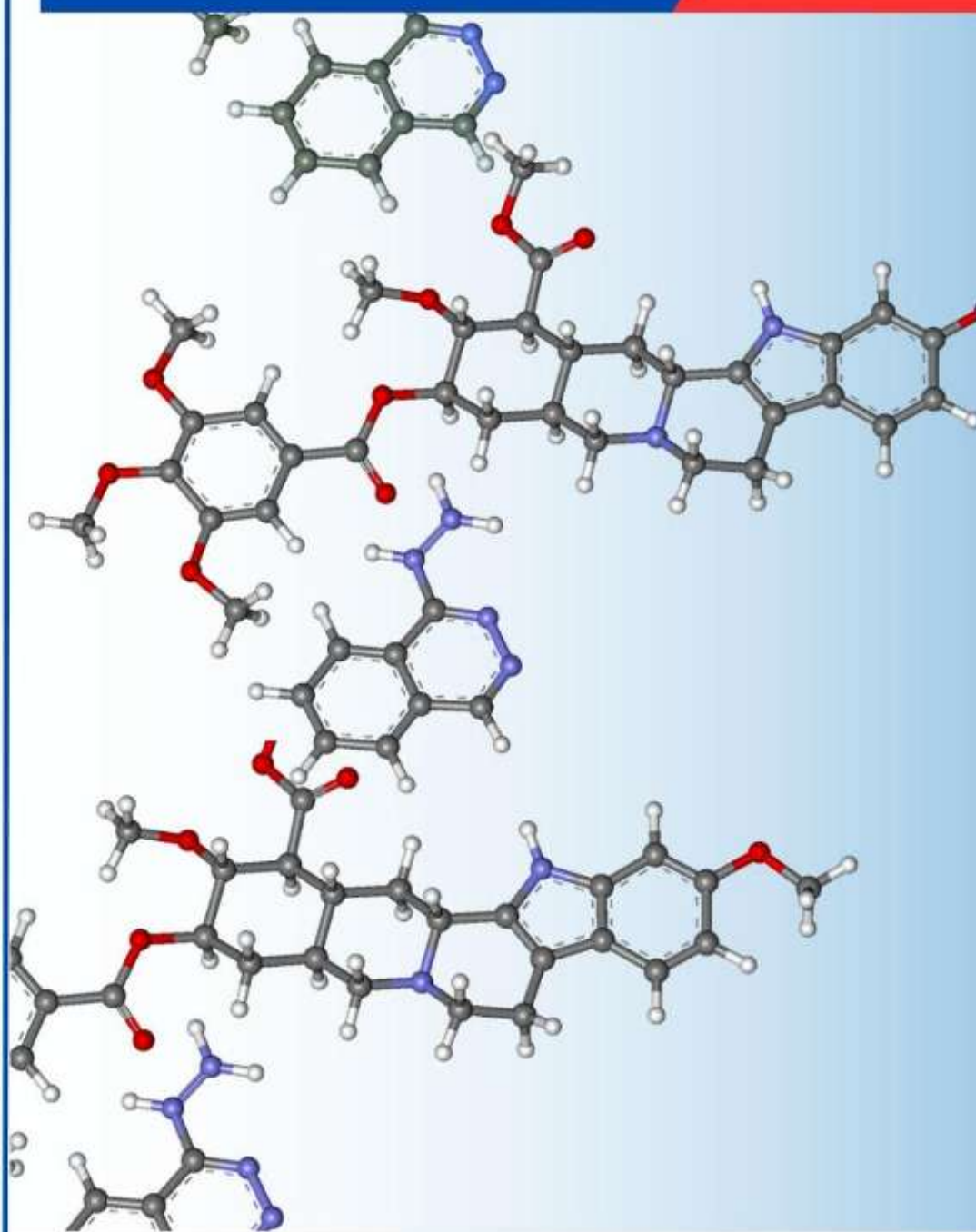




# STEMJAS

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## **EDITORIAL**

STEM Journal of Anambra STAN (STEMJAS) is a publication of **Science Teachers Association of Nigeria, Anambra State Chapter**. STEMJAS is developed to disseminate information on Science, Technology, Engineering and Mathematics (STEM) Education to teachers, teacher-trainers, researchers and other interested persons. Articles that are of relevance to STEM education are published in this journal. We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Ebele C. Okigbo  
**Editor-in-Chief**

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## INTEGRATING DIGITAL TOOLS AND ARTIFICIAL INTELLIGENCE IN SCIENCE CLASSROOMS IN NIGERIA

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### Abstract

Science classrooms in Nigeria will witness changes in the use of artificial intelligence AI, and digital tools. With the advent of the fourth industrial revolution and changes in the production and distribution of goods and services, educators must, of necessity, adopt classroom techniques that encourage student participation, innovative learning approaches, and active student participation in all classroom activities. In this paper, efforts are made to show how AI can be employed in teaching techniques such as simulation, virtual laboratories, and the use of AI to ensure learning management in Nigerian schools. This paper will also examine teachers' competences, classroom infrastructural limitations, and the need of AI in Nigerian secondary and tertiary institutions. This paper shows that while digital and AI tools and techniques have pedagogical and transformative possibilities in Nigerian schools, effective use of AI requires teacher training in the use of AI in our schools. This paper calls to mind the difficulties in the effective use of AI in modern Nigerian school. These drawbacks include unstable power supply, high cost of digital facilities, and shortages of digital personnel. This work will show that while digitalization and AI can bring benefits in Nigerian educational system, there are necessary infrastructure that must be put in place to enable the country reap the full benefits of the marriage of AI and the use of digital tools.

**Key Words:** Digital tools, Artificial intelligence, Pedagogy, Virtual laboratories, Nigeria.

### Introduction

Changes in science classrooms in Nigeria through the use of digital tools and Artificial intelligence AI, must in fact, bring positive benefits in Nigerian Science Education. Integrating digital tools and Artificial intelligence will introduce changes in pedagogical methodologies that



will ensure better learning of contents taught and the ability to create innovations in the application and use of scientific principles in experimentations and innovations.

This will overcome the limitations in the use of old and outmoded methodologies that can no longer be of benefit in modern digital scientific age (Mustapha et al 2025). Mustapha et al surmised that these benefits must come at a cost which is in addressing unique infrastructural deficiencies which include costs in the acquisition of digital and AI tools. While Nigeria like other Countries in the world is gradually undergoing changes in its science and AI uses in science classrooms, there remains enduring problems and acquisition of the scientific and digital tools and the structures necessary for their application. These structures include the supply of electricity, which is a sine qua non in the use of digital tools and AI services. There are also inadequate laboratory facilities consequent on overcrowding of limited classroom spaces. It is important not to forget that the teacher is the spirit that moves activities in the classroom. Thus mere availability of digital devices in the classroom is not enough. Teachers must possess digital literacy, pedagogical competence in the use of digital devices and a positive attitude towards adoption and application of new technologies.

Onasany and Adegbija, 2021 suggest that successful implementation of AI and digital tools in science classrooms will necessarily depend on administrative support. Apart from administrative support, there is need for curriculum alignment in on-going professional development. What this suggests is that the professional preparation of science teachers must include digital acquaintance and AI application in the design and use of pedagogical devices.

This paper discusses the integration of digital tools and artificial intelligence in science classrooms in Nigeria. The emphasis is on pedagogical benefits, challenges in the implementation and possible strategies in the adoption of AI and digital innovations. The paper hopes to contribute to the growing body of knowledge on the enhancement of learning in science classrooms. The paper hopes to provide insight to policy makers, educators and researchers trying to modify the teaching and learning of science in Nigeria school.

### **Theoretical And Conceptual Frame Work**

Both the constructivist and inquiry learning theories are useful in Integrating digital tools and AI in science classrooms. Constructivist theory suggests that learners build knowledge through active exploration and reflection. Digital tools such as simulations and virtual labs align with this theory by allowing students to manipulate variables and hypotheses in a safe, controllable environment.

Constructive theory is another way of employing the inquiry learning process in science classroom. In an inquiry classroom the teacher refrains from telling the student's what they already know or should know. Telling Students what they already know or should know deprives them of the excitement of finding things out by themselves (Uzoh, A etal, 2015). The use of AI must of necessity involve using AI to draw from student what they already know or should know



rather than AI telling them everything. The uses of AI to tell students defeat the spirit of inquiry (Uzoh, A etal 2015).

The use of AI in integrating digital tools requires teachers who know the use of questioning as a basic mode of discourse in a science classroom. AI must not be used to give students direct answers to questions generated as a mode of discourse in a science classroom.

The use of AI in a science classroom should aim at promoting divergent views and continuous thought. AI should be so programmed that it does not accept any right answers. Because most often, right answers serve to terminate further thought. An inquiry teacher must exploit the advantages of pluralizing, that is, he does not ask for a reason but for reasons, not for a cause but for causes. In the use of AI he must exploit the power of contingent thinking.

AI should be involved in simulations and the use of virtual tools which must be combined by allowing students manipulate variables, test hypotheses, and derive conclusion which could be accepted or subjected to further testing.

In modern science classrooms, AI should be used to enable teachers use digital skill in the classroom to enable students learn how to solve problems through generation of hypotheses and the application of pedagogical techniques in finding answers to questions generated using the inquiry process. In the use of AI in integrations of digital tools in science classrooms simulation can be used to transform how students learn. It enables people to probe into ideas, values, and events which enable them to arrive at comprehensive knowledge of issues. The pedagogical approach combines necessary pedagogical techniques with AI generated teaching techniques. Simulation reduces an otherwise abstract topic to a familiar everyday affair which may be too abstract and complicated when it is taught through the use of lecture method. In a normal simulation class students assume roles when AI is used alongside simulation. Students identify with AI characters and endeavor to follow the process in the solution of the problem which he can disagree with and challenge. This generates discussion and further analyses of the problem studied.

### **Digital Tool In The Nigerian Science Class Room**

Digital tools have started to change how science is taught and learned in Nigerian schools. Simulation software and virtual laboratories or similar simulation tools allow Nigerians students to explore abstract scientific phenomena, such as molecular reactions and mass energy interactions. Given the widespread use of mobile phones in Nigeria, science apps such as simulation app, quizzes, augmented reality presents opportunities for students to learn outside traditional classroom situations. Also, tools like Google classroom or other Learning Management System (LMS) support assignment delivery, peer discussion, feedbacks and resource sharing, which is particularly helpful in large classes.



## **Integration of AI In Science Teaching And Learning**

AI generated system can be used to enable personalized learning system which will enable students to progress at their own pace (Samuel & Salisu, 2025). As we have seen above, AI can be combined with role playing or simulations as well as being a very necessary technique that can be combine with inquiry. It is necessary to adapt Intelligent Tutoring System and Assessment with AI. This can be adapted as a tool to use in the difficult questioning technique systems that are necessary in the use of simulation and inquiry technique. AI driven simulation can result in predictive modeling, based on student inputs.

AI can free teacher's time for more pedagogical classroom tasks. Along with inquiry technique, AI can be used to design experiments, suggest hypotheses, generate possible data analysis, thus making complex inquiry simple.

Integrating of digital tools and AI in Nigerian science education can yield benefits. It can improve conceptual understanding of inquiry skills, digital simulations and the use of virtual labs which may enable student experiments in designing scientific hypotheses and hypothetical conclusions. The system must necessarily increase student engagement in classroom activities. Digital simulation and virtual labs enable students design hypotheses and test them. AI enables personalized feed backs from hypotheses generated and tested by the students. In large classrooms, AI tools can be helpful in achieving more personalized assessment, which may be difficult to manage manually. Acquisition of digital tools and AI skills can help manage large data analysis.

## **Benefits of Integrating Digital Tool And AI In Nigerian Science Education**

1. Improved conceptual understanding and Inquiry skills. Digital simulations and Virtual labs help students visualize and experiment with scientific phenomena that are otherwise difficult to access physically.
2. Increased student Engagement. Interactive digital content and AI-powered personalized tasks can make science more engaging thus motivating students to persist through challenges.
3. Differentiated instruction. AI enables personalized feedback and learning trajectories addressing the needs of students with varying prior knowledge.
4. Support for large classrooms. In Nigeria, where class sizes can be large, AI tools can help deliver more Individualized feedback and assessments which is hard to manage manually.
5. Preparation for STEM careers. Familiarity with digital tools and AI builds relevant skill (digital Literacy, data analysis, Computational thinking) that are highly valuable in future STEM professions (Imoniri, 2025)



## Challenges To Integration Of Digital Tools And AI In Nigerian Context

With all the benefits that come through the integration of AI and digital tools in Nigeria, there are evident challenges that must be recognized and solutions found to them. One of the most important challenges AI and digital integration in Nigeria must encounter is the area of electricity.

Electricity is the spirit that makes AI and digital tools possible. AI cannot function in the absence of electricity. In Nigeria, the problem of a reliable and uninterrupted supply affects all science activities. AI is electricity centered so too digital integration. If digital integration with AI must yield the necessary benefits we look forward to the supply of electricity which must be continuous and dependable. From this perspective, we see that AI integration and digital tools is not even possible in schools where the supply of electricity is zero.

In addition to lack of reliable and adequate supply of power in most rural areas, the supply of internet facilities in these schools is practically impossible. Along with the problem in the difficulty of procuring and use of internet facilities, there is the problem of expense in the procurement of sufficient hardware to support digital learning in our schools (Mustapha. et al, 2025).

Teacher training and acquisition of pedagogical skills in combining AI and digital tools will be a problem to be overcome if Nigerian science classes must combine AI and digital tools. In the words of (Adeneye et al, 2025). "Procuring, maintaining and updating digital and AI platforms can be expensive, and funding is often "lacking". There is also the abuse of AI and digital integration by some unscrupulous persons which the science teacher must pay attention to. (Obidiebube et al, 2025) raises concerns around students' data privacy, algorithmic bias, and fair access to AI tools.

## Attempts Made To Integrate AI and Digital Tools in Nigeria

There are evidence that some schools in Nigeria are exploring AI and digital tools for personalized learning. There are initiatives and promising efforts in Edo state, despite infrastructural challenges. Divine Santos Nino International School is a good example of attempts at incorporating AI tool and school apps to boost digital skills and efficiency. Another attempt in this regard is the University of Nigeria Nsukka (UNN) and Enugu State University of Technology (ESUT) (Google.com) These institutions are making efforts to integrate ICT with AI learning data-driven teaching. There is expectation that Nigerian schools will introduce modules in AI, robotics, and programming.

According to the Guardian Nigeria News (20<sup>th</sup> May 2025). Adorable British College in Enugu has made history by becoming the first to formally integrate AI in its curricula. Also Television Continental News TVC (12<sup>th</sup> November 2025) reported that the federal government of Nigeria



has expressed hope that unity colleges will soon integrate AI into their teaching and learning processes.

AI is helping Nigerian teachers build better classroom experiences for their students. This trend is worldwide and is not peculiar to Nigeria. Nigerian education technology startups like schoola are speeding up the reality of AI application in Nigerian schools. Schoola is an educational technology platform based in Kaduna which is equipping Nigeria teachers with AI powered tools driven towards developing local curricula and classroom situations. It operates Curri AI and Curri SRC. Please note that Curri AI is an artificial intelligence-powered curriculum support tool designed to help educators plan, design, and improve lesson content while Curri SRC stands for Curri standard Resources and Content. It is not the AI itself but the structure-framework or system that Curri AI works with. Through these platforms it helps K-12 educators, i.e teachers and educational professionals who teach students from kindergarten, through grade one to grade twelve (primary and secondary school) plan more effectively and teach more creatively with the aid of AI.

Schoola's tools are built on AI teacher enablement. Their support helps teachers in planning, engaging students and teaching more effectively across Nigeria. Platforms like Curri AI speed up teacher planning and lesson delivery time in classrooms. AI platforms enable teachers who work with out-of-school children delivers their lessons effectively. Teachers who normally did all their work manually found their work easier and more effective when Internet Relay Chat (IRC) introduced them to Curri AI. Teachers in secondary schools say that the introduction of Curri AI has shortened their lesson preparation time and student engagement in classrooms (Guardian Nigeria 11<sup>th</sup> June 2025). Teachers in Nigerian schools such as Daral Hada Foundation Elementary and Tahfeez school assert that the appeal of AI-powered tools offered practical and logistical solutions to classroom problems. AI enabled teaching and learning give students early start to digital learning. Thus AI in classrooms has enable teachers reclaim their time in classrooms and during lesson preparation. Areas where-ap-group chats are growing are enabling new technology and growing professionally. The gain includes improvement in content quality and satisfaction of parents in the learning process of their children. On the whole, AI in Nigeria should be seen as a support system which brings out teacher creativity and effectiveness.

### **Pedagogical Strategies for Effective-Integration of AI and Digital Integration**

In addition to what we have written above on the use of pedagogical techniques like inquiry and simulation, it is also possible to use various problem-based teaching techniques which can be combined with AI to achieve good results. The teacher can combine lecture with direct AI uses and techniques that can enable students learn both collaboratively and independently. The teacher can encourage group work, virtual environment by combining discussion techniques and simulation or group reviews supported by digital platform. There could be organized training, work-shops for teachers in digital pedagogy and AI literacy.



There is need to include digital literacy and AI uses in ensuring that students are adequately exposed to AI and digital tools from very early stages. Government should prioritize AI and digital literacy in Nigerian schools. This is because AI and digitization have come to stay and every effort must be made to enable students to acquire expertise in the use of these techniques. Collaboration with Educational Technology Companies, NGOs and international donor agencies can help introduce digital and AI interventions In Nigeria schools. There is need for regulatory and ethical framework and policies to prevent AI and digital tools from unethical uses.

It is heartening that several promising trend could shape education in Nigeria. If cost of AI equipment is scale down making it available to science teachers and students, this will give fillip to science education in Nigerian Educational technology startups can develop AI powered Science apps and platforms which are tailored to meet Nigerian curricular and contents needs. Virtual reality and augmented reality can be combined with AI to ensure the use of complex scientific Phenomena in Nigerian science classrooms.

With more and more demonstrable benefits in the use of AI and digital tools, more and more favorable policy investments will be directed towards improvement in AI and digital tools integration in Science schools.

### **Conclusion**

From what is written above, it is evident that integrating digital tools and AI in Nigerian science classrooms will create powerful avenues for learning in Nigerian schools. To realize these benefits, coordinated efforts, investment in infrastructure, pedagogical capacity building curriculum reforms, and ethical governance must be ensured as Nigeria moves toward a digital driven future.

### **Recommendations**

1. **Infrastructure Investment:** To reap the benefits of integrating Digital Tool and Artificial intelligence in the Science classroom, it is important for government to improve electricity supply, internet access, and digital device availability.
2. **Teacher Training:** Government should, as matter of necessity, provide continuous professional development on digital pedagogy and AI literacy to teachers.
3. **Curriculum Revision:** Digital literacy and AI competencies should be enabled in the national science Curriculum by the federal ministry of education.
4. **Policy Development:** Government should establish ethical guidelines for AI uses, data protection, and responsible technological deployment.
5. **Public Private Partnerships:** Educational Technology Companies and NGOs should be engaged by federal and state governments to support digital integration in under-resourced schools.
6. **Monitoring and Evaluation:** Governments at all levels should track the effectiveness of digital and AI interventions to guide policy and practice.



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