



# Leveraging Artificial Intelligence to Enhance the Quality of Education in Secondary Schools: The Nigerian Experience.

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## ABSTRACT

This paper examined leveraging Artificial Intelligence (AI) with the aim of enhancing the quality of secondary school education with particular reference to Nigeria. Considering the fact that AI usage has the ability to transform the teaching and learning processes in schools, it has become imperative to study its adoption and the potential benefits that comes with it. Specifically, the paper highlighted: what secondary school is, use of AI in secondary schools, types of AI, benefits of adopting AI in secondary schools, challenges of AI usage among others. The paper pointed out some of the challenges of AI usage in Nigerian secondary schools as: Inadequate infrastructures and technological readiness; teachers' lack of necessary AI training; data privacy and ethical concerns; curricula incompatibility; limited stakeholders' awareness among others. The paper further recommended robust stakeholders' awareness and engagement; adoption of a clear policy and regulatory framework; prioritization of AI adoption; provision of adequate infrastructures among others. Considering the potential benefits of AI adoption in secondary schools in Nigeria, if the above challenges and recommendations are strictly taken care of, the quality of education in Nigerian secondary schools would be greatly enhanced.

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## INTRODUCTION

Education is essential in the developmental process of every nation. An educated population is more likely to be conscious of their rights and obligations and strive to contribute positively towards the growth and development of the nation. In an ever-changing society, education guarantees creativity, adaptability and innovation, thereby empowering citizens to face new challenges that might come their ways as they live. Education is therefore, not just a powerful agent of national development, but also an essential driver that enhances a good future for any nation. Delving into new and innovative ways of teaching and learning, such as the use of artificial intelligence (AI) would further enhance the quality of secondary school education in Nigeria.

The existing teaching and learning process has lingered for quite some time in Nigerian education system, with particular reference to secondary schools. This has had its flaws over time due to global changes in the education landscape which call for a paradigm shift from the existing ways to new and innovative methods of teaching and learning which would eventually lead to improved outcomes in Nigerian secondary schools' system (Onuh & Onoge, 2025). Artificial Intelligence usage would eliminate such weaknesses in Nigerian secondary school system as inadequate subject mastery, poor methodological skills, low motivation, inadequate use of assessment and feedback and poor professional development among others (Nwuke & Yellowe, 2024). AI adoption is capable of identifying, authenticating and addressing teaching and learning related variables in schools such as performance analytics, and classroom monitoring through: AI-driven classroom observation tool (such as TeachFx, Edthena, or AI-enabled cameras) which are capable of analyzing teaching patterns, communication dynamics and student engagement levels among others (Nwuke & Yellowe, 2024). In Nigeria, the introduction of AI into secondary schools teaching and learning process provides and enhance the quality of teaching and learning, thereby boosting overall secondary education system in the country.

Introducing Artificial Intelligence in secondary school education system would significantly transform the teaching and learning process in schools. This is capable of introducing innovative methods of instructional delivery, assessment, student support, administrative capacity enhancement among others. This has the potential of positively impacting and improving educational outcomes and ultimately leading to the attainment of secondary school goals and objectives. However, the successful adoption of AI into secondary school education system requires addressing several challenges such as infrastructural limitations, digital literacy, ethical orientations among others.

## CONCEPT OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) has come up as a transformative force across all sectors of human endeavors, prompting large scale debate regarding its definition and scope. AI could be seen as the ability of machines or computer systems to perform roles that typically require human efforts such as reasoning, learning, problem-solving, perception, language understanding among others (Hwang & Chien, 2022). This definition involves a wide range of technologies and approaches that focuses on the creation of a system that is capable of functioning intelligently and independently towards providing solutions to complex human endeavors.

The evolution of AI over time signals advancement in technology and positive shift in knowledge. Jakhar and Kaur (2020) saw AI as the ability of computer or computer-controlled robot to perform roles commonly associated with intelligent beings. This definition highlights focus on replicating human-like cognitive abilities in machines. It is however important that AI is not a monolithic concept as it involves various levels of complexities, from basic predictive systems to advanced autonomous entities (Hwang & Chien, 2022).

There is a difference between AI and Machine Learning (ML). AI refers to the concept that focuses on the creation of machines that are capable of performing intelligent behaviors while ML refers to a sub-set of AI that is concerned with developing algorithms that allow computers to learn from and make decisions based on available data (Nwuke & Yellowe, 2024). Nwuke and Yellowe further observed that Artificial Intelligence is the big idea while Machine Learning is the engine that drives it. This relationship implies that while all forms of Machine Learning applications are forms of AI, not all AI systems rely on Machine Learning. Some operate based on predefined rules and logic without the need for data-dependent learning processes (Hwang & Chien, 2022).

With the continuous integration of AI into various spheres of life, understanding its definition and implications has become increasingly essential. The evolving nature of AI therefore necessitates ongoing and further debates among technologists, ethicists, policy-makers and the general public to unveil its complexities and establish its potentials responsibly through delineating the scope and possible capabilities of AI, society can better anticipate its benefits and better shape the changes that lie ahead (Jakhar & Kaur, 2020).

AI application in education refers to the application of AI technologies to enhance and modify teaching and learning processes (Hwang & Chien, 2022). This application involves utilizing Machine Learning algorithms, natural language processing and data analytics to create adaptive educational environments focused on individual student needs. Artificial Intelligence's benefits to education are many and offers opportunities to address obvious challenges, transform methodological skills and enhance progress

towards educational goals, including Sustainable Development Goal (SDG) number 4, which ensures inclusive and equitable education for all (Eze & Amadi, 2021). A significant application of AI in education is in the area of personalized learning. AI systems analyze data on each student performance and learning preferences, enabling the customization of materials and teaching-learning strategies. This individualized approach enables students to learn at their own pace, keeping in mind their strengths and weaknesses, thereby enhancing their overall engagement and comprehension (Yahaya, Ibrahim & Salihu, 2024). For example, adaptive learning platforms adjust content difficulty based on real-time assessments providing challenges that are peculiar to students' current skill level and promoting a more effective learning environment.

Similarly, automated grading and assessment presents another significant upgrade provided by AI. AI-powered grading systems automatically grades assignments, quizzes and examinations, providing instant feedbacks to students. This process not only reduce administrative stress but also enable learners receive instant feedbacks (Yahaya, Ibrahim & Salihu, 2024). By automating the evaluation process, educators can devote more time to instructional issues and focus more on student support.

## **SECONDARY SCHOOL**

A secondary school is an educational institution where the second level of the three levels of education (primary, secondary and tertiary) takes place. It is preceded by elementary or primary education and comes before tertiary education levels. Secondary education refers to the education children receive after primary education and before tertiary education. Ezeocha (2018) viewed secondary education as education that normally take place in secondary schools, taking place after primary education and may be followed by higher educational or vocational training. Similarly, Campbell (2019) stated that secondary education, often referred to as a high school, is a school that provides secondary education between the ages of 11 and 19 depending on location after primary school and before higher education.

Children usually go to secondary schools between the ages of 11 and 16 years and end between the ages of 16 and 18 years as the case may be. The school as a learning environment comprises of physical, academic, social and cultural environment (Campbell, 2019). The physical environment is made up of school; location, physical features and structures within and outside the school. Buildings, equipment and infrastructures available within a school and its environs also constitute the physical environment. In the context of this work, secondary school refer to the education children receive primary education and before tertiary education.

## **USE OF AI IN TEACHING, LEARNING AND ADMINISTRATIVE ROLES IN NIGERIAN SECONDARY SCHOOLS**

Artificial Intelligence (AI) has transformed the educational landscape by way of innovative tools and systems that enhance the quality of teaching, learning and administrative tasks globally. The adoption of AI into the Nigerian secondary school system would not only improve methodological approaches but also streamline other educational operations in the entire system. With the increase in global demand for personalized education and effective administrative processes, the adoption of AI continuously expand across different aspects of the education system (Musa & Bello, 2023). In the instructional process, AI facilitates delivery by supporting teachers with tools that personalize content and adapt to students' needs.

AI-driven platforms such as Intelligent Tutoring Systems (ITS), Adaptive Learning Software, and Automated Lesson Planners assists educators in bringing up strategies that best suit individual student needs in the learning environment.

AI systems and platforms used in education analyses learners' response in real time and adjust learning materials to match level of pace, skill and comprehension (Musa & Bello, 2023). AI-driven teaching and learning facilities are gaining prominence in Nigerian secondary schools, particularly in pilot programs that are designed to improve in STEM subjects (Okonkwo & Bello, 2023). AI has the capacity to positively impact instructional efficiency by way of automating content generation and real-time feedback systems. Such facilities as GPT-based engines can assist educators in creating quizzes, assignments, lesson summaries that are capable of saving time hitherto spent on routine tasks (Okonkwo & Bello, 2023). Similarly, AI allows for formative assessment through provision of instant feedbacks to learners. This enables educators focus more on instructional strategies at the expense of grading of students' performance. Quite a number of teachers in Nigerian secondary schools have started adopting AI-based formative assessment tools to monitor learners progress on continuous basis and come up with interventions to sort out identified gaps.

In the area of school administration, AI provides robust innovations that shapes school administrative processes in such areas as admissions, scheduling, staff allocation and performance monitoring. According to Musa and Bello (2023), predictive analytics is one of the most powerful AI tool that is employed by school administrators in forecasting students' enrolment, identification of at-risk students and improving resource planning, utilization and allocation. Such facilities make it possible for use of data-driven decision-making which enhances overall school effectiveness. AI tools such as power school and Brightspace insights provides real-time interactive dashboards that assist school administrators monitor students' academic performance, enrolment, attendance, teacher productivity among

others (Okonkwo & Bello, 2023). AI also has the capacity to transform school communication and support systems by way of automation. For instance virtual assistants are used in sending automated reminders for datelines, fees, school events among others, while machine learning algorithms manage email sorting, helpdesks queries and document filing. Hwang and Chien (2022) observed that some Nigerian schools have started integrating AI into their administrative systems to manage students' enrolment, records, reduce bureaucratic bottlenecks and improve general service delivery.

### TYPES OF ARTIFICIAL INTELLIGENCE (AI) TOOLS USED IN EDUCATION

Artificial Intelligence has changed the educational environment through the development and use of innovative tool that improve the instructional process. Such tools or facilities can be categorized into different groups depending on their usage within the school system. The major categories include: Intelligent Tutoring Systems (ITS); AI-powered Grading Systems; Chatbots for Educational Support and Predictive Analytics Platforms (Onyema & Olayemi, 2021). Each of these AI tools contributes differently improving the quality of education as follows:

**Intelligent Tutoring systems (ITS):** This is one of the most important AI tool used in education that is designed to simulate one-on-one instruction delivery through personalized learning experiences. This tool is capable of adapting to learners' personal pace, identifying knowledge gaps, and providing real-time feedbacks (Onyema & Olayemi, 2021). According to Onyema and Olayemi, ITS uses algorithms that analyze students' responses and intelligently adjust the difficult levels or content in order to ensure improved comprehension. These tools appear to be more effective in Mathematics, Sciences and language learning, where problem-solving and sequential understanding are required (Onyema & Olayemi, 2021).

**AI-powered Grading System:** This is another category of AI tools that promotes assessment efficiency in the school system. These tools automatically evaluate assignments such as multiple-choice tests, short answers, structured and subjective responses, among others. The major advantage of these tools lies in their ability to produce immediate feedback and reduce educators' workload (Hwang & Chien, 2022). AI Grading tools employs Natural Language Processing (NLP) and Machine Learning approaches to assess the structure, content relevance, grammatical accuracy of written responses among others. This makes it possible for educators to allocate more time to instructional planning and student engagement. In the Nigerian experience, where class sizes in public secondary schools can be overwhelming, such tools could be very useful in sorting out assessment-related issues (Hwang & Chien, 2022).

**Chatbots:** These are AI-driven interactive platforms that provide 24/7 assistance learners and teachers. This tool has the capacity to provide answers to frequently asked questions, help in course navigation and provide reminders for assignments or datelines among others. Chatbots are inclusive-learning compliant and assist learners with disabilities to access real-time academic assistance without depending solely on teachers (Omotayo & Adebayo, 2023). Additionally, Chatbots can enhance learners' engagement and reduce response time for administrative and academic queries.

**Predictive Analytics:** This is a category of AI system used in education that employs the use of historical and real-time data to forecast students' performance, identify at-risk students and suggest remedies. These tools uses machine learning algorithms to monitor students academic progress, attendance, behavior among others to predict outcomes such as drop-out rates or subject mastery. Predictive analytic tools have been adopted in many African countries as a means of improving decision-making in school and curriculum development in schools (Omotayo & Adebayo, 2023). By identifying learners who may be struggling earlier in the academic year, schools can bring up targeted remedies to guard against failure or drop-out. In the same manner, Edtech platforms such as Civitas Learning and Brightspace insights have shown clear signs of high accuracy in predicting learners' success and personalizing support mechanisms (Kumar & Daniel, 2022).

### BENEFITS OF ADOPTING AI IN SECONDARY SCHOOLS

The adoption of Artificial Intelligence in secondary school education has positively impacted the teaching and learning process worldwide. AI adoption has brought about innovative methods of instructional delivery, assessment, student support, improved administration, among others, which have ultimately improved the quality of educational outcomes. One of the most obvious benefits of AI in secondary school system is the promotion of personalized learning where intelligent tutoring adaptive learning platforms tailor educational contents to meet individual learning pace, strengths and weaknesses among learners (Omotayo & Adebayo, 2023).

Similarly, AI tools such as lesson planning assistants and content generation algorithms help teachers focus more on creative teaching and student engagement, at the expense of administrative burdens. A striking benefit of AI in secondary school education is its ability to support inclusive secondary school education. Such AI tools as speech-to-text applications, real-time translation and visual recognition softwares help learners with disabilities and language barriers to access learning materials (Omotayo & Adebayo, 2023). These AI tools empowers students with special needs by

providing them with personalized support and other requirements. For example, visually impaired learners can use AI-driven screen readers, while learners with learning disabilities can take advantage of AI softwares that break down complex concepts into digestible contents. This brings about educational equity and make sure no learner is left behind on account of cognitive, linguistic or physical challenges.

In a similarly manner, AI enhances learner engagement and motivation through gamification interactions learning platforms and chatbots. These platforms create dynamic and immersive learning atmospheres that make learning more enjoyable and reliable to digital-native learners. AI-drive chatbots and virtual tutors keep learners engaged through the provision of instant answers to their questions and reinforcing learning through quizzes and feedbacks (Kumar & Daniel, 2022). Abundance of real-time academic support from these platforms help students reduce frustration and promote positive learning especially in online or blended learning environments.

AI also offers significant value in terms of data-driven decision-making and early intervention. Predictive analytics tools make use of historical and real-time data to forecast students' performance and identify those at-risk of under-achievement or dropout. This enables school administrators and teachers to bring about targeted interventions aimed at addressing academic or behavioural issues before they get out of hand. Schools that use AI analytics can improve performance tracking, allocate resources more effectively and design customized intervention programs for struggling students (Kumar & Daniel, 2022). Such insights are capable of supporting curriculum development and policy formulation at both school and governmental levels.

AI-driven administrative platforms in secondary schools have substantially reduced paper works and have improved communication between teachers, parents and school administration. With streamlined administrative operations, schools are capable of redirecting their attention to core educational objectives and improving the overall quality of instruction in the institutions (Kumar & Daniel, 2022). In Nigerian experience, use of AI in secondary schools serves as a way of bridging the digital divide and modernizing the educational system. Although challenges exist in areas such as inadequate infrastructure and teacher preparedness, the potential benefits of AI usage are obvious if properly harnessed.

## **CHALLENGES OF AI USAGE IN NIGERIAN SECONDARY SCHOOLS**

Despite the obvious advantages of adopting AI in secondary school education, its implementation in developing countries, including Nigeria suffers numerous challenges. These challenges include among others, the following:

Inadequate infrastructure and technological readiness in many secondary schools. This is evident in

low and middle-income countries. AI adoption requires a stable internet connectivity, reliable electricity, advanced hardware, and up-to-date software systems, many of which are lacking in public secondary schools (Omotayo & Adebayo, 2023).

Most Nigerian secondary school teachers lack the necessary training required to integrate AI into the teaching and learning process. The issue of teacher preparedness and digital competence remains a strong barrier to the effective use of AI tools in the school demands a certain level of technical proficiency among educators (Kumar & Daniel, 2022).

Data privacy and ethical concerns another challenge to AI adoption in secondary schools. AI platforms relies heavily on large data volumes to function maximally. There are concerns about the reliability of data collected, stored and used especially in environments that lack robust data policies (Kumar & Daniel, 2023).

Curricular incompatibility and pedagogical misalignment is another challenge facing adoption of AI in Nigerian secondary schools. Most secondary school curricular are not designed with technology-enhanced instruction in mind. Teachers struggle to align AI-driven content with national education standards and assessment methods (Kumar & Daniel, 2022).

Limited stakeholders' awareness and engagement is yet another challenge facing the adoption of AI in secondary school education. Most school administrators, parents, and policy-makers still lack a clear understanding of what AI is and how it can benefit education (Omotayo & Adebayo, 2023). This leads to skepticism, fear of job loss and general resistance to change.

Policy and regulatory gaps constitute another challenge to the effective implementation of AI in secondary schools in Nigeria. Presently in Nigeria, there is no comprehensive national policy on AI in education. This absence creates ambiguity around roles, standards, funding mechanisms and accountability measures. Policy vacuums not only limits large-scale investment in AI but also leaves room for fragmental efforts (Kumar & Daniel, 2022).

Another significant challenge to AI adoption in secondary schools is the cost of acquisition and maintenance of AI technologies. AI-powered platforms and applications often with high installation and subscription costs, which are often not affordable for most public secondary schools in Nigeria (Omotayo & Adebayo, 2023). This constraint limits the capacity of most secondary school administrators to invest in AI technology, thereby limiting its adoption.

## **RECOMMENDATIONS**

The following recommendations among other if properly carried out would ensure effective and smooth adoption of AI in secondary school education in Nigeria:

Robust stakeholders' awareness and engagement. Relevant stakeholders should be made to

understand the potential benefits of AI adoption and be gainfully engaged in its implementation process.

Clear policy and regulatory frameworks should be put in place by Nigerian government. A clear policy and regulatory mechanism, with clear implementation time-lines would go a long way in ensuring a meaningful AI adoption in Nigerian secondary schools.

Nigerian government should prioritize AI adoption in secondary school education by making bigger financial commitment. This would make available finances required for AI adoption are provided in secondary schools to ensure its smooth adoption.

Adequate teachers training is required. Teachers are the major drivers of the teaching and learning process. As such, if they are adequately trained in AI adoption processes, the desired results would easily be achieved.

Secondary school curriculum should be restructured to be compliant with AI standards to ensure effective and smooth adoption.

Secondary schools' administrators should ensure availability of relevant and reliable data in schools. AI adoption relies heavily on data and availability of reliable data would facilitate AI adoption in secondary schools.

## CONCLUSION

Artificial Intelligence has the capacity to revolutionize the educational landscape through the development and deployment of intelligent tools that enhance the teaching and learning processes. In the African (Nigerian) context, the evolution of AI has taken a unique trajectory. Although its adoption is still in its early stages, there has been concerted efforts towards localizing AI applications to meet local needs. Although there are foundational challenges facing the adoption of AI in secondary school education, with concerted efforts and resilience, these challenges would be overcome overtime. With determination and political will on the side of Nigerian government, these challenges would eventually be overcome. This could set the stage for effective and smooth adoption of AI in secondary school system. The adoption of AI in secondary school system has the potential to transform the education sector significantly if properly harnessed.

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