ARTIFICIAL INTELLIGENCE AND THE NIGERIAN EDUCATIONAL SYSTEM: BENEFITS, CHALLENGES AND WAY FORWARD

Ebighigbo Mary Madona and Iyanda Adisa Bolaji
Department of Health Education, University of Ibadan, Ibadan

Abstract
AI is a computer system that performs task typically requiring human intelligence for leaning, problem solving and decision making. AI technologies, such as intelligent tutoring systems, alleviate pressures by offering personalized tutoring and feedback, allowing teachers to address the diverse needs of students more effectively, enhance educational quality and contribute to the achievement of broader goals for sustainable development. AI in Nigeria educational system has potentially improved students learning outcomes, enhance teacher skills and promote environmental awareness. It analyses large data sets from students' interactions, identify trends, strengths and areas for improvement, improving educators insights to develop or refine sustainability focused curricula, enhance accessibility, making sustainability education more inclusive for global audience. It is a potential solution to several challenges facing the education system that have long hindered the quality of education countries of the world. Through AI-powered virtual simulations and interactive modules, teachers and health educators do gain practical experience that ensures a safe and controlled environment for learning. Continuous professional of teachers in utilisation of AI and other technologies development should be introduced in the country to empower teachers.

Key Words: Artificial intelligence, Educational system, Benefits, Challenges

Introduction

Artificial intelligence (AI) has become an integral part of our lives, transforming the way we live, work and interacts with one another, including health, education of life aspects. Artificial Intelligence (AI) has emerged as a transformative force across various sectors, including education, offering innovative solutions to complex challenges. AI in Education is revolutioning education by personalizing learning platforms that adapt to individual student needs, intelligent tutoring system and tools that automate administrative tasks like grading to free up educators time. In a world where information overload can be overwhelming, AI steps in as the superhero, cutting through the chaos with its super human ability to analyze, process, and deliver personalized health education with ease. Gone are the days of relying solely on textbooks or waiting for doctor's appointments to get the lowdown on our health concerns. It provides a virtual guardian, offering instant and reliable accessible information that empowers us to make informed decisions, helping to promote continuous learning and adaptability.

In an era marked by rapid technological advancements, Artificial Intelligence (AI) stands out as a transformative force, revolutionizing sectors across the globe with

education being no exception. From adaptive learning platforms and intelligent tutoring systems to automated grading and predictive analytics, AI is reshaping pedagogical approaches, administrative processes and student engagement. These innovations offer promising opportunities for enhancing learning outcomes, improving access and supporting educators including health educators in delivering more personalized instruction (Okanlawon et al, 2025). However, as AI's influence expands, it becomes increasingly important to examine its implementation within diverse socio-economic and cultural contexts. While much of the global discourse is centred on developed nations, the unique challenges and opportunities in emerging regions such as Africa particularly Nigeria demand focused attention.

Nigeria, with its large and youthful population, faces persistent issues including inadequate infrastructure, teacher shortages, uneven access to quality education and regional disparities in digital literacy and connectivity. The integration of AI into Nigeria's education sector presents both a formidable challenge and a transformative opportunity. On one hand the country's limited technological infrastructure and policy gaps could hinder the effective deployment of AI tools. On the other hand strategic implementation of AI could help bridge gaps in teacher availability, personalize learning in overcrowded classrooms and offer scalable solutions to address educational inequities across urban and rural areas.

Policy makers need to implement AI solutions that are not only innovative but also ethical, inclusive and sustainable. By offering a comprehensive review of current developments, this paper provides valuable insights that can inform strategic planning, policy formulation and technology deployment. It also contributes to the broader academic discourse by emphasizing the importance of context-aware, evidence-based AI integration in education serving as a resource for future research, curriculum development and capacity building in Nigeria and other comparable settings. Zawacki-Richter et al. (2019). The rapid advancement of technology has created a paradigm shift in various sectors globally, and the education sector is no exception. In Nigeria, the integration of Artificial Intelligence (AI) into education has emerged as a potential solution to several challenges facing the education system, such as, inadequate infrastructure, large class sizes, lack of qualified teachers, and unequal access to educational resources, which have long hindered the quality and inclusivity of education in the country. Despite efforts made by the Nigerian government and other stakeholders to improve educational outcomes through various reforms, the country continues to face significant challenges in achieving the goals set under Sustainable Development Goal (SDG). However, ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all will surely address these issues (United Nations, 2020).

Artificial Intelligence, is often referred to as the simulation of human intelligence in machines, has been recognized for its transformative potential in addressing educational challenges worldwide. In recent years, Artificial Intelligence (AI) technologies such as machine learning, natural language processing, and robotics have gained attention for their ability to revolutionize teaching and learning processes (Oni., 2021). Artificial Intelligence(AI)'s applications in education are vast, ranging from personalized learning

platforms that cater for individual student needs, automated administrative tasks, to Artificial Intelligence(AI) driven tools that support teachers in assessment, feedback, and instructional design (Eze and Ani, 2023). Globally, Artificial Intelligence (AI) has been adopted in various educational settings to enhance the quality of education, improve access to learning, and foster innovation. In Nigeria, where educational disparities are prevalent across urban and rural areas, Artificial Intelligence (AI) holds significant promise in improving both access to and quality of education. Research shows that a large portion of the Nigerian population lacks access to quality education due to issues such as poor infrastructure, inadequate teaching materials, and lack of qualified educators in certain regions (Olatunji & Adebayo, 2022). Artificial Intelligence (AI) offers an opportunity to bridge this gap by providing personalized learning experiences, offering support to educators, and reducing the administrative burden on schools, allowing teachers to focus on more impactful aspects of their work (Alabi & Olufunke, 2023). Furthermore, the Nigerian government has recognized the importance of technology in the educational sector, evidenced by the introduction of initiatives like the National Policy on Information and Communication Technology (ICT) in Education, which aims to promote digital literacy and integrate ICT into the national curriculum (FRN, 2018). However, despite these efforts, there is a noticeable lag in the widespread adoption of Artificial Intelligence (AI)-driven educational technologies.

According to Akpan et al., (2022) and Okanlawon et al., (2025), a major challenge remains the lack of technological infrastructure, particularly in rural and underdeveloped areas, where the absence of reliable internet access, electricity, and computing devices hampers the effective use of Artificial Intelligence (AI) in education. In addition to infrastructure challenges, Nigerian education system faces issues of overburdened teachers, outdated curriculum content, and a lack of professional development opportunities for educators. Artificial Intelligence(AI) technologies, such as intelligent tutoring systems, can alleviate some of these pressures by offering personalized tutoring and feedback, allowing teachers to address the diverse needs of their students more effectively (Olaniyi &Adefolalu, 2021). Also, Artificial Intelligence (AI) has the potential not only to enhance educational quality but, contribute to the achievement of broader goals for sustainable development, which is a key consideration for policymakers, educators and other stakeholders. Despite these opportunities, the integration of Artificial Intelligence (AI) in Nigerian education is fraught with barriers, including resistance to change, lack of expertise in Artificial Intelligence (AI) among educators, and concerns around data privacy and security (Adewale & Adeyemi, 2023). Additionally, there is need for regulatory frameworks to guide the ethical use of Artificial Intelligence (AI) in education and to ensure that it benefits all segments of society, particularly marginalized groups who may be excluded from the digital divide.

AI systems are trained on datasets from Western contexts which can introduce algorithmic bias when deployed in African settings. For example, speech recognition systems may struggle with Nigerian accents or indigenous languages due to underrepresentation in training data (Adeleke, Adewumi, & Osoba, 2023). Such limitations can result in unfair or inaccurate outcomes for students. Additionally, the opaque nature of

AI decision-making often referred to as the "black box" problem raises concerns about transparency and accountability. Educators and students may be unable to interpret how AI arrives at conclusions, which can undermine trust in these systems (Jobin, Ienca, &Vayena, 2019). Addressing these concerns will require the development of ethical AI guidelines tailored to Nigeria's educational and cultural context. Limited Infrastructure and Digital Divide AI implementation in education relies heavily on stable internet access, electricity and availability of digital devices and resources that remain unevenly distributed across Nigeria. According to the Nigerian Communications Commission (2023), only about 45% of the population has access to broadband internet with rural and underserved regions facing the most significant deficits. This digital divide continues to hinder the deployment of cloud-based AI systems and online learning platforms, reinforcing pre-existing educational inequalities. Table 1 Applications of Educational Levels in Sub-Saharan Africa Education Level AI Applications Key Challenges Primary NLP literacy tools, voice-based tutors Language Future Directions barriers, limited infrastructure Secondary Adaptive learning Localized content, mobile-based AI Scalable platforms, assessment tools Tertiary Learning analytics, AI powered tutoring/admin Teacher training gaps, digital divide Data low-cost solutions, teacher-AI synergy privacy, algorithmic bias, tech gaps Explainable institutional AI, policy alignment This table summarizes the typical AI use cases, key implementation challenges, and potential future directions across primary, secondary and tertiary education levels in the African context. It highlights context-specific barriers and opportunities for scalable AI adoption. Frequent power outages further compound the issue. Many schools, particularly in rural areas lack reliable electricity, which disrupts access to AI-powered tools and limits the development of digital literacy skills (World Bank, 2022). As a result, even when AI-based solutions are available their effectiveness is curtailed by infrastructural constraints.

Bridging this gap requires strategic investments in digital infrastructure, particularly in underserved regions as well as inclusive policies that ensure equitable access to emerging educational technologies. Teacher Preparedness and Resistance A major barrier to AI integration in Nigerian education is the lack of teacher preparedness. Many educators lack the technical knowledge and pedagogical training required to effectively implement AI tools in the classroom. A study by Omodan and Ige (2021) found that while teachers acknowledge the potential of AI in enhancing learning, most are unfamiliar with its practical application in teaching and assessment. There is also resistance among educators, often rooted in fears that AI could replace human teaching roles or diminish professional autonomy. This concern is particularly prevalent in public schools where exposure to educational technology is already limited. To ensure AI adoption is both effective and sustainable, it is crucial to reposition AI as a supportive tool rather than a replacement. Professional development programmes, in-service training and national policies promoting AI literacy among educators are essential steps in this direction (Okoye & Ekechukwu, 2022).

The high cost of acquiring, deploying and maintaining AI technologies remains a significant challenge, particularly for public schools and low-income communities in Nigeria. While some private institutions have begun to integrate AI-enhanced tools into

their educational systems, many public schools continue to struggle with basic teaching resources making the implementation of advanced technologies a lower priority. Beyond initial investments, AI systems require ongoing costs related to software updates, infrastructure maintenance and technical support expenses that are often overlooked in educational budgets. Without sustained funding these technologies risk becoming short-lived pilot projects with limited long-term impact. International organizations such as UNICEF and UNESCO have supported some AI-based education initiatives in Nigeria, but their scalability remains constrained in the absence of strong government commitment and private sector collaboration (UNESCO, 2022). A sustainable approach will require coordinated investment strategies and policies that prioritize long-term infrastructure and capacity-building in the education sector. Most AI-based educational tools are developed in English and are often grounded in Western pedagogical frameworks. This presents a significant challenge in a multilingual country like Nigeria, where over 500 indigenous languages are spoken. AI systems that fail to reflect local linguistic and cultural realities risk alienating learners and limiting their effectiveness (Ezeani et al., 2022).

For example, speech recognition tools and intelligent tutoring systems may struggle with Nigerian accents or fail entirely to support indigenous languages such as Yoruba, Hausa and Igbo. This linguistic mismatch can exclude students in rural or non-English-dominant regions, further widening educational disparities. Additionally, cultural perceptions of technology, shaped by religion, tradition and socioeconomic status, influence how AI tools are received and adopted. To promote inclusive use, AI systems must be localized linguistically, culturally and contextually to align with Nigeria's diverse educational environment.

Benefits of AI to Nigeria Educational System

Adaptive Learning Platforms: This has become a cornerstone of personalized education globally using AI algorithms to adjust content delivery based on real-time student performance and learning patterns. These systems promote individualized learning experiences by allowing students to engage with material at their own pace, making them particularly valuable in contexts characterized by overcrowded classrooms and limited teacher-student interaction (Pane et al., 2017).

In Nigeria, the adoption of adaptive learning systems is gradually gaining momentum, particularly in private schools and tertiary institutions equipped with reliable digital infrastructure (EduTech Nigeria, 2023). The platform has been deployed in various state-backed education initiatives, aiming to bridge learning gaps exacerbated by socio economic disparities. Despite these advances, scalability remains a critical challenge. Many public schools, especially in rural and underserved areas, face infrastructural limitations including erratic power supply, inadequate ICT equipment and poor internet penetration (Aminu et al., 2022).

These barriers severely restrict equitable access to adaptive learning tools. Furthermore, teacher preparedness and digital literacy are often insufficient to support effective implementation of such technologies in classroom settings (Omoera&Obayelu,

2021). To address these disparities, public-private partnerships and government-led digital education programmes are increasingly being promoted. However, these efforts must be complemented by sustained investments in infrastructure, teacher training and localized content development to ensure that adaptive learning platforms can benefit all learners across Nigeria, not just those in well-resourced environments.

Automated Assessment and Feedback

AI automates the grading of assignments, quizzes, and projects related to sustainability topics, providing immediate and detailed feedback to students (Heffernan & Heffernan, 2014). Examples include platforms like Grade scope help evaluate complex sustainability essays and problem-solving tasks. Artificial Intelligence is increasingly being explored as a tool to streamline assessment and provide timely data-driven feedback to both learners and educators. Globally, AI-based assessment tools are widely used for grading multiple-choice tests, providing instant feedback and even evaluating short-answer or essay responses through natural language processing (NLP) techniques (Deeva et al., 2021; Luckin et al., 2016). These systems promise greater consistency, reduced grading time and insights into learner progress over time. In Nigeria, the use of AI for assessment remains in its nascent stages.

These innovations are particularly aimed at primary and secondary education sectors where access to computers is low but mobile phone penetration is high (GSMA, 2022). Looking ahead, there is significant potential to integrate AI-based continuous assessment mechanisms into standardized testing frameworks such as WAEC (West African Examinations Council) and JAMB (Joint Admissions and Matriculation Board). Doing so could help mitigate challenges like human grading biases, long result processing times and inconsistencies in marking standards (Okebukola, 2020). AI-driven Assessment and Feedback

AI-Powered Administrative Tools Beyond classroom applications, Artificial Intelligence is playing an increasingly vital role in educational administration, offering tools that automate routine tasks and support data driven institutional management. Globally, AI solutions are being used for grading, timetable scheduling, admissions processing, performance tracking and resource allocation, reducing human workload and increasing operational efficiency (Zhao & Wong, 2020; Holmes et al., 2022). In Nigeria, adoption is still in the early stages but gaining traction, particularly in private and federal universities. Exploring AI-enhanced systems for automated scheduling, student performance analytics and attendance monitoring (Ajayi & Adetunji, 2022). These tools help administrators make faster, more accurate decisions regarding academic planning, faculty workload and learner support services. AI-powered dashboards are also being piloted in teacher education programmes to monitor student progress and flag at-risk learner's early, enabling intervention before failure occurs (Nwachukwu & Okeke, 2021). In addition, AI is being used to predict student attrition and recommend personalized academic support plans and especially valuable function in Nigeria's resource-constrained institutions where student-to-advisor ratios are often high. However, the expansion of these tools faces

several constraints. Issues such as data privacy, digital infrastructure gaps, and limited AI literacy among administrators remain significant barriers (Aina & Bello, 2023).

Personalized Learning

Artificial Intelligence can provide tailored instruction to individual student needs, abilities, learning styles and learning experiences for students based on their individual needs, preferences, and progress. For example, adaptive learning platforms use Artificial Intelligence algorithms to identify knowledge gaps and suggest customized learning paths, enabling students to better understand sustainability concepts at their own pace (Holmes et al., 2019) (Chen & Li,2023). Personalized and Inclusive Learning Personalized learning driven by artificial intelligence is transforming the educational experience by adapting content and instruction to individual learners' needs, pace and preferences. AI analyze learner behaviour, assess competencies and recommend tailored learning paths thereby increasing engagement and reducing dropout rates (Bulger, 2016; Holmes et al., 2022). In resource-constrained settings such as Nigeria, where classrooms are often overcrowded and under-resourced, the value of personalization becomes even more pronounced. In recent years, AI-powered educational tools such as uLesson and Mavis Talking Books have emerged as prominent examples of personalized learning in Nigeria. These platforms leverage AI algorithms to deliver curriculum-aligned content, adaptive quizzes and data-driven insights into student progress. uLesson for instance, uses machine learning to recommend lessons based on learners' performance, while Mavis Talking Books integrate voice-based interaction, making learning accessible for early readers and learners with low literacy skills (Adepoju et al., 2022). AI has also made inroads into inclusive education initiatives, especially through educational radio programmes and mobile-based learning, which are widely used in rural and underserved areas.

Intelligent Tutoring Systems and Stimulation-Based Education

AI-based tutoring system provided one-on-one supports to students, freeing up human teachers to focus on more complex tasks. It guides students through sustainability topics by providing instant feedback and explanations. These systems simulate one-on-one tutoring experience, which has been shown to enhance learning outcomes (Woolf, 2020). AI-powered stimulation system can also provide students with realistic and interactive learning experience, enhancing their skills and decision-making ability and it has gained momentum across global educational landscapes, showing promising results in enhancing student learning outcomes (Kim et al., 2023)

Data-Driven Insights for Curriculum Design

Artificial Intelligence analyses large data sets from students' interactions to identify trends, strengths and areas for improvement. Educators can use these insights to develop or refine sustainability focused curricula (Zawacki-Richter et al., 2019).

Examples include Artificial Intelligence analytics platforms like Edmodo Insights help educators track engagement with sustainability content.

Gamification and Simulations

Artificial Intelligence enables immersive simulations and gamified learning experiences that make sustainability education engaging. For example, AI powered serious games simulate real-world sustainability challenges, allowing studen"SimCity EDU" teach urban planning with sustainability principles to explore solutions in a risk-free environment (Johnson et al., 2021). It helps students with immersive learning environments powered by intelligent systems. These platforms use adaptive algorithms to personalize simulations and game-based experiences based on learners' behaviour and performance. Technologies like virtual and augmented reality, when combined with AI, can create engaging and culturally relevant simulations especially for subjects such as science, history, and civic education. While high-end solutions may seem out of reach in some Nigerian contexts, developers are already exploring mobile-friendly, low-bandwidth alternatives. These include WhatsApp based learning bots and gamified quizzes designed for basic devices with limited internet access.

Predictive Analytics for Student Engagement

Artificial Intelligence predicts student engagement levels and flags at-risk learners. Educators can then intervene to ensure students remain engaged in sustainability courses (Nguyen et al., 2018). Examples are Artificial Intelligence systems in platforms like Blackboard Learn use predictive models to enhance retention in environmental studies programmes.

Artificial Intelligence (AI)-Powered Language Translation and Accessibility

Artificial Intelligence tools like Google Translate and Microsoft Immersive Reader break language barriers and enhance accessibility, making sustainability education more inclusive for global audiences (Wu et al., 2020). Examples are real-time translation helps disseminate sustainability knowledge in regions where resources are not available in local languages.

Virtual and Augmented Reality for Experiential Learning

Artificial Intelligence enhances virtual and augmented Reality technologies to provide hands-on experiences in sustainability. Students can explore ecosystems, understand renewable energy systems, or model the effects of climate change in virtual environments (Freina& Ott, 2015). Example: Artificial Intelligence (AI)-powered VR tools like "Eco Learn" immerse students in environmental scenarios.

Automated Assessment and Feedback

AI automates the grading of assignments, quizzes, and projects related to sustainability topics, providing immediate and detailed feedback to students

(Heffernan & Heffernan, 2014). Examples include platforms like Grade scope help evaluate complex sustainability essays and problem-solving tasks.

Artificial Intelligence in Research Support

Artificial Intelligence tools assist students and researchers in sustainability fields by analysing data, suggesting resources, and generating reports. For example, natural language processing (NLP) tools summarize large data sets and academic papers (Mihalcea &Tarau, 2004)(Smith & Johnson,2024). Example: Tools like Zotero and Mendeley leverage AI to organize and reference sustainability research.

Behavioural Nudging

Artificial Intelligence applications in sustainability education use nudging techniques to encourage environmentally friendly behaviors among students. For example, AI chatbots send reminders to conserve resources or participate in green initiatives (Thaler & Sunstein, 2008). Example: Chatbots like Replika can promote daily eco-friendly habits.

Addressing Teacher Shortages

Nigeria has one of the highest teacher-to-student ratios globally, leading to overcrowded classrooms and poor learning outcomes (UNESCO, 2021) .Artificial Intelligence (AI) can mitigate this challenge by automating administrative tasks. The challenges include inadequate access to quality education, teacher shortages, high dropout rates, and an over-reliance on traditional teaching methods. Integrating Artificial Intelligence (AI) into the educational system could provide innovative solutions that enhance accessibility, inclusivity, and sustainability.

Challenges of Artificial Intelligence on Nigeria's Educational System

Artificial Intelligence holds immense potential to address some of the most pressing educational and developmental challenges in Nigeria. These challenges include inadequate access to quality education, teacher shortages, high dropout rates, and an over-reliance on traditional teaching methods. Integrating Artificial Intelligence (AI) into the educational system could provide innovative solutions that enhance accessibility, inclusivity, and sustainability.

Job Displacement, Bias and Equality

The increase use of AI in Nigeria educational system may displace human teachers, particularly in areas of where tasks are repetitive or routine and AI systems can perpetuate existing biases and inequalities in education, exacerbating existing problems

Dependence on Technology and Cyber Security Risk
Reliance on mostly AI-powered tools can lead to lack of critical thinking and problem-solving skills in students and also educational systems can be vulnerable to cyber-attacks, compromising student data and safety.

Bridging Access to Education
Nigeria faces significant disparities in access to education, especially in rural areas where infrastructure and teacher availability are limited. Artificial Intelligence (AI)-powered solutions, such as adaptive learning platforms, can help bridge this gap by delivering personalized learning experiences to students irrespective of their location. For instance, Artificial Intelligence (AI) Artificial Intelligence based tools like chatbots and virtual tutors can provide on-demand support, helping students learn at their own pace (Luckin et al., 2016). Moreover, these platforms can be designed to function offline, ensuring that students in areas with limited internet connectivity can still benefit.

Conclusion
Artificial Intelligence offers innovative solutions to long-standing issues by improving access to education, enhancing quality and promoting inclusivity, as well as fostering lifelong learning, aligning education with industry demands and support data-driven policymaking for sustainable development. AI enhances health and skills of student and ensures a safe and controlled environment for learning. It has the potentials to transform education, but it requires careful consideration of the challenges and complexities involved.

Artificial Intelligence is reshaping the educational landscape globally, offering transformative potential for personalized learning, inclusive education and data-informed pedagogy. As this review has demonstrated, AI applications such as Intelligent Tutoring Systems and adaptive learning platforms are enabling more responsive and effective teaching and learning practices. These innovations are not limited to high-income countries, Nigeria in particular, is beginning to witness the emergence of localized and impactful AI-driven educational solutions. However, substantial challenges remain. Infrastructure deficits, digital inequality, teacher preparedness, data privacy concerns and the lack of comprehensive regulatory frameworks continue to hinder large-scale adoption. In addition to these implementation barriers, this review identifies several key research gaps including the need for localized AI systems, empirical impact studies, ethical policy design, and scalable solutions for underserved regions. Looking ahead, the future of AI in education must be grounded in ethical, inclusive and locally relevant approaches.

Nigeria has a unique opportunity to leapfrog traditional educational limitations by investing in AI solutions that align with its sociocultural and economic realities. Key steps include implementing national AI education policies, promoting AI literacy in teacher training, fostering public-private partnerships and encouraging homegrown research and innovation. Ultimately, AI should be viewed not as a replacement for educators, but as a powerful ally enhancing human capabilities and supporting equitable, lifelong learning

opportunities. If approached thoughtfully, Artificial Intelligence can be a catalyst for bridging educational gaps and empowering a new generation of learners across Africa and beyond. The study therefore recommended the following;

i. Government should invest in infrastructure, capacity building, and the development of ethical and inclusive policies, through strategic implementation. Comprehensive policies should be established to govern the ethical and inclusive use of AI in education, ensuring that no group is left behind in its implementation.
ii. Schools and Universities should introduce AI related courses to equip students with skills relevant to the digital age and foster awareness of AI's applications in various sectors. Adequate funding should be allocated to provide schools with the necessary technology, such as computers, internet access, and AI-enabled tools, to bridge the digital divide between urban and rural areas.
iii. Investigate the development and effectiveness of AI tools adapted to local languages, cultural contexts and pedagogical norms in Africa as well as exploring how educators can work synergistically with AI systems to enhance instructional delivery while maintaining professional autonomy.
iv. Examine gaps in existing regulatory frameworks and propose comprehensive policy guidelines for the ethical implementation of AI in education across African countries and assess the potential of mobile-friendly, low-bandwidth AI innovations to improve learning outcomes in rural and underserved communities.
v. Professional development programmes should be introduced to help educators understand and effectively use Artificial Intelligence (AI) applications in teaching and learning. Partnerships between technology companies and schools should be encouraged to provide AI solutions, resources, and technical support tailored to Nigeria's educational needs.
vi. Developers should design Artificial Intelligence (AI) systems that address Nigeria's unique challenges, such as multilingual education, by incorporating local languages and contexts into the software. Regular assessments should also be conducted to measure the impact of AI in education, ensuring that implementation aligns with national goals for sustainability and development.
vii. Implementing robust regulations and guidelines: Government should encourage the development and deployment of AI systems that prioritize environmental sustainability and reduce waste.
viii. Developing transparent and explainable AI systems, investing in teacher training support and continuously monitoring and evaluating AI-powered systems.
ix. Investing in AI literacy and training. It should be ensured that educators and health professionals are equipped to work effectively with AI-powered tools.
x. Promoting environmental sustainability, government should encourage the development and deployment of AI systems that prioritize environmental sustainability and reduce waste.

xi. Promoting environmental sustainability, encouraging the development of AI systems that prioritize environmental sustainability and reduce waste.

xii. Conduct long-term empirical studies evaluating the outcomes and sustainability of AI-based interventions in public and low-resource educational setting

xiii. Provide funding and infrastructure for AI-based tools in public schools. Public-private partnerships (PPPs) and international collaborations will be key in building the financial and technical capacity required to scale AI across Nigeria's educational ecosystem.

References

Adewale, A. A., & Adeyemi, B. S. (2023). Artificial Intelligence in Nigerian education: opportunities and challenges. *Nigerian Journal of Educational.* Vol.7 No.1,2025, 151-155

Akpan, E. U., Udofia, U. E., & Eze, M. C. (2022). The impact of technology on education in Nigeria: the case for Artificial Intelligence (AI). *Education and Development Journal*, 12(4), 134-148.

Alabi, A. M., & Olufunke, O. A. (2023). Revolutionizing Nigerian Education with AI: challenges and prospects. *International Journal of Educational Research*, 9(1), 45-56.

Adepoju, O. A., Oladejo, B. A., & Akinyemi, A. A. (2022). Leveraging mobile AI applicationsfor personalized learning in Nigeria: A case study of uLesson and Mavis Talking Books. *African Journal of Educational Technology*, 9(1), 41–55.

Aina, O. B., & Bello, S. A. (2023). Ethical implications of artificial intelligence adoption inNigerian universities. *African Journal of Educational Management*, 21(2), 33–48.

Ajayi, A. O., & Adetunji, O. O. (2022). Digital transformation in Nigerian higher education: The role of AI-powered administrative systems. *Nigerian Journal of Educational Administration and Planning*, 12(1), 56–72.

Ali, O. , Abdelbaki W., Shrestha A., Elbasi E., Alryalat M. A. A., & Dwivedi Y. K. 2023. "A Systematic Literature Review of Artificial Intelligence in the Healthcare Sector: Benefits, Challenges, Methodologies, and Functionalities." *Journal of Innovation & Knowledge* 8(1) 33-47.

Aminu, A. U., Ahmed, A., & Suleiman, S. (2022). Digital infrastructure challenges in Nigeria's education sector: A rural-urban comparison. *Journal of African Educational Research Network*, 12(1), 45–58.

Bulger, M. (2016). Personalized learning: The conversations we're not having. Data & Society Research Institute. https://datasociety.net Cohen, G., & Tso, M. (2022). The role of AI in assessment and personalized learning: A global overview. *Educational Research Quarterly*, 41(3), 72–85

Chen .L. et al., (2023) Artificial intelligence in health education: A review of the recent literature. *International Journal of Artificial Intelligence in Education*, 33(1), 1-25

China.Chin Press Ltd National Bureau of Statistics (2021). Poverty and Inequality in Nigeria 2021.Statistical Report

Climate Change (2021). The Physical science basis. Intergovernmental Panel on Climate change. IPCC Report.UK

Cordeschi, R. (2007). AI Turns Fifty: Revisiting its origin. Retrieved fromhttps://doi.org/1080/08883951070125304

Deeva, N., Zia, H., & Kalra, S. (2021). Intelligent systems for automated assessment in education: A review of trends and challenges. *International Journal of Educational Technology in Higher Education*, 18(1), 1–16.

EduTech Nigeria. (2023). Roducate: Bridging learning gaps with technology. https://www.edutech.ng Ezeani, I., Ijoma, L., & Nwachukwu, M. (2022). Cultural considerations in AI applications for education in Nigeria. *International Journal of Educational Technology*, 9(4), 234–249.

Eze, M. C., & Ani, P. F. (2023). AI-driven personalized learning and teacher support in Nigerian classrooms. *Journal of African Educational Technology*, 5(2), 12-27.

Federal Republic of Nigeria (2018). National Policy on Information and Communication Technology in Education. Federal Ministry of Education, Lagos:

GSMA. (2022). The Sub mobile economy: -Saharan https://www.gsma.com/mobileeconomy/sub-saharan-africa/ Africa 2022. Hennessy, S. (2010). Teacher factors influencing classroom use of ICT in Sub Saharan Africa. Itupale Online Journal of African Studies.

Heffernan, N. T., & Heffernan, C. L. (2014). The Assessments ecosystem: building a platform that brings scientists and teachers together for minimally invasive research on human learning and teaching. *Journal of Educational Studies*,5(2) 45-65

Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial Intelligence in education: promises and implications for teaching and learning. *Journal of Educational Studies*,6(2) 67-87

Holmes, W., Bialik, M., & Fadel, C. (2022). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign. Huang, W., & Liu, X. (2021). AI and education: Global trends and challenges. *Journal of Global Education*, 19(1), 100–115

Ighodaro, C. et al. (2021). Renewable energy for sustainable development in Nigeria. *Energy Policy Journal*,4(2)34-49 IPCC (2021).

Johnson, L., et al. (2021). Gamification for sustainability: engaging learners in real-world challenges.UK.Lon Press

Kim .J. (2022). The effects of A-powered learning systems on students critical thinking and problem-solving skills in health education. *Journal of Educational Computing Research*, 67 (4), 14-28

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An Argument for AI in Education.

NERDC. Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education. *Journal of Educational Studies*,4(2) 34-56

Nguyen, A., Gardner, L., & Sheridan, D. (2018). "A multi-method evaluation of AI Applications in education." *Computers & Education Journal*,5(2) 126, 1-17.

Nguyen, H., et al. (2018). Predictive analytics in education: data-driven approaches to student engagement. *Nigerian Journal of Educational Psychology*,8(2) 71-98 NSIP (2020). National social investment programme. USA. Annual Report.

Nwachukwu, C. U., & Okeke, C. I. O. (2021). AI-based academic analytics for student retention in Nigerian universities. *International Journal of Education and Development Using ICT*, 17(2), 19–34.

Odeyemi, O., &Ogunseitan, O. (1985). Petroleum industry and its pollution potential in Nigeria. Environmental Pollution Series B. Lagos, Nigeria

Okanlawon, A. J., Moronkola, O. A., & Iyanda, A. B. (2025). AI-Driven Healthcare: Assessing the Impact of Artificial Intelligence in Health Education, Health Promotion and Health Management of Athletes. *Nigerian School Health Journal*, *37*(2). Retrieved from https://journal.shepan.org/index.php/NSHJ/article/view/202

Okebukola, P. (2020). Redesigning assessment practices in Nigeria's higher education using artificial intelligence. *Council for the Regulation of Education in Nigeria (COREN) Policy Brief Series*, 3(2), 1–12.

Olaniyi, O. P., &Adefolalu, O. B. (2021). Artificial Intelligence in Nigerian educational systems: Teachers' Perspectives. *Nigerian Journal of Educational Psychology*, 8(4), 56- 70.

Olatunji, S. A., & Adebayo, B. I. (2022). Barriers to educational access and technology in Nigeria: the role of Artificial Intelligence. *Journal of Educational Development Studies*, 10(3), 222 235.

Omoera, O. S., & Obayelu, A. E. (2021). Integrating ICT in Nigerian secondary schools: Prospects and challenges for adaptive learning. *Nigerian Journal of Educational Technology*, 18(2), 33–49.

Oni, I. T., Akinyele, O. D., &Fasanya, A. O. (2021). Global trends in AI education: lessons for Nigeria. *Journal of Global Education and Innovation*, 6(1), 103-116.

Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2017). Informing progress: Insights on personalized learning implementation and effects. RAND Corporation.

Pearson. McKinsey & Company. (2020). The Future of Work in Africa: Embracing Technology for a Prosperous Future. McKinsey & Company. USA Mihalcea, R., &Tarau, P. (2004). Text rank: bringing order into texts.

Sam Kayode, C. O., Ojo, S. T., & Aliyu, R. T. (2023). Assessment of level of digital literacy among science teachers at the junior secondary schools in Ibadan, Oyo State, Nigeria. *Papers in Education and Development*, 41(2).

Smith.P. et al (2024). A-powered adaptive learning in health education: A systematic review. *Journal of Educational Computing research*, 70 (4), 419-437

Thai Press Transparency International (2023). Corruption perceptions index 2023. Transparency International Report

Thaler, R.,& Sunstein, C. (2008). Nudge: improving decisions about health, wealth, and happiness. USA.

UNESCO Report UN-Habitat (2019). Urbanization in Nigeria: challenges and Opportunities. 'UN' Report United Nations (2015). Transforming our world: the 2030 agenda for sustainable development.

UNESCO. (2021). Global education monitoring report: inequality in education. United Nation Report United Nations. (2020). Transforming Education: the role of technology and innovation in achieving the SDGs. United Nations Education and Research Group.

Woolf, B. P. (2020). Building intelligent interactive tutors: student-centered strategies for revolutionizing e-learning. India, Indiana Press Ltd

World Bank (2022). Energy access in Sub-Saharan Africa: Nigeria country profile.

World Bank Report World Bank. (2020). Inclusive education: the role of technology insupporting marginalized Learners.

World Bank Report Wu, D., et al. (2020). AI-powered language translation and its impact on education.

Zawacki-Richter, O. , Marín V. I., Bond M., and Gouverneur F. 2019. "Systematic Review of Research on Artificial Intelligence Applications in Higher Education: Where Are the Educators?." *International Journal of Educational Technology in Higher Education* 16,(1): 1–27.

Zawacki-Richter, O., et al. (2019). Systematic review of research on artificial intelligence applications in higher education. India, Indiana Press Ltd

Zhao, Y., & Wong, A. (2020). Transforming school administration with AI: A globalperspective. *Educational Technology Research and Development*, 68(5), 2251–2266.