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Research Article

Application of Artificial Intelligence (Ai) in Enhancing Inclusive Education in Nigeria

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Abstract

The study explores the application of Artificial Intelligence (AI) in enhancing inclusive education in Nigeria, with emphasis on its potential to address challenges faced by learners with diverse needs. Inclusive education seeks to provide equal learning opportunities for all students regardless of their physical, intellectual, social, or linguistic differences. However, in Nigeria, the implementation of inclusive practices has been hindered by inadequate infrastructure, limited teacher training, funding constraints, and socio-cultural barriers. This paper examines how AI technologies such as adaptive learning platforms, intelligent tutoring systems, speech-to-text and text-to-speech tools, predictive text, and AI-driven analytics can be leveraged to foster inclusivity, improve access for learners with special needs, and support teachers through data-driven insights and automated processes. The study highlights the transformative benefits of AI, including personalized learning, democratization of education in rural areas, enhanced teacher support, improved accessibility for students with disabilities, and real-time feedback systems. Despite these benefits, critical challenges such as infrastructural deficits, high implementation costs, weak policy frameworks, teacher unpreparedness, and digital inequality continue to impede the full adoption of AI in Nigerian schools. To maximize AI's potential, the study recommends deliberate strategies including investment in infrastructure, teacher professional development, establishment of a national AI-in-education policy, culturally relevant AI applications, and strong data protection frameworks. By adopting these measures, Nigeria can effectively harness AI to create equitable, engaging, and inclusive learning environments. The researchers concluded that AI integration, if properly managed, can bridge educational gaps, promote equity, and significantly improve the quality of inclusive education in Nigeria.

Keywords: Artificial Intelligence (AI), Inclusive Education, Educational Technology and Accessibility.

Introduction

Inclusive education refers to the practice of educating all students, regardless of their physical, intellectual, social, emotional, linguistic, or other conditions, within the same educational setting. This approach aims to provide equal opportunities for all learners, ensuring that diversity is embraced and every student has access to quality education (UNESCO, 2022; Ainscow & Miles, 2008). In Nigeria, inclusive education has gained significant attention in recent years, with policies and initiatives being developed to address the educational needs of marginalized and vulnerable groups (Federal Ministry of Education [FME], 2020).

Inclusive education is crucial for fostering an equitable society where all individuals can contribute meaningfully. In Nigeria, the importance of inclusive education cannot be overstated, as it is not only essential for the individual development of marginalized learners but also for the creation of an equitable and just society, where diversity is celebrated and every individual is empowered to contribute meaningfully to the community (Eze, 2019; Odo, 2021). Despite the critical role of English proficiency in Nigeria's educational and socio-economic development, many learners, especially those with diverse needs, face challenges that hinder their academic success (Afolabi, 2020). Integrating inclusive education promotes collaboration, differentiated instruction, and the use of adaptive resources, which can significantly enhance learners' engagement and proficiency in various subjects (Florian & Black-Hawkins, 2011). Inclusive education is an approach that seeks to ensure all students, regardless of their background, abilities, or disabilities, have access to quality education within mainstream classrooms. It emphasizes the importance of diversity and aims to remove barriers to learning and participation (UNICEF, 2018).

Artificial Intelligence (AI) refers to the capability of computational systems to perform tasks that typically require human intelligence, such as learning, reasoning, problem-solving, perception, and decision-making. AI systems utilize algorithms and data to simulate human cognitive processes, enabling machines to adapt to new inputs and perform specific tasks autonomously (Russell & Norvig, 2021). In education, AI encompasses a range of technologies that can personalize learning experiences, automate administrative tasks, and provide datadriven insights to enhance teaching and learning processes (Luckin et al., 2016; Holmes et al., 2019).

In Nigeria, the implementation of inclusive education faces challenges such as inadequate infrastructure, limited teacher training, and cultural attitudes towards disability. However, recent policies and initiatives aim to promote inclusive education by addressing these barriers and fostering an inclusive educational culture (FME, 2020; Okeke, 2021). Technology has become an integral part of modern education, offering innovative solutions to traditional teaching and learning challenges. In Nigeria, the role of technology in education has been transformative, particularly in addressing issues such as inadequate infrastructure, a shortage of qualified teachers, and limited access to quality learning resources. The integration of educational technology (EdTech) has improved students' academic performance, technological literacy, analytical ability, and creative thinking (Oyelere et al., 2021). Government frameworks, private sectors, and academic institutions support technology integration by training teachers and providing professional development activities (Adeyemo, 2020).

Furthermore, during the COVID-19 pandemic, the Nigerian government encouraged the use of e-learning platforms and adopted an e-learning policy to guide educational institutions in implementing distance education. This policy emphasized the use of technology to deliver lessons and engage with students remotely, ensuring learning continuity through

various channels such as printed materials, online learning, radio, or TV programs (FME, 2020; UNESCO, 2020).

Application of AI in Inclusive Education

The application of Artificial Intelligence (AI) in inclusive education has the potential to transform the learning experiences of all students, particularly those with diverse learning needs or disabilities. By leveraging AI technologies, educators can design more personalized, engaging, and equitable learning environments that address individual learners' strengths and challenges (Luckin et al., 2016).

AI enables the customization of curricula to meet the unique needs of learners with disabilities. Intelligent tutoring systems and adaptive learning platforms can adjust content difficulty, pace, and presentation style based on real-time learner performance. For example, AI-driven platforms can provide visual, auditory, or kinesthetic learning materials tailored to each student's preferred learning mode, ensuring that learners with physical, cognitive, or sensory impairments are actively engaged in the learning process (Holmes et al., 2019). By offering individualized learning pathways, AI helps to reduce educational disparities and promotes equal access to quality education.

AI-powered assistive technologies are critical in supporting inclusive education. Tools such as speech-to-text and text-to-speech applications help students with visual impairments or dyslexia access learning materials effectively. Predictive tools, including AI-based word completion and grammar checkers, assist students with writing difficulties in expressing their ideas clearly (Almalki et al., 2021). Similarly, AI-powered hearing aids and captioning systems enable learners with hearing impairments to follow classroom instructions and participate in discussions. Such technologies reduce barriers to learning and empower students to achieve academic success in mainstream classrooms.

AI can also enhance classroom management and learning analytics to support inclusive education. By analyzing data on student engagement, participation, and performance, AI systems provide educators with insights into individual learning patterns and potential challenges. For instance, AI can detect students who are struggling with specific concepts and alert teachers to provide targeted interventions (Baker & Inventado, 2014). Additionally, AI based scheduling and resource management tools help teachers optimize classroom activities and ensure that students with diverse needs receive adequate attention and support.

Assessment and feedback are critical components of inclusive education, and AI has the potential to make these processes more adaptive and effective. AI-driven assessment platforms can provide instant, personalized feedback, highlighting areas of strength and identifying topics requiring additional practice. For students with learning disabilities, AI can adjust the format of assessments, such as providing oral, visual, or interactive tasks, to ensure accessibility and fairness (Peña-López et al., 2020). Moreover, AI analytics can track learners' progress over time, enabling teachers to make data-informed decisions that enhance learning outcomes for all students.

AI's applications in inclusive education from curriculum personalization and assistive technologies to classroom management and adaptive assessment offer transformative opportunities to create equitable, engaging, and effective learning environments. The integration of AI not only supports learners with disabilities but also enhances overall classroom experiences, fostering an inclusive educational culture that values diversity and promotes equal opportunities.

Benefits of AI in Enhancing Inclusive Education

Artificial Intelligence (AI) offers transformative opportunities for inclusive education by improving access for learners with special needs, personalizing learning experiences,

supporting teachers with data-driven insights, and fostering equitable participation. By leveraging adaptive technologies and innovative tools, AI enhances learning outcomes and promotes an inclusive environment where all students can thrive.

1. Improved Access for Learners with Special Needs: AI technologies have significantly improved access to education for learners with special needs by providing tailored support and assistive tools (Morris, 2023). For instance, AI-powered applications can offer real-time language translation and speech-to-text services, enabling students with hearing or language impairments to participate more fully in classroom activities. Additionally, AI tools like Grammarly assist students with learning disabilities in enhancing their writing skills by providing real-time feedback and error correction. These advancements facilitate a more inclusive learning environment by accommodating diverse learner needs (Almahasees, 2021).
2. Personalized Learning and Differentiated Instruction: AI facilitates personalized learning by adapting educational content to meet the diverse needs of students. Platforms such as Alef Math Pathways utilize AI to assess individual student performance and create customized learning paths, allowing for real-time adjustments based on ongoing assessments (Karyotaki & Panagiotakopoulos, 2022). This approach aligns with the principles of differentiated instruction, ensuring that all learners, regardless of their abilities, receive appropriate challenges and support. Furthermore, AI-driven tools enable educators to implement Universal Design for Learning (UDL) principles by providing multiple means of representation, engagement, and expression, thereby accommodating various learning styles and needs. This adaptability ensures that all students have equitable access to learning opportunities, fostering an inclusive educational experience (Zawacki-Richter et al., 2021).
3. Enhanced Teacher Support and Decision Making: AI supports educators by automating administrative tasks and providing data-driven insights into student performance. Tools like Socrait assist teachers by recording classroom interactions, tracking student behavior, and generating reports, thereby reducing workload and allowing for more focused instructional planning (UNESCO, 2023). This automation enables teachers to allocate more time to individualized instruction and student engagement. Moreover, AI systems can analyze multimodal data, including academic progress and behavioral patterns, to offer valuable insights that inform instructional strategies and interventions. This data-driven approach enables educators to make informed decisions that enhance student outcomes and foster an inclusive learning environment (Chen et al., 2020).
4. Democratization of Education in Rural Areas: AI-powered mobile technologies have the potential to bridge educational gaps in rural Nigeria by providing access to quality learning resources and instruction (Chukwuedo, 2022). These technologies can deliver educational content remotely, overcoming geographical and infrastructural barriers, and ensuring that students in underserved areas receive equitable educational opportunities. The integration of AI in rural education promotes inclusivity by extending learning beyond traditional classroom settings (Okonkwo & Ade-Ibijola, 2021).
5. Support for English as a Second Language (ESL) Learners: AI-driven tools can enhance the learning experience for ESL students by providing personalized language instruction and practice (Duan et al., 2020). These tools can adapt to individual proficiency levels, offering targeted exercises and feedback to improve language skills. The use of AI in ESL education supports inclusive learning by addressing the specific needs of non-native English speakers and facilitating their integration into mainstream classrooms (Ahmed, 2023).
6. Teacher Professional Development and Well-being: Integrating AI into education can support teachers' professional development by providing access to personalized training and

resources. AI systems can identify areas where educators may need further support and recommend targeted professional development opportunities. Additionally, by automating routine tasks, AI can reduce teacher workload, preventing burnout and enhancing overall wellbeing. This support enables teachers to focus more on instructional quality and student engagement (Tang et al., 2021; Kim & Lee, 2023).

7. Enhancing Accessibility for Students with Disabilities: AI-driven assistive technologies play a crucial role in supporting students with disabilities (Miao & Holmes, 2021). Tools such as predictive text, speech recognition, and personalized learning platforms can adapt to individual needs, providing tailored support for students with cognitive, speech, or mobility impairments. These technologies enable students to participate more fully in educational activities, promoting inclusivity and equal learning opportunities (Al-Azawei, 2022).

8. Real-Time Feedback and Adaptive Learning: AI systems can provide real-time feedback to students, allowing for immediate correction of errors and reinforcement of concepts (Ifenthaler & Yau, 2022). Adaptive learning platforms can adjust the difficulty level of tasks based on student performance, ensuring that learners are appropriately challenged. This personalized approach helps maintain student engagement and supports continuous learning, contributing to an inclusive educational environment (Holmes et al., 2021).

9. Facilitating Collaboration Among Educators: AI can facilitate collaboration among educators by providing platforms for sharing resources, strategies, and insights. These collaborative tools enable teachers to work together in developing inclusive teaching practices and addressing the diverse needs of their students. By fostering a collaborative professional community, AI supports the creation of inclusive educational environments (Li & Lalani, 2020).

Challenges of AI Implementation in Inclusive Education in Nigeria

Despite its potential, the adoption of Artificial Intelligence (AI) in inclusive education in Nigeria is hindered by infrastructural deficits, high costs, limited teacher preparedness, weak policy frameworks, and issues of equity and access (Okonkwo & Ade-Ibijola, 2021). These challenges must be addressed for AI to effectively support inclusive learning.

1. Infrastructure and Technology Gaps: A major challenge is the lack of adequate infrastructure to support AI integration in schools. Many institutions, particularly in rural Nigeria, face poor electricity supply, weak internet connectivity, and insufficient access to digital devices. These deficiencies hinder the effective deployment of AI-powered tools needed for inclusive classrooms (Ogunode & Abigeal, 2021).

2. Cost and Funding Issues: Implementing AI technologies is financially demanding, requiring significant investments in hardware, software, and technical support. Unfortunately, Nigeria's education sector faces chronic underfunding, making it difficult to prioritize advanced AI systems (UNESCO, 2021). The dependence on imported AI technologies also increases costs, thereby limiting access for schools serving learners with special needs (Okoye & Ogbuanya, 2022).

3. Teacher Readiness and Training: Teachers are central to AI adoption, but many lack the necessary skills to utilize AI-based assistive technologies. Limited exposure, insufficient professional development opportunities, and resistance to change affect teacher readiness (Oluwajana et al., 2020). Without targeted training, teachers may struggle to integrate AI effectively into inclusive education practices (Aderibigbe & Mbah, 2022).

4. Policy and Regulatory Challenges: Nigeria lacks a comprehensive national AI strategy in education, which creates uncertainty regarding standards, ethics, and accountability. Unlike developed nations that have clear AI education policies, Nigeria is still at the early

stages of policy formulation (Adeoye, 2021). This policy gap weakens coordination and slows down AI adoption for inclusive learning (Ogunode, 2022).

5. Cultural Resistance and Attitudinal Barriers: There is often skepticism and resistance among stakeholders toward the adoption of AI in education. Some parents and educators perceive AI as a replacement for human teachers, while others mistrust its long-term benefits (Ifeanyi & Chukwu, 2021). Such negative perceptions hinder acceptance, especially in communities with strong attachment to traditional teaching methods.

6. Data Privacy and Security Concerns: AI applications often rely on sensitive student data, including health and learning records. In Nigeria, where data protection frameworks are weak, concerns about misuse or unauthorized access to learners' information remain high (Adetunji, 2021). These risks raise ethical challenges, particularly when working with vulnerable groups such as learners with disabilities.

7. Sustainability of AI Projects: Many AI-related educational projects in Nigeria are donordriven or pilot initiatives that fail to sustain beyond initial funding. A lack of long-term maintenance plans, technical expertise, and institutional support limits sustainability (Okoro & Edeh, 2021). This undermines the continuous use of AI in inclusive classrooms.

8. Language and Content Limitations: Most AI educational tools are designed in English or foreign languages, creating accessibility barriers for learners in Nigeria who speak indigenous languages. The absence of locally relevant AI applications and culturally sensitive content reduces inclusiveness and learner engagement (Ojo & Alabi, 2022).

9. Inequality and the Digital Divide: AI integration in education risks widening existing inequalities between urban and rural learners, as well as between wealthy and low-income schools. While elite schools in urban areas may have the infrastructure to deploy AI tools, public schools in rural communities are often left behind, thereby deepening educational inequality (UNICEF, 2021; Adebayo & Oyewole, 2022).

Strategies for Effective AI Integration in Inclusive Education in Nigeria

Maximizing the benefits of Artificial Intelligence (AI) in inclusive education requires deliberate strategies. These measures are essential for overcoming barriers and creating inclusive, AI driven learning environments.

1. Government and private stakeholders should prioritize expanding internet connectivity, providing stable electricity, and equipping schools with affordable digital devices. Public-private partnerships can play a vital role in reducing the digital divide, especially in rural areas.
2. Nigeria should adopt cost-sharing models such as partnerships with EdTech firms, donor agencies, and NGOs to fund AI integration. Subsidies, tax incentives, and grants can also encourage local innovation in AI for inclusive education.
3. Teachers should undergo continuous professional development to build competence in using AI-powered educational tools. Training should focus on both technical usage and pedagogical strategies for leveraging AI to support diverse learners.
4. The government should develop a national AI-in-education policy that outlines guidelines for ethical use, data privacy, accessibility standards, and integration into inclusive education. Clear policies will provide direction and accountability.
5. AI applications must be adapted to Nigeria's linguistic and cultural diversity. For instance, AI-powered speech-to-text and translation tools should support indigenous languages to promote accessibility for all learners.

6. Collaboration among policymakers, educators, researchers, EdTech developers, and parents is essential to ensure that AI solutions are relevant, affordable, and user-friendly. Such partnerships can also help scale pilot projects to wider adoption.
7. Raising awareness about the potential of AI for inclusive education among teachers, parents, and communities is critical. Advocacy can reduce resistance to technology adoption and encourage community support for digital transformation in schools.
8. Since AI relies on data, schools must implement strong data protection protocols. Training educators on ethical data use and ensuring student privacy will build trust in AI systems and promote wider adoption.
9. Establishing a robust monitoring and evaluation framework will help track the effectiveness of AI integration. Research institutions should be funded to study the impact of AI on inclusive education and provide evidence-based recommendations for scaling up.

Conclusion

This study has highlighted the transformative potential of Artificial Intelligence (AI) in enhancing inclusive education in Nigeria. It established that AI can significantly improve access for learners with special needs through assistive technologies such as speech-to-text, language translation, and adaptive learning systems. AI also supports personalized learning and differentiated instruction by tailoring educational content to individual learner needs, while simultaneously assisting teachers in decision-making through data-driven insights. However, the study identified critical challenges hindering effective implementation, including infrastructural gaps, high costs, inadequate teacher training, weak policy frameworks, and issues of digital literacy and equity. Despite these challenges, the adoption of AI remains a promising pathway toward building a more inclusive, equitable, and sustainable education system in Nigeria.

The study that, Nigerian policymakers and education stakeholders must prioritize the development of robust policies and frameworks that support the ethical and equitable use of AI in inclusive education. This includes addressing infrastructural deficits by investing in reliable electricity, internet connectivity, and affordable digital devices. Adequate funding mechanisms through government allocations, public–private partnerships, and international collaborations are essential to bridge cost-related barriers. Moreover, teacher capacity development through continuous professional training in AI tools must be prioritized to ensure readiness for AIdriven classrooms.

On the practical side, educational institutions should gradually integrate AI solutions into teaching, learning, and assessment processes while adhering to Universal Design for Learning (UDL) principles to ensure inclusivity. Equally, strong regulatory mechanisms must be established to safeguard data privacy, ensure fairness, and prevent biases in AI applications. By aligning AI adoption with Nigeria's inclusive education goals, the country can enhance access, participation, and quality learning outcomes for all students, particularly those with special needs.

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