



## AN ANALYSIS OF THE ROLE OF ARTIFICIAL INTELLIGENCE IN NIGERIA'S EDUCATIONAL SYSTEM

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### Abstract

*This study examined the role of artificial intelligence in Nigeria's educational system. Artificial intelligence is an expert system that helps in the delivery of lessons and instructional materials content in classrooms. It was observed that the forms of educational technology applied in Nigerian classrooms are medieval, and it advocated for modern enlightenment on the delivery of instructional materials content. Available studies have concentrated on the impact of ICT and Expert systems on the academic performance of primary, secondary, and tertiary education without considering the practical use of Artificial Intelligence systems on the performance of teachers' duties. Therefore, this study examined artificial intelligence as a tool for improving the education system in Nigeria, the challenges of artificial intelligence in Nigeria, the role of Artificial Intelligence in Nigerian educational system, and recommends that Artificial Intelligence should be inculcated in the school curriculum in Nigeria and special training should be made for teachers on the use of Artificial Intelligence.*

**Keywords:** Artificial Intelligence (AI), Nigerian Education system, Instructional materials content

### Introduction

Artificial intelligence is a branch of Computer science that is concerned with the design of intelligent devices that displays features or characteristics related with Human Intelligence. Artificial intelligence can simply be defined as designing machines to make

them behave like humans, i.e. in terms of reason and process. They have the power to go as far as spatial processing, language processing and even image processing. It is defined as intelligence exhibited by machines and has many applications in today's society. AI is a program developed to perform specific tasks that are being utilised for a wide range of activities including medical diagnosis, electronic trading platforms, robot control, and remote sensing. It has been used to develop and advance numerous fields and industries, including finance, healthcare, education, transportation, and more.

Artificial Intelligence (AI) according to Nwakunor (2021) is the computer-controlled robots that think intelligently like human. These robots are controlled electronically with the aid of the computer by mimicking the competencies of the human mind. AI keeps records and analysis of every action being made by the user. As a result of innovation in science and technology, AI is used in all facets of life for human development and comfort. For example in the educational sector, AI is used to teach children who are at the play group, preparatory and kindergarten classes using robots as teaching aids in the classrooms to impact knowledge on them.

Artificial Intelligence has become a part of our normal lives as we are surrounded by this technology from automatic parking systems, smart sensors for taking spectacular photos, and personal assistance. Similarly, Artificial Intelligence in education is being felt, and the traditional methods are changing drastically. Taking a study from the Chinese who deeply understood their onions, in the world, they are currently the leading AI nation which has a 100% effect on their productivity from education to technology evolution. The academic world is becoming more convenient and personalised, thanks to the numerous applications of AI for education. This has changed the way people learn since educational materials are becoming accessible to all through smart devices and computers. Today, students do not necessarily need to attend physical classes to study, as long as they have computers and internet connection. AI is also allowing the automation of administrative tasks, allowing institutions to minimise the time required to complete difficult tasks so that the educators can spend more time with students. Nigeria as a developing nation, however, will need to improve her educational system by embracing the expertise of AI.

AI has impacted education, as a teaching and learning process for knowledge and skills acquisition by individuals and groups, with varying degrees of outcomes. To ensure inclusive and equitable quality education while promoting lifelong learning opportunities in line with the Sustainable Development Goal 4, AI must be promoted for educational activities in developing countries. It has been argued that AI offers benefits in increasing access to quality education in Nigeria, and Africa as a whole. The innovative, evolutionary and revolutionary growth and development of digital technology and ICT in education have instigated the fourth education revolution (Education 4.0). Education 4.0 has a significant effect on learning opportunities, educational policies, and instructional procedures (Eleyyan, 2021). Education 4.0 is evolutionary in nature since newer technologies and education approaches have been replaced by previous technologies and education approaches, AI is a major player of Education 4.0.

### **Overview of Artificial Intelligence**

Artificial Intelligence is both a driving force of the fourth educational revolution and a major carrier of the technological progress that is changing societies and economies globally. AI refers to the study of intelligent machines and software that can reason, learn, gather knowledge, communicate, manipulate and perceive objects (Verma, 2018). Artificial Intelligence is a part of computer science that deals with the design of intelligent systems; that is, systems that exhibit characteristics associated with intelligence in human behaviours (Ocana et al., 2019). Similarly, Strusani and Hounghbonon (2019) define AI as a combined large volume of data with computing power to simulate human intellectual abilities such as reasoning, language processing, perception, vision recognition and spatial processing.

### **Education in Nigeria: A Swift Overview**

Education is an investment that pays off anytime, anywhere. Education is the process of teaching, training and learning especially in schools, colleges or any organised setting to improve knowledge and develop skills. According to John Dewey, education is defined as the development of all those capacities in the individual which will enable him control his environment and fulfil responsibilities. Martin Luther King Junior sees education as the function to teach one to think intensively and to think critically. Educational training takes place in Nigeria at the nursery, primary, secondary, and tertiary levels.

Onasanya, Ayelaagbe & Laleye, (2012) explain that over the years, Nigeria has experienced continuing crises in education, including limited access to educational opportunities and resources, large class size, poor implementation of planned curriculum, inadequate funding, poor management, lack of interest in endeavour of learning, low number of qualified teachers and low literacy and basic education skills. Regrettably, illiteracy has come to stay in many developing countries of the world including Nigeria. This in turn leads to poor performance of students in examination; and malpractice is inevitable. Effective service delivery in educational training depends on the technique or method used by the teacher in teaching concepts, means of communication, material or media used during the process and the nature of learners in the instructional setting. In Nigeria, teachers believe that Artificial Intelligence will be a new driving force for the development of intelligent library and better ideas on information in order to meet up with the current global trends.

### **Major Artificial Intelligence Technologies**

The major Artificial Intelligence technologies as outlined by Thomas and Gambari (2021) include: machine vision, expert systems, machine learning, natural language processing, deep learning, and robotics.

#### **1. Machine Vision (MV)**

Machine Vision, also known as computer vision, is a major technology of Artificial Intelligence that enables software to recognise patterns, make predictions, and apply newly discovered patterns to situations that were not included or covered by their initial design (Richter et al., 2019). It enables visual perception like human recognition of image characteristics with high speed, high precision, and high accuracy, it uses a camera and computer to perform the functions of recognition, tracking, measurement of objects and image processing. Machine vision technology has been widely adopted in video surveillance, automated facial recognition, and biometric face-scanning surveillance, autonomous driving, medical image analysis, and archaeology (Chen, 2019). It can be utilised in education for taking attendance records, monitoring facial expressions of students and facial detection of a confused learner. Automated Facial Recognition (FR) integrated with machine vision has been used for attendance marking in class. The use of the FR system for attendance marking allows teachers and students to use class time more effectively and saves lecturers' time by eliminating the need to cross-check the attendance.

## **2. Expert System (ES)**

Knowledge-based expert system is the ability of computer software to imitate a human expert on a particular subject area to solve a problem using a well-organised body of knowledge. Nwigbo and Madhu (2016) note that an expert system uses a knowledge base of human expertise for problem-solving and making decisions exactly as a human expert would have done. In education, expert system's applications are embedded into the Intelligent Tutoring System (ITS) which act as professional tutors to provide personalised learning to students considering the students' prior knowledge and ability. Artificial Intelligence career coaches are embedded with expert system to provide individualised advice to students based on their history, experience, skills, combined with career requirements to satisfy students' need to further their study (Khare et al., 2018).

## **3. Natural Language Processing (NLP)**

Natural language processing is a technology of Artificial Intelligence mainly concerned with the imitation of human natural language and communication methods. The Natural language processing offers ways of communicating with an intelligent system using natural languages such as English, French, Swahili, and Chinese in either written or spoken form. It is integrated into machines to enable the machines to perform useful activities that require natural human language, and is integrated into talking calculators to provide oral dictation of punched numbers or signs. It also allows more users in different countries to have access to either spoken or written information in different languages; and persons with visual impairments, hearing difficulties, dexterity and motor difficulties can initiate and manage conversations with others independently. Natural language processing is integrated into commonly used services such as Google Translate and chatbots (Kolodny, 2017). It helps learners with spelling and grammatical corrections and also offers automatic online translation for works with multiple languages.

## **4. Machine Learning**

Machine learning (ML) is the most advanced area of Artificial Intelligence, it refers to the designing, training, and deploying of models to applications, processes, and other machines by providing algorithms, Application Programming Interfaces (APIs), development and training toolkits, data, and computing power. Goksel and Bozkurt (2019) add that Machine Learning is a system in which existing data is used for future predictions. Content providers use Machine Learning to determine what course material works best in each study area. With Machine Learning, lecturers make use of feedback and scoring systems to help grade assignments, guard against plagiarism, and assess students' progress. Machine Learning is integrated into Natural Language Processing to provide text-to-speech applications, language-to-language translation applications. Machine Learning has changed the way information is searched for by automating related suggestions to users and making recommendations for information to search with just a click.

### **5. Deep Learning (DL)**

Deep Learning, also known as deep neural network, is a technology for implementing Machine Learning. It is primarily used in pattern recognition and classification applications supported by large data sets (Chen, 2019). It allows virtual assistants to detect and understand speech, images, sound and videos. Deep learning has increased the efficiency of online learning, as adapted educational software are used in online platforms which makes it easy to meet individual needs of students; thus fostering personalised learning and offer an opportunity for learners to get extra assistance from tutors.

### **6. Robotics**

Robotics entails the science and technology of designing, constructing, operating, manufacturing and application of robots. The Robot Institute of America in 1979 defines a robot as a reprogrammable, multifunctional manipulator designed to move materials, parts, tools, or specialised devices through various programmed motions for the performance of a variety of tasks. Robots are built with the ability to sense their environment in ways that are similar to the way that humans sense their surroundings (Odoh, 2018). They can be used to provide a synchronous lesson to students who are absent from school. For example, Avatarion, a Swiss company that builds robots connected to the Microsoft Azure IoT Hub to provide lessons to physically absent students in a class, with full video and audio connections in their hospital or home, to enable them to participate in the learning process. The student uses a tablet to control the robot's movements, and answer questions by raising the robot's hand and speaking through a connected microphone and speaker (Mamudu & Lamido, 2017).

AI has the potential to address some of the biggest challenges in education today, innovate teaching and learning practices, and accelerate progress towards SDG 4 (UNESCO, 2023). With the ability to analyse data on students' performance and preferences, AI can help educators to create customised lesson plans and assessments that align with each student's unique strengths and weaknesses. This can improve students' engagement and motivation, and ultimately lead to better academic outcomes.

### **Artificial Intelligence in Education**

Artificial Intelligence has penetrated and influenced growth in education through the invention of educational applications, web searches and several learning platforms with several functions they can perform. Below are examples of AI in education categorised under these branches as outlined by Olafare (2023):

1. **Expert system-** Educational AIs that function like this include Intelligent Virtual Reality. Examples include:

(a) ChatGPT is a chatbot launched by OpenAI. It is built on a GPT-3 with a large language model and fine-tuned (an approach to transfer learning) with both supervised and reinforced learning techniques.

(b) Teal is a one-stop model for organising and managing your job search. It is like having your own personal ATS or CRM for the job search.

(c) Calendly streamlines scheduling and eliminates 'back-and-forth'. This increases the likelihood of booking a meeting with someone.

(d) ResyMatch- match your résumé with any job description to increase chances of an interview.

2. **Machine Vision**—Examples of AIs that can perform these features include Automated facial recognition and Gradescope.

3. **Natural Language Processing-** Examples of Educational AIs under this branch include:

(a) Presentation translator- has features that let you add live subtitles to your presentations in PowerPoint, as you are speaking. Presentation Translator can display subtitles directly on your PowerPoint presentation in any one of more than 60 supported text languages. This feature can also be used for audiences who are deaf or hard of hearing.

(b) Grammarly- This is an Artificial Intelligence-based solution that helps user with correct grammar usage. Grammarly goes well beyond the standard word processor grammar and spelling checks. Instead of simply flagging glaring errors, Grammarly can also offer style and usage suggestions. It helps users to fine-tune their writing style to fit into the context to which their writing is targeted. It also helps to present idea in a simpler, yet communicating way.

(c) Twitter Bot – A twitter bot is a particular kind of software bot that utilises the Twitter API to manage a twitter account. This software bot is capable of carrying out tasks including tweeting, retweeting, liking, following, unfollowing, and sending direct messages to other accounts on its own. In order to use it properly, you should broadcast useful information, automatically produce engaging or imaginative material, and automatically reply to users' direct messages.

(d) Speeko – can help user practice interviewing with an AI speech coach. Also helps user get better at public speaking.

4. **Robotics-** some educational AIs that perform like robots are Padlet and smartboards.

5. **Machine Learning-** Educational AIs that function like this include:

(a) Turn-it-in- is a service for online plagiarism detection offered by the American company Turnitin, LLC, a division of Advance Publications. It was established in 1998 and provides licenses to universities and high schools. These institutions utilise the software as a service (SaaS) website to check submitted works for plagiarism against its database and the content of other websites. Findings can be utilised in formative evaluation to help students evaluate how to avoid plagiarism and enhance their writing, as well as to become aware of similarities with current sources. Moreover, Turnitin, LLC manages the educational website 'plagiarism.org' and provides a similar plagiarism-detection service called 'authenticate' for newspaper editors and book and magazine publishers. The Turnitin suite also includes the online grading and constructive feedback tools: GradeMark and PeerMark (student peer-review service).

(b) Research gate- enables scientists and researchers to share papers, ask and answer questions, and locate partners through social networking.

(c) Scopus- A comprehensive, highly maintained abstract and citation database, enriched data, and connected scholarly literature from a wide range of fields are all combined in a singular way by Scopus. Scopus locates credible research fast, recognises experts, and gives users access to trustworthy data, analytics, and analytical tools. With one database and one subscription, you can move your research, teaching, or other priorities forward with confidence.

(d) Gooru- Gooru- is an online "GPS for learning" tool for material exploration, which allows the instructor's dashboard includes a number of choices for quickly gauging student's progress. Gooru compiles data from many sources and applies AI to calculate traits across various dimensions, including knowledge, mindsets, and talents.

(e) Web of science- is a platform with paid access that gives users access to numerous databases that contain reference and citation data from academic journals, conference proceedings, and other publications across a range of academic subjects.

### **Artificial Intelligence in Nigeria**

The government of Nigeria has taken steps to promote the advancement of Artificial Intelligence in the country. This is obvious in the formation of National Agency for Research in Robotics and Artificial Intelligence (NARRAI) in 2018. According to the then Minister of Science and Technology, Dr. Ogbonnaya Onu, in 2018, NARRAI will coordinate and control all researches relating to AI and robotics. Ladeinde (2019) adds that the agency will collaborate with international research bodies, work with tertiary institutions and promote Nigeria's ability to leverage Artificial Intelligence technologies for economic growth.

In 2015, a twenty-four-year-old Nigerian, Bobai Ephraim Kato built a fully functional Artificial Intelligence robot for his final year project at the International College of Business and Technology (ICBT) in Sri Lanka when the directive came to his class to create software that uses Artificial Intelligence for predictions and solutions; the robot has been tested and trusted for puzzle-solving (Ogbonnia, 2017). ScholarX in Nigeria, is a social impact start-up focusing on education to help young Africans from

low-income backgrounds have access to quality education through scholarships, crowd-funding and e-learning (Nsehe, 2019). Another AI Innovation can be traced to the Obafemi Awolowo University iLab team, where Ishola Babatunde Isaac in July 2016 developed a system called Remote Lab. This Artificial Intelligence system allows students to control real laboratory equipment over the internet without time and space restriction and this Remote Lab has been a great substitute for experimentation in Nigerian Universities. In June 2018, Google established its AI research hub in the University of Lagos, Nigeria (Hussain, 2018).

### **The Role of Artificial Intelligence in Education**

AI has penetrated education spheres, in the form of intelligent books, web browsers, education apps, and learning platforms (Karsenti, 2019). AI has also enabled new ways of learning, teaching, assessment and research, thus increasing the efficiency of educational activities and giving access to a wide range of information.

#### **1. Teaching prospects**

AI will give flexibility to teachers in Nigerian educational institutions. Depending on the specific technology, using AI could reduce the burden of attending classrooms, marking papers and other tasks, enhancing the overall teaching experience and quality. The use of AI could assist teachers in identifying the learning needs and abilities of individual students and developing appropriate measures to respond to such needs. Also, teacher-facing AI systems are used to support the teacher and reduce workload by automating tasks such as administration, assessment, feedback, and plagiarism detection. AI could also provide additional support for teachers in analysing students' data, predicting their academic achievements, and proffering solutions to address their learning challenges. Importantly, AI helps educators gain greater insight into how students are progressing. That means they could adjust their approach, supporting students' individual needs. Furthermore, AI could foster the development of smart content and platforms for the professional development of teachers. Peers and mentors may emerge from such communities, invariably boosting teaching experience and quality, including AI mentors for learners and further development educators through virtual global conferences.

#### **2. Simplifying Administrative Tasks**

AI can automate the administrative duties of teachers and academic institutions. Educators spend a lot of time grading exams, assessing homework, and providing valuable responses to their students. However, technology can be used to automate grading tasks where multiple tests are involved. This means teachers would have more time with their students rather than spend long hours grading them. The school admissions board is the other department that is gaining a lot from AI. Artificial intelligence allows for the automation of classification and processing of paperwork.

#### **3. Smart Content**

AI and education go hand-in-hand and the new techniques could be all that is required to ensure that all students attain their ultimate academic success. Smart content is a very hot subject matter today. Robots can produce digital content of similar quality as what



different essay writing services can create. This technology has already reached a classroom setting. Smart content also includes virtual contents like video conferencing, video lectures. AI systems are using traditional syllabuses to create customised textbooks for certain subjects. As a result, textbooks are being digitised, and new learning interfaces are being created to help students of all academic grades and ages.

#### **4. Personalised Learning**

Through AI-powered apps, students get targeted and customised responses from their teachers. Teachers can condense lessons into smart study guides and flashcards. They can also teach students depending on the challenges they face in studying class materials. Unlike in the past, college students can now access a larger window time for interacting with teachers.

#### **5. Global Learning**

Education has no limits, and AI can help to eliminate boundaries. Technology brings drastic transitions by facilitating the learning of any course from anywhere across the globe and at any time. AI-powered education equips students with fundamental IT skills. With more inventions, there will be a wider range of courses available online and with the help of AI, students will be learning from wherever they are.

#### **6. New Efficiencies**

AI improves IT processes and unleashes new efficiencies. Schools can determine the appropriate methods of preventing students from getting lost in crowds when they run in corridors. AI can also be used in the modelling of complex data to enable the operations department to create data-driven forecasts. This, in turn, allows proper planning for the future, for example assigning seats during school functions or ordering food from local cafeterias. Speaking of which, schools can avoid a lot of wastages caused by over-ordering, thereby saving costs.

### **Challenges of Artificial Intelligence in Education**

Artificial Intelligence (AI) in the Nigerian educational system faces a range of challenges that need to be addressed in order to ensure its effective integration and utilisation. Some of these challenges include:

1. **Infrastructure:** The availability and quality of infrastructure, such as reliable internet access and electricity, as well as availability of computer systems are important prerequisites for implementing AI tools and technologies in education. Nigeria faces infrastructural limitations that can hinder the widespread adoption of AI in the educational system.
2. **Funding:** Adequate financial resources are essential for the development and implementation of AI initiatives. Lack of funding can impede the procurement of necessary hardware, software, and expert personnel needed to deploy AI solutions effectively in Nigerian schools and universities.

3. **Awareness and Understanding:** Creating awareness and providing a comprehensive understanding of AI among education stakeholders is crucial. Educators, administrators, and policymakers need to be familiar with AI concepts, its potential applications, and its limitations to make informed decisions, develop appropriate policies, and design relevant curricula.

4. **Skills Gap:** There is a shortage of professionals with expertise in AI within the Nigerian educational system. The lack of qualified AI trainers, data scientists, and engineers hinders the development and deployment of AI solutions. Bridging this skills gap through targeted training and capacity-building programs is necessary to fully leverage AI in education.

5. **Ethical Considerations:** The ethical implications of AI usage, such as data privacy, security, and algorithmic bias, must be carefully addressed in the educational context. Ensuring that AI systems are transparent, fair, and unbiased is essential to build trust and prevent potential harm.

6. **Content Localisation:** Many AI-powered education technologies and resources are often developed based on foreign contexts and may not be directly applicable to the Nigerian educational system. Localising AI content, including language, cultural references, and examples, is vital for its effective integration into the Nigerian educational landscape.

7. **Resistance to Change:** Resistance to change is a common challenge when introducing new technologies like AI. Some educators and administrators may be hesitant to embrace AI due to fear of job displacement or unfamiliarity with the technology. Ensuring proper training, addressing concerns, and showcasing the benefits of AI can help to overcome this resistance.

8. **Teacher Training and Readiness:** Many educators may lack the necessary training and skills needed to effectively teach using AI tools and technologies. Providing proper training and professional development opportunities to teachers is crucial in order to harness the full potential of AI in enhancing the teaching and learning experience.

9. **Digital Divide:** There is a significant digital divide between urban and rural areas, as well as between different socioeconomic groups, in Nigeria. This disparity in access to technology and digital literacy skills creates a barrier to the widespread use of AI in education, leading to unequal opportunities for students across the country.

10. **Curriculum Adaptation:** Adapting the education system's curriculum to accommodate AI-related subjects and skills poses a challenge. Addressing this challenge requires collaboration and coordination between educational institutions, policymakers, and industry experts to ensure that students are equipped with the relevant knowledge and skills needed in the age of AI.

Addressing these challenges requires collaboration among government agencies, educational institutions, industry partners, and relevant stakeholders. By overcoming these obstacles, AI can contribute significantly to enhancing the Nigerian educational system, improving learning outcomes, and preparing students for the demands of the future.

### Conclusion and Recommendations

AI unarguably holds the potential to revolutionise teaching and learning in Nigeria by eradicating challenges associated with conventional educational methods. The application of AI in teaching and learning has come to stay, and Nigeria will likely leverage AI to achieve its educational goals, including enhanced knowledge acquisition in classroom settings and at home. AI is good in instructional delivery at every level as it blends instruction. It is also efficient and effective in instructional delivery. However, there are hitches that seem to show that AI has its own issues in instructional delivery. The following recommendations were made:

1. **Infrastructure Development:** The government needs to invest in improving internet connectivity, providing computer systems, and building digital infrastructure in schools across the country. This will enhance students' and teachers' access to AI tools and technologies.
2. **Digital Literacy Programs:** Comprehensive digital literacy programs should be implemented to bridge the digital divide and equip students and teachers with the necessary skills to use AI tools effectively. These programs should target both urban and rural areas, ensuring equal opportunities for all.
3. **Teacher Training and Development:** training programs and initiatives should be established to equip teachers with the skills and knowledge required to integrate AI into their teaching practices. Continuous professional development opportunities should be provided to keep teachers up-to-date with the latest advancements in AI.
4. **Integration into Curriculum:** there should be collaboration with educational stakeholders to integrate AI-related subjects and skills into the national curriculum. This integration should be accompanied by the development of relevant learning resources and teaching materials.
5. **Public-Private Partnerships:** partnerships between the government, educational institutions, and industry players should be fostered to provide funding, resources, and expertise in AI education initiatives. This collaboration will support the sustainable integration of AI in the Nigerian education system.

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