understanding of AI tools themselves. Teachers need to know how to navigate AI-powered platforms, use AI assistants for tasks like lesson planning and creating resources, and troubleshoot common technical issues. This is the basic level of competence required to even begin working with AI in an educational context.

- **Pedagogical Integration:** This is the core of effective AI use. Teachers must learn how to strategically integrate AI into their teaching to support student learning.

For example, they can use AI to differentiate instruction for students with varying needs, generate personalized quizzes and assignments, and create engaging, interactive learning activities. The focus here is not on the technology itself, but on how to apply it to enhance student outcomes.

- **Ethical Considerations:** This is arguably the most critical and often overlooked part of training. Teachers must be educated on the risks associated with AI, particularly concerning data privacy and security. They need to understand the difference between “open” and “closed” AI models and know what kind of student data is safe to input. They must also learn to identify and mitigate bias in AI-generated content. AI models are trained on vast datasets that may contain societal biases, which can be unintentionally replicated. Teachers must be equipped to fact-check AI outputs, promote critical thinking in students, and ensure the tools are being used ethically and equitably.

Continuous Professional Development and Redefining Teacher Roles:

Providing continuous training opportunities for educators, including personalized courses, virtual assistants, and platforms that keep them updated on technological trends and innovative teaching strategies, is vital. AI-powered virtual assistants can help teachers with a wide range of tasks, from generating personalized lesson plans and quizzes to providing feedback on assignments. Platforms like Khanmigo and Eduaide.Ai are examples of tools that act as a teaching assistant, saving teachers time and reducing workload. Training should help teachers embrace new roles, focusing on human interaction, critical thinking, and social-emotional learning, while leveraging AI for automated tasks.

With AI tools automating tasks like generating lesson plans, creating quizzes, and even grading, teachers are freed from much of the administrative burden. This allows them to focus on the human aspects of teaching that AI simply cannot replicate. Teachers can now dedicate more time to building relationships with students, understanding their individual needs, and fostering their social and emotional development. AI can assist by identifying student emotions or providing personalized plans for SEL, but the human connection remains vital for cultivating empathy, resilience, and collaboration.

Additionally, in an age of readily available information, the teacher's role is not to provide answers, but to teach students how to think critically. Teachers can use AI as a tool for inquiry, challenging students to verify AI-generated information, evaluate its biases, and engage in high-level discussions and debates. This shifts the classroom from a place of knowledge transmission to a hub of critical inquiry. It is important to focus training for teachers should focus on how to use AI as a powerful assistant for repetitive and time-consuming tasks such as

Administrative Efficiency: AI can be used to streamline administrative work, such as drafting emails to parents, organizing student data, and creating reports. This saves teachers hours each week, allowing them to reinvest that time into instructional planning and student interaction.

Personalized Learning: AI platforms can analyze student performance data to identify knowledge gaps and create personalized learning paths. Teachers can use these insights to provide targeted support to struggling students or offer advanced challenges to high-achievers. This augments the teacher's ability to differentiate instruction at a scale that was previously impossible.

3. Contextually Relevant Curriculum and High-Quality Content

For the application of AI to be successful in Africa, it must be supported by **contextually relevant curricula and high-quality content**. This means that educational materials and the AI models that create them must be tailored to local cultures and needs, be of high quality, and be ethically developed.

Local Adaptation

Simply importing AI models and curricula from other countries can be ineffective and even harmful. The most effective educational content is one that reflects the local context. For Africa, this means developing AI curricula that respect diverse cultural values and linguistic diversity, including indigenous languages.

AI models should be trained on African-specific datasets to ensure they can understand local dialects, cultural nuances, and real-world challenges like climate change, agriculture, or public health that are unique to the continent. This approach ensures that AI doesn't just deliver information but delivers it in a way that is relevant and meaningful to the students' lives.

Quality Assurance

Digital resources, platforms, and content must be held to a high standard. **Quality assurance** is critical to ensure that AI-generated educational materials are pedagogically sound, accurate, and aligned with national curricula. Governments can play a key role by implementing **certification initiatives** for digital content. A certification process would involve a rigorous review to verify that the content is accurate, effective, and free of misinformation, providing a seal of approval that educators and parents can trust.

Ethical Content Development

The ethical development of AI for education is paramount. AI models are trained on vast amounts of data, and if this data is biased or of low quality, the AI will produce biased or flawed content. Therefore, AI models used for instructional design must be trained on **high-quality, curriculum-aligned material** that follows best pedagogical practices. This is a proactive step to prevent the replication of outdated, inaccurate, or culturally biased content. Ensuring ethical content development requires a focus on fairness, transparency, and accountability throughout the AI development process, from data collection to final output.

4. Strong Governance and Policy Frameworks

Effective integration of AI in education requires strong governance and policy frameworks. Governments must develop a clear, strategic vision that balances opportunities and risks, while also implementing ethical regulations and fostering collaboration among various stakeholders.

System-Wide Vision and Strategy: Governments need to create a system-wide vision and strategy for AI in education. This involves a comprehensive plan that is tailored to local contexts and balances the benefits of AI with potential risks. This strategy should be based on a thorough analysis of the country's AI readiness, including infrastructure, skills, and resources. Strategic priorities should be established based on a cost-value assessment, ensuring that investments in AI tools are both effective and economically viable for the education sector.

Ethical and Regulatory Frameworks: To ensure the responsible use of AI, governments must implement **comprehensive data protection laws and ethical frameworks**. This is critical for guaranteeing the ethical, non-discriminatory, and equitable use of AI tools and the protection of learners' data. These frameworks should ensure that AI systems are transparent and auditable, meaning their decisions can be explained and verified. A strong model for this is **UNESCO's "Recommendation on the Ethics of Artificial Intelligence,"** which provides a global standard for ethical AI development and deployment.

Interdisciplinary Planning and Collaboration:

The development of effective AI policies cannot be done in isolation. It requires **interdisciplinary planning and collaboration** from a wide range of experts. Governments must mobilize a diverse group of stakeholders, including educators, learning scientists, AI engineers, social scientists, and representatives from civil society and the private sector. This multi-stakeholder approach ensures that policies are well-informed, practical, and address the needs of all parties involved. It also helps in building the capacity of policymakers themselves, so they can better understand and regulate a complex and rapidly changing field.

Education Management Information Systems (EMIS):

A crucial component of this framework is the establishment of **robust, accessible, and AI-powered Education Management Information Systems (EMIS)**. These systems are vital for collecting, organizing, analyzing, and distributing educational data. By using AI, EMIS can provide data-driven insights that support decision-making, optimize resource allocation, and promote equity. For example, an AI-powered EMIS could analyze student performance data to identify schools in need of additional resources or to detect trends that signal a need for curriculum adjustments.

5. Investment in Research and Development (R&D)

Investing in research and development (R&D) is a critical step for African nations to successfully integrate AI into their educational systems. This involves both funding local innovation to create human-centric AI tools and building a robust evidence base to inform policy decisions.

Funding Local Innovation: To create a sustainable and relevant AI ecosystem for education, African countries must prioritize funding local innovation. This means providing grants and attracting corporate investment to support the development



of AI-in-education tools that are specifically designed for African contexts. This approach is essential for several reasons:

- **Cultural Relevance:** Locally developed AI tools are more likely to be trained on diverse datasets that reflect African cultures, languages, and learning styles, making them more effective for students.
- **Economic Growth:** By fostering an environment that supports local research and development, countries can create jobs, build a skilled workforce, and reduce their reliance on foreign technology.
- **Responsible AI:** Local R&D can focus on developing human-centric AI that prioritizes responsible use, data privacy, and ethical guidelines tailored to African social norms.

Building an Evidence Base: To ensure that investments in AI are effective, it's crucial to build a robust evidence base. This is done by funding pilot programs, data-driven assessments, and long-term impact studies. These studies help policymakers understand which AI-supported solutions lead to measurable improvements in learning outcomes. For example, a recent pilot program in Nigeria that used generative AI as a virtual tutor showed significant learning gains, with students performing better on their exams.

This kind of data is invaluable for making informed decisions and scaling up successful initiatives. Without this evidence, there's a risk of investing in technologies that don't effectively address local educational challenges.

6. Public Awareness and AI Literacy

The democratization of artificial intelligence requires a citizenry equipped with fundamental understanding of how AI systems operate, their capabilities, and their limitations. Providing comprehensive AI education to all citizens, particularly targeting those under 50 who are most likely to encounter AI systems throughout their careers and daily lives, represents a critical investment in societal resilience and democratic participation.

Effective AI literacy programs must prioritize the development of critical thinking skills that enable citizens to evaluate AI-generated content and recommendations with appropriate skepticism. This involves teaching individuals to recognize the difference between correlation and causation in AI outputs, understand the role of training data in shaping AI behavior, and identify potential sources of algorithmic bias.

Citizens equipped with these analytical tools become active participants in the AI ecosystem rather than passive consumers of automated decisions. AI literacy education should emphasize the importance of informed consent and responsible engagement with AI systems. This includes understanding the implications of data sharing, recognizing when AI systems are being used in decision-making processes that affect their lives, and knowing their rights regarding algorithmic transparency and appeal processes. Citizens who understand these concepts can make more informed choices about which AI services to use, what data to share, and when to seek human oversight or intervention.

A crucial component of AI literacy involves demystifying artificial intelligence by clearly communicating what AI systems can and cannot do. This education should address common misconceptions about AI consciousness, creativity, and infallibility while explaining concepts such as hallucinations in large language models, the brittleness of machine learning systems outside their training domains, and the ongoing need for human oversight in high-stakes decisions. By understanding these limitations, citizens can maintain appropriate levels of trust and skepticism when interacting with AI systems.

AI literacy programs must include comprehensive education about digital privacy and data rights in the age of artificial intelligence. Citizens should understand how their personal data is collected, processed, and used to train AI systems, as well as their rights under data protection regulations. This knowledge empowers individuals to make informed decisions about privacy settings, data sharing agreements, and the use of AI-powered services while advocating for stronger protections when necessary.

The AI landscape is often characterized by unrealistic expectations fueled by sensationalized media coverage and marketing claims. Effective public education programs actively work to dismantle harmful myths about AI while providing realistic assessments of current capabilities and future prospects. This includes addressing fears about immediate job displacement, clarifying the timeline for artificial general intelligence development, and explaining the difference between narrow AI applications and science fiction portrayals of AI systems.

7. Sustainable Financing and Partnerships

Sustainable financing and partnerships are crucial for the successful and lasting integration of AI into education. This requires long-term financial planning and a collaborative approach involving multiple stakeholders. These stakeholders must include government entities, educational institutions, technology providers, and community organizations working together to create a robust framework for implementation. This collaborative effort will ensure that resources are allocated efficiently, addressing both the technological needs and the educational goals of diverse communities.

Fostering collaboration among diverse stakeholders is essential for effectively integrating AI into education. This includes **governments, educational institutions, technology developers, the private sector, and civil society**. This model allows for the pooling of resources, sharing of expertise, and the development of solutions that are not only technologically advanced but also contextually relevant and equitable. **Governments** set the strategic vision and provide policy frameworks and regulations.

They ensure that AI is implemented ethically, equitably, and in alignment with national education goals while **Educational Institutions** (schools, universities, and research centers) provide pedagogical expertise. They identify specific learning challenges, test new technologies in pilot programs, and provide feedback on what works in the classroom.

The **Private Sector** will need to provide the critical financial investment, technical expertise, and innovation. Corporations can partner with schools to offer resources, mentorship, and real-world learning opportunities, like site visits to a tech company while **Civil Society** organisations, including non-profits and community groups, acts as a crucial link to the communities.

They ensure that AI solutions are inclusive, address the needs of marginalized groups, and promote ethical use and data privacy. This multi-stakeholder approach ensures that the development and deployment of AI in education is not just a technological undertaking, but a collaborative effort that is grounded in local needs and values.

Policy Implications and Recommendations

The application of AI in education across Africa reveals both promise and structural gaps, requiring deliberate policy action to ensure that adoption is equitable, sustainable, and contextually relevant. Governments must first establish clear AI-in-education policies embedded within broader national AI strategies, aligning with the African Union Continental AI Strategy and UNESCO guidance on responsible AI. Such policies should safeguard against risks such as data misuse, algorithmic bias, and exclusion of marginalized learners, while enabling innovation through supportive regulation. Investments in digital infrastructure and electrification are essential, particularly in rural and low-resource settings where adaptive AI solutions can have the greatest impact.

Evidence from Kenya's M-Shule and Nigeria's Edo State pilots illustrates that SMS-based and generative AI tools can be deployed cost-effectively if supported by strong connectivity and data governance frameworks. Teacher empowerment should be central: blended professional development that combines pedagogy and digital competence can enhance teachers' ability to integrate AI into classroom practice. Furthermore, governments and donors must prioritize **local content creation in African languages**, ensuring AI tools reflect cultural and linguistic diversity. Finally, sustainable scaling requires **public—private partnerships** that mobilize EdTech startups, civil society, and international development partners around inclusive AI innovation.

To unlock AI's transformative potential in African education systems, governments and stakeholders must implement a comprehensive strategy that prioritizes human-centered design, ethical governance, and inclusive collaboration across all levels of implementation that hinges on the recommendations below;

1

Develop a System-Wide Vision and Strategic Priorities

African governments must establish a clear, comprehensive vision for AI integration in education that acknowledges both transformative opportunities and inherent risks. This vision should be deeply rooted in local contexts, cultural values, and specific educational needs. For low and middle-income countries, the initial focus should center on conducting thorough AI readiness assessments, identifying critical infrastructure gaps, and securing sustainable funding mechanisms. Strategic objectives must be grounded in evidence-based assessments of current AI readiness levels and the actual capabilities of available AI systems, rather than market hype or unrealistic projections. This approach ensures sustainable implementation and prevents resource misallocation.

2

Establish Robust Ethical, Inclusive, and Equitable Frameworks

Governments must implement robust data protection legislation and regulatory frameworks that guarantee ethical, transparent, and auditable use of student data. These frameworks should integrate privacy-by-design, security-by-design, and ethics-by-design principles from the initial stages of AI system development and deployment. Policy frameworks must proactively address how AI applications can perpetuate or amplify existing biases in educational systems.

All AI tools deployed in educational settings should undergo rigorous bias testing, be trained on diverse and representative datasets, and promote educational practices that value fairness and equity for all learners. Policies must prioritize universal access to AI technologies regardless of gender, disability status, socio-economic background, ethnicity, culture, or geographic location. This requires developing affordable AI technology models, implementing targeted digital inclusion programs, and systematically addressing the digital divide through infrastructure investment and capacity building. In addition, educational authorities must facilitate transparent public discourse on AI ethics, data privacy, and human rights in education.

Special attention must be given to protecting vulnerable populations, particularly children and students with learning difficulties, through age-appropriate consent mechanisms and enhanced safeguarding protocols.

3**Invest in Teacher Training and Professional Development**

Educational systems must continuously assess and redefine teacher roles and competencies within AI-enhanced learning environments. This requires strengthening teacher training institutions and developing comprehensive capacity-building programs that prepare educators to effectively collaborate with AI systems while maintaining their essential human role in education.

As such, educational systems must provide continuous training and technical support for teachers, ensuring they can maintain effective teaching practices even when AI systems experience downtime or technical issues. This includes fostering professional learning communities where educators can share best practices and collaborative problem-solving strategies.

4**Develop Contextually Relevant Curricula and Content:**

Educational authorities must comprehensively review and adapt curricula to enable meaningful AI integration and transform traditional learning methodologies. AI curricula should reflect local contextual and cultural values, including indigenous languages and knowledge systems, while aligning with broader educational objectives and global competency frameworks.

Most importantly, AI systems used for instructional design must be trained exclusively on high-quality, curriculum-aligned, and pedagogically sound materials. All AI-generated educational content must undergo expert human review and validation to ensure accuracy, cultural appropriateness, and educational effectiveness.

5**Strengthen Digital Infrastructure and Education Management Information Systems (EMIS):**

Governments must significantly increase investment in digital infrastructure, including reliable internet connectivity and stable electricity access, to support widespread and sustainable AI deployment in educational settings across urban and rural areas. Educational authorities should explore how AI technologies can enhance Education Management Information Systems (EMIS), making them more robust, accessible, and capable of supporting data-driven decision-making for resource allocation, student progress tracking, and evidence-based policy development.

Implementation strategies must include comprehensive cost-benefit analyses and sustainable funding models that balance immediate deployment needs with long-term maintenance, ongoing training, and continuous adaptation of digital educational ecosystems.



Conclusion

The diagnostic analysis of AI in education in Africa demonstrates a continent at a critical inflection point. Pioneering initiatives—ranging from Kenya’s adaptive platforms and Malawi’s tablet-based foundational programs to Nigeria’s generative AI pilots—illustrate how AI can be harnessed to personalize learning, improve teacher effectiveness, and strengthen data-driven decision-making.

At the same time, systemic challenges persist: connectivity gaps, unreliable electricity, limited teacher digital capacity, fragmented policy frameworks, and inequities that risk leaving behind rural learners, girls, and displaced populations.

The opportunities are nonetheless significant. If strategically deployed, AI can accelerate progress toward SDG4 by expanding access, enabling personalized and inclusive education, and providing governments with real-time insights for better policy and resource allocation.

The African Union’s Continental AI Strategy provides a unifying policy frame, but successful implementation will depend on **country-level investment, coordinated partnerships, and robust safeguards for ethics and data protection. In sum, AI is neither a silver bullet nor a marginal add-on**; it is an emerging system-shaping force. Africa’s task is to ensure AI adoption in education is **context-sensitive, equity-driven, and future-oriented**, turning today’s pilots and innovations into scalable solutions that prepare learners and teachers for the demands of a digital age.

NOTICE

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