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Exploring the Challenges of Artificial Intelligence in Basic Education in Nigeria

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Abstract

This paper examines the challenges of Artificial Intelligence (AI) in basic education with a particular focus on its application in Nigeria. It discusses the potential benefits of AI in enhancing teacher-learner interactions, personalizing learning experiences, and improving access to quality education. The paper also identifies key challenges to the integration of AI in basic education, such as lack of skilled professionals and low digital literacy among basic education teachers, cultural adaptation and traditional resistance, inadequate infrastructure, high cost of implementation and shortage of instructional materials, equity and accessibility challenges, lack of localized content, absence of capacity training programme and limited government support and policy framework. This is an analytic position paper. Through an analysis of secondary data gathered from various print and online sources, the paper emphasizes the need for addressing these challenges in order to effectively implement AI at basic education level in Nigeria. It recommends that future research focus on developing AI-powered educational tools tailored to local contexts and evaluating their impact. Additionally, the paper advocates for increased government funding for AI programs in basic education institutions, along with the establishment of monitoring mechanisms to ensure proper allocation and utilization of funds. In conclusion, the paper asserts that while AI holds the potential to revolutionize basic education in Nigeria, its successful integration will depend on thoughtful planning, implementation, and ongoing evaluation.

Keywords: *Artificial Intelligence and Basic Education*

Introduction

Basic Education according to the Federal Republic of Nigeria national policy on education (FRN2013) is the education given to children aged 0-15 years. It encompasses the Early Child Care and Development Education (0-4) and 10 years of formal schooling. Early Child Care and Development Education however is segmented into ages 0-4 years, situated in daycare or crèches, fully in the hands of the private sector and social development services, whilst ages 5-6 are within the formal education sector. The goals of Basic Education are to:

a. Provide the child with diverse basic knowledge and skills for entrepreneurship, wealth generation and educational advancement;

b. develop patriotic young people equipped to contribute to social development and in the performance of their civic responsibilities;

c. inculcate values and raise morally upright individuals capable of independent thinking, and who appreciate the dignity of labour;

d. inspire national consciousness and harmonious co-existence, irrespective of differences in endowment, religion, colour, ethnic and socio-economic background; and

e. provide opportunities for the child to develop manipulative skills that will enable the child function effectively in the society within the limits of the child's capability.

Artificial Intelligence (AI) refers to the creation of computer systems and machines designed to perform tasks that typically require human intelligence, such as learning, reasoning, problem-solving, perception, and natural language understanding (AFSA, 2022). AI technologies include machine learning, deep learning, natural language processing, computer vision, and robotics, all of which allow computers to analyze large datasets, identify patterns, make predictions, and automate complex processes (Ogunode, Edinoh & Okolie, 2023). AI is already making an impact across multiple fields, including healthcare, finance, transportation, customer service, and education, with the potential to revolutionize industries, increase efficiency, and generate new opportunities (AFSA, 2022). As young children interact with AI applications—such as chatbots and recommendation tools—in their daily lives and learning, there is growing concern over the lack of focus on developing AI literacy for this age group. While children may use AI products, they may not fully understand how to use them, nor be aware of the underlying principles and potential limitations of these technologies. Furthermore, the misinformation or inappropriate suggestions provided by AI tools may pose safety risks to children. Therefore, it is essential to promote AI literacy among young children, emphasizing the technology's limitations, ethical considerations, and a basic understanding of how it works (Kong et al., 2021, 2022; Long & Magerko, 2020; Ng et al., 2021a, b).

Conceptual Clarification
Artificial Intelligence

Artificial intelligence (AI) was initially defined by John McCarthy in 1956 as "the science and engineering of creating intelligent machines" (McCarthy, 2007; Su et al., 2023). The primary objective of AI research is to develop intelligent machines capable of performing a wide range of tasks. This involves techniques such as machine learning, neural networks, and natural language processing (Mondal, 2020; Su et al., 2023). According to Alagbe (2023), AI is the ability of machines or computers to replicate human cognitive abilities, including learning from experience, recognizing objects, understanding and responding to language, making decisions, and solving problems. These abilities enable AI to perform tasks typically associated with humans, such as welcoming hotel guests or driving a car. Ogunode, Edinoh, and Okolie (2023) further described AI as programs designed to exhibit human-like intelligence, structured within computers, robots, or other machines to facilitate various services and tasks that contribute to the socio-economic and political development of society. They also defined AI as systems, packages, and applications integrated into digital computers or computer-controlled robots to complete assignments using human-like intelligence. In this context, artificial intelligence is considered a specialized branch of computer science. Through continuous research and development, AI aims to simulate, extend, and enhance human intelligence across various fields, including language processing, image recognition, and intelligent robotics (Edinoh et al., 2024).

Basic Education

Basic Education refers to the foundational stage of education that equips individuals with essential knowledge, skills, and values to participate effectively in society. It typically encompasses primary and lower secondary education, often covering fundamental literacy, numeracy, life skills, and social competencies. The concept varies across countries and contexts but generally aligns with universal goals like the right to education and lifelong learning like literacy and numeracy- developing the ability to read, write, and perform basic arithmetic operations, cognitive skills-enhancing critical thinking, problem-solving, and decision-making skills .(UNESCO 2000). Basic education according to the Federal Republic of Nigeria national policy on education (FRN, 2013) is the education given to children aged 0-15 years. It encompasses the Early Child Care and Development Education (0-4) and 10 years of formal schooling. Early Child Care and Development Education however is segmented into ages 0-4 years, situated in daycare or crèches, fully in the hands of the private sector and social development services, whilst ages 5-6 are within the formal education sector. Basic education serves as the groundwork for lifelong learning by nurturing curiosity and adaptability, instilling values such as empathy, cooperation, and respect for diversity. promoting emotional well-being and resilience, imparting knowledge about civic responsibilities, human rights, and environmental sustainability, encouraging active participation in community and democratic processes, adapting curricula to address local needs, culture, and challenges, such as gender equity or indigenous knowledge systems, Basic education has expanded beyond formal schooling to include; Early Childhood Education (ECE) recognized as a critical stage for development, non-formal and informal education which is learning opportunities outside traditional school settings and digital literacy which aims at addressing the modern need for understanding and using technology effectively. In summary, basic education is a dynamic and inclusive concept designed to provide individuals with the tools to thrive in diverse aspects of life. It is deeply intertwined with global efforts to foster equality, sustainability, and human development. (United Nations 2015,Unicef,2019).

Methodology

This study employed an analytical research design, using a literature review approach to explore the current state of AI in basic education in Nigeria. Relevant articles, reports, and books were reviewed to identify the benefits, challenges, and future directions of AI in basic education in Nigeria.

Artificial Intelligence and Basic Education

Future generations of children will interact with technology very differently from those of previous generations due to artificial intelligence (AI). AI is transforming our daily lives, work, and leisure (Ali et al., 2019). In early childhood education (ECE), artificial intelligence (AI) tools are being employed more and more to improve the learning and development of young children (Su and Yang, 2022). The majority of research demonstrated how AI has improved children's understanding of AI, robotics, computer science, machine learning, and related fields dramatically. Additionally, it has improved children's abilities in reading, creativity, emotional regulation, cooperative learning, and computational thinking (Su and Yang, 2022). In early childhood education (ECE), artificial intelligence (AI) tools are being employed more and more to improve young children's learning and development (Lin et al., 2020; Su and Yang, 2022; Vartiainen et al., 2020). For example, two recent studies examined the use of AI robots to teach machine learning to youngsters (Lin et al., 2020; Su and Yang, 2022; Vartiainen et al., 2020). Artificial intelligence (AI) has transformed various sectors, including education in Nigeria. The integration of AI in early childhood education has the potential to improve learning outcomes and bridge the educational gap. Edinoh, Oche and Adesola (2024) asserts that that the Nigerian educational system is made up of Early Child Care Education (ECCE), primary school education, junior secondary schools education, senior secondary school education and tertiary education. All these unit or form of education matters and is needed to function well to realize the objectives of education in Nigeria.

Artificial intelligence (AI) has become an integral part of modern society, transforming various sectors, including education (Russell & Norvig, 2020). In Nigeria, the education sector faces numerous challenges, including inadequate infrastructure, shortage of qualified teachers, and limited access to quality education (UNESCO, 2020). Early childhood education, in particular, is critical for laying the foundation for future learning and development (Vygotsky, 1978).

Benefits of Artificial Intelligence in Basic Education in Nigeria.

- Artificial intelligence (AI) presents a unique opportunity in basic education to help young students develop their soft skills. Yahya & Mohamed (2024) affirming the benefits of AI said while artificial intelligence is commonly linked to technology, there is increasing acknowledgment that AI can improve children's abilities in communication, critical thinking, teamwork, and adaptability.
- Through interactive platforms and customized learning experiences, artificial intelligence (AI) has the ability to enhance creativity, strengthen social relationships, and sharpen problem-solving abilities.
- Through the use of customized approaches and flexible algorithms, artificial intelligence (AI) has the ability to enhance the development of a wide range of soft skills and suit individual learning styles.
- The integration of AI in early childhood education has the potential to improve learning outcomes and bridge the educational gap in Nigeria as AI-powered educational tools have been shown to enhance teacher-student interactions, personalize learning, and increase access to quality education (Goodfellow et al., 2016).
- In early childhood education, AI can support teacher-led instruction, facilitate adaptive learning, and provide real-time feedback (Pati.R , Kelly. M, Nicole. A & Lucara S. (2023).

Challenges of Artificial Intelligence in Basic Education in Nigeria.

AI in early childhood education has the potential to enhance learning and teaching, but its implementation in Nigeria faces several challenges. Despite all the benefits of AI as seen in this paper, the effective integration of AI in basic education in Nigeria has not been a smooth ride yet. It requires careful consideration of the following issues.

Inadequate Infrastructure

Infrastructural facilities have been conceptualized by Ogunode (2020a) as those facilities aiding the delivery of services in educational institutions. The availability of the infrastructural facilities in adequate quantities will support effective administration of educational institutions and the inadequacies will prevent effective administration of educational institutions Many schools, especially in rural areas, lack the necessary infrastructure, such as reliable electricity, internet connectivity, and digital devices, to support AI implementation. This creates a barrier to adopting AI technologies. The importance of infrastructural facilities in educational institutions according to Ogunode & Agwor (2021) includes; aiding effective delivery of administrative functions in schools; making the delivery of services fast and reliable; enabling teachers to deliver lessons fast; infrastructural facilities provide a conductive working environment for both teachers and students; infrastructural facilities enable learners to learn at ease and learn well; infrastructural facilities enable the teachers to teach well, prepare their lessons, and deliver them online using information and communication technology (ICT) which is very relevant for instructions in artificial intelligence. The importance of school infrastructural facilities in the realization of educational goals especially in basic education cannot be underestimated. School facilities aid the delivery of the teaching and learning process in the schools. The school offices provide a conducive working environment for teachers, the classrooms help the learners to learn while the school fence protects students, the teachers, and school administrators from criminals. The school plant protects the entire human resources from the sun, rain, heat cold, and snow (Ogunode & Agwor 2021). It is unfortunate that as important as these facilities are to the attainment of educational objectives, most educational institutions in Nigeria especially the basic eduction are faced with shortage of this important aspect of educational activities.

Lack of Skilled Professionals and Low Digital Literacy among Basic Education Teachers

There is a noticeable shortage of professionals with specialized training in artificial intelligence (AI) and its applications in education, which poses a significant challenge to the effective integration of AI into the Nigerian basic education system. This

skills gap hampers the ability to develop, deploy, and maintain AI systems in schools, ultimately limiting their potential impact on teaching and learning. Without trained experts, schools struggle to utilize AI solutions tailored to local needs, leading to suboptimal outcomes. Furthermore, a considerable number of educators and caregivers, particularly in Early Childhood Education (ECE) and basic education generally lack the necessary skills to use AI tools effectively. This deficiency in digital literacy among teachers is a significant barrier to the successful adoption of AI technologies in classrooms. Teachers who are not well-versed in using digital and AI-driven tools are less likely to incorporate them into their teaching practices, which limits students' exposure to innovative learning methods and hinders progress in modern education, Edinoh, (2023).

High Cost of Implementation and Shortage of Instructional Materials:

Implementing AI requires significant investment in software, hardware, and maintenance. Many basic education centers in Nigeria operate with limited budgets and may find it challenging to afford these technologies. Ogunode and Josiah (2023) defined instructional materials as educational resources assembled by the teachers to implement teaching programmes in the classroom. Instructional materials are special educational resources that aid the teachers to deliver the lesson. Instructional materials are used in all forms of educational institutions. Teachers in educational institutions teach well with the deployment of instructional materials. Instructional materials serve as a channel between the teacher and the students in delivering instructions. They may also serve as the motivation for the teaching-learning process. It is used to get the attention of the students and eliminate boredom. The non-availability or inadequacy of instructional resources especially for the implementation of AI at basic education level which according to Ogunode and Agwor (2021) is due to shortage of funds will affect the effective implementation of the programme as gadgets and internet connection as well as other digital devices are indispensable prerequisites for effective and efficient deployment of artificial intelligence learning activities.

Cultural Adaptation and Traditional Resistance:

Nigeria is a cultural nation. Cultural and traditional mindsets in some communities may resist AI adoption, viewing it as a threat to conventional teaching methods or as a technology that could dehumanize education. The universal access and top-down approach which is one of the sector-specific principles developed for AI in cultural heritage is meaningful participation, Pansoni et'al, (2023). This prescribes that the use of AI technologies should be implemented in an inclusive manner through a bottom-up approach involving different stakeholders and competencies Pansoni et'al, (2023). Many contend that cultural heritage digitization is frequently adopted top-down and as a means rather than an aim, omitting several vital aspects of the community's needs. As Taylor and Gibson (2016) argue "certain digitization activities can subtly reinforce non-democratic structures". For example, this might be the case of digitizing the cultural heritage of indigenous communities. This would ask for both hearing and centering their voices and considering the consequences that such operation (i.e., the resulting free access to that heritage) would bring to the target community. The target communities conceive some cultural sites as sacred or symbolic, and their access is allowed only to people of a specific gender or age. For this reason, there is a risk that the digital reproduction of a cultural heritage site and its resulting free access will not align with the worldview of the target communities. Neglecting communities' needs and values reinforces different forms of discrimination, Manzuch (2014). Consequently, these risks are at odds with the commitment of cultural institutions to present a variety of perspectives and to promote cultural diversity and mutual dialogue between cultures Manzuch, (2014), as well as with the ethical principles of fairness, equity and nondiscrimination promoted by the general EU (2019) and UNESCO (2021) recommendations. Moreover, the involvement of communities' members might help overcome the risk of excluding them from benefiting from AI's economic and cultural opportunity in cultural heritage without violating its sacred and identity value. For some communities, cultural heritage has sacred value, and using disruptive technologies such as AI to enjoy this heritage could be a form of heresy. To respond to this risk, it becomes necessary to introduce an additional domain-specific ethical principle: dignity, i.e., the need to ensure the respectful preservation of culturally sensitive material, such as material of sacred, identity significance, and its intrinsically human nature, Pansoni et'al, (2023). For this reason, it is desirable to engage in an open dialogue with the communities that live the cultural heritage to represent it in a manner consistent with their customs and traditions especially in developing the content for children in basic education.

Equity and Accessibility Challenges

One of the most pressing challenges in implementing basic education in Nigeria, particularly in integrating artificial intelligence (AI), is the issue of equity and accessibility. Socioeconomic disparities play a significant role in determining which children can access the benefits of AI-driven educational tools and platforms. These disparities often lead to unequal opportunities for learning, further entrenching educational inequalities in the country, Taylor and Gibson (2016). Children from affluent families are far more likely to have access to AI-driven educational resources due to their families' ability to afford private schools equipped with advanced technology. These schools often have the infrastructure, funding, and trained staff to integrate AI tools into their teaching practices. Students in such environments benefit from personalized learning experiences, access to cutting-edge technology, and enhanced educational content, giving them a significant advantage in terms of skill development and readiness for future opportunities. In contrast, children from low-income families—many of whom attend public schools or community-based learning centers—rarely have access to AI tools or even the basic infrastructure required to support such technologies Pansoni et'al, (2023). Many public schools in Nigeria lack stable electricity, reliable internet connectivity, and functional computer systems, all of which are prerequisites for implementing AI in education. Without access to these resources, children in remote communities are left at a significant disadvantage, unable to reap the benefits of modern educational advancements. This disparity has far-reaching implications. When children from disadvantaged backgrounds are excluded from AI-driven educational opportunities, it not only limits their individual potential but also reinforces systemic inequalities. Over time, this educational divide can lead to a wider gap in economic and social outcomes, perpetuating cycles of poverty and inequality in the broader society, Ogunode and Agwor (2021).

Absence of Capacity Training Programme:

Most Nigerian teachers are not information technology (IT) literate. Artificial intelligence is an emerging field of learning that requires training and retraing to ensure the mastery of the concepts.

The gap in accessibility also extends to teacher training, Edinoh (2023). Schools serving affluent communities are more likely to invest in professional development programs that train educators to use AI tools effectively. Meanwhile, teachers in low-income areas often lack the digital literacy skills necessary to incorporate AI into their teaching, further exacerbating the divide between different socioeconomic groups. Training programmes like seminars, workshops and conferences that are intended to rejuvenate, enlighten, update and introduce new approaches for effective delivery of educational programmes as well as improve the skills of teachers in the educational sectors are either squashed at planning stage or aborted at the implementation stage. Allocation for such trainings are diverted, Osies (2020)

Lack of Localized Content:

Most artificial intelligence (AI) systems are developed with a broad, global audience in mind, often neglecting the unique cultural, linguistic, and educational contexts of specific regions like Nigeria. These systems typically rely on algorithms and programming frameworks designed for environments that may not align with the realities faced by Nigerian children. For instance, AI tools might use languages, examples, or references that are unfamiliar or irrelevant to students in Nigeria, making the systems less engaging and effective for their intended users. Additionally, such systems often fail to incorporate culturally sensitive teaching methods, local dialects, or context-specific content that could better resonate with Nigerian learners. The challenges go beyond mere content mismatch. Developing AI solutions that are tailored to the Nigerian context demands specialized expertise, including knowledge of local languages, traditions, and educational frameworks. For example, creating AI tools that support indigenous languages, incorporate culturally relevant examples, or address local pedagogical challenges requires not just advanced technical skills but also deep contextual understanding. Unfortunately, these resources and expertise are in short supply within Nigeria, making it difficult to create localized AI solutions that address these specific needs effectively, Edinoh, Oche and Adesola (2024).

Limited Government Support and Policy Framework

One of the significant challenges hindering the integration of artificial intelligence (AI) into basic education in Nigeria is the lack of adequate government support and a comprehensive policy framework. Currently, there are insufficient government policies or strategic plans specifically designed to guide the adoption and implementation of AI technologies in the education sector Edinoh, Oche and Adesola (2024). This gap leaves schools and educators without the necessary direction to effectively incorporate AI tools into their teaching and learning processes. A robust regulatory framework is essential for establishing clear guidelines on how AI can be integrated into educational practices, especially for young learners in basic education. Such policies would ideally cover important aspects like teacher training, curriculum alignment, ethical considerations, data privacy, and the allocation of resources for AI-driven initiatives Ogunode, Edinoh, and Okolie (2023). Without these directives, schools face significant uncertainty about how to proceed, which often leads to hesitancy in adopting new technologies. Moreover, the absence of government-led initiatives results in minimal funding and infrastructural support for AI adoption in education. Schools, especially in remote areas, often lack the resources needed to acquire and maintain AI technologies, let alone provide the necessary training for educators. The government's limited involvement also means that opportunities for public-private partnerships, which could facilitate access to advanced AI solutions, are not being fully explored, Ogunode et' al (2023b). Additionally, the lack of a strategic direction hinders the ability to create localized AI solutions tailored to the specific needs of Nigerian children. Without government oversight and investment, the development of culturally relevant and linguistically appropriate AI tools becomes challenging. This oversight further widens the gap between global AI advancements and their applicability in the Nigerian context, Edinoh et'al (2024).

Discussion:

The review of existing literature reveals that AI-powered educational tools have the potential to enhance teacher-learners interactions, personalize learning, and increase access to quality education in Nigeria. The integration of AI in basic education in Nigeria has the potential to revolutionize the education sector. AI-powered educational tools can support teacher-led instruction, facilitate adaptive learning, and provide real-time feedback. Moreover, the process of adapting or developing such AI systems is resource-intensive, requiring substantial financial investment, skilled personnel, and advanced technological infrastructure. These prerequisites are often out of reach for many local developers and educational institutions in Nigeria due to limited funding and a lack of robust technological ecosystems. Consequently, the potential for AI to transform education in Nigeria remains largely untapped, with the technology failing to address the specific challenges faced by learners and educators in the country. For Nigeria to harness the full potential of AI in education, there is a pressing need for targeted initiatives aimed at developing localized AI solutions. These initiatives could include collaborations between local stakeholders and international AI developers, increased funding for localized AI research, and programs to train experts in culturally adaptive AI design. By prioritizing these efforts, Nigeria can create AI systems that not only bridge the existing gaps but also empower its education sector to meet the unique needs of its children effectively.

Recommendations:

The challenges mentioned in the paper out of many others reveals that careful planning, implementation, and evaluation are necessary to ensure the effective integration of AI in basic education in Nigeria and must be addressed. The authors are also advocating that the government should in consultation with relevant agencies;

- Develop context-specific AI-powered educational tools for basic education in Nigeria factoring the unique culture of Nigeria.
- Provide digital literacy and AI-specific training for educators and support for the effective integration of AI-powered educational tools.
- Address infrastructure challenges, such as access to devices and internet connectivity.
- Evaluate the effectiveness of AI-powered educational tools in improving learning outcomes.
- Devise a monitoring mechanism of the funds allocated basic education using appropriate government agencies to avoid diversion of such funds.
- Promote the development of cost-effective, localized AI tools
- Adapt AI systems to align with Nigerian cultural and language needs.

- Develop clear policies and provide funding for AI in education.

- Support access for underserved communities through subsidies or donations.

To address this challenge, the Nigerian government needs to prioritize the integration of AI in education by developing a comprehensive policy framework. This framework should include clear guidelines for schools, funding mechanisms for technology adoption, and initiatives for building educators' digital literacy. Collaborative efforts involving government agencies, private sector stakeholders, and educational institutions could also help bridge the gap, ensuring that AI technologies are effectively and equitably deployed to enhance learning outcomes for young children. By taking these steps, Nigeria can position itself to leverage AI's transformative potential in basic education while addressing the unique challenges faced by its education sector.

Conclusion:

Artificial intelligence has the potential to transform basic education in Nigeria. However, the effective integration of AI requires careful consideration of the cultural context and adaptation, infrastructural facilities, instructional materials, professional teachers, and teacher capacity training programmes among other challenges mentioned above. Future research should focus on developing context-specific AI-powered educational tools, evaluating their effectiveness, and addressing the challenges associated with their integration. Also, government should increase funding of basic education institutions for the development of artificial intelligence in all public basic education institutions across the country and set up a monitoring mechanism of the funds using appropriate government agencies to avoid diversion of such funds should be put in place.

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