



## **Integration of Artificial Intelligence in Pedagogy of Science Education: Perceptions of Mathematics and Biology Educators in Nigerian Universities**

**Eunice Nwakaego Onah<sup>1</sup>, Veronica Chinonyelum Ude<sup>2</sup> & Mary-Rose Chibundo Enema<sup>3</sup>**

<sup>1</sup>Department of Science Education, University of Nigeria, Nsukka

<sup>2</sup>Department of Science and Computer Education, Godfrey Okoye University, Enugu

<sup>3</sup>Department of Electronic Engineering, University of Nigeria, Nsukka

**Corresponding Author:** vude@gouni.edu.ng

### **Abstract**

This study explored the perceptions of Mathematics and Biology educators in Nigerian universities regarding the integration of Artificial Intelligence in education. Generative AI like Meta and the like can quickly summarize solutions to many science concepts needed for daily living. As AI continues to transform various sectors, its potential impact on pedagogy in science education remains a topic of interest in this digital world. This research explored how educators in Nigerian universities perceive AI's integration in enhancing teaching and learning in Mathematics and Biology. The Purpose of this research was to find out how educators perceived the use of AI which will be reflected on how students integrate AI Aright. Two Research questions and one null hypothesis guided the study. One null hypothesis was formulated . Descriptive research design was employed .Sample size was 300(160 Mathematics Educators and 140 Biology educators) that responded to the two questionnaire items. 10- item Mathematics Fundamental Concepts AI (MAFUC-AI) instrument and 10-item Biology Fundamental Concepts AI (BIFUC-AI) were used to collect data.Data collected were analyzed using Meanto answer the research questions and independent t- test for the null hypothesis at 0.05 level of significance. The researchers examined the benefits and challenges associated with AI adoption, including its potential to personalize learning, improve students' engagement, and facilitate assessment.The study also highlights educators' concerns regarding AI's limitations like potential biases in AI algorithms and the need for adequate training and support. The findings provide insights into the readiness of Nigerian universities to adopt AI in science education and inform strategies for effective AI integration. The findings also project that there is no significant difference on the Mean Perception of Mathematics and Biology Educators on the adoption of AI for teaching concepts. Slight seen from the mean responses on the 20 item questionnaires used to answer the two research questions for Mathematics and Biology educators. Although the results registered Very High Perception, recommendations were made to include need for comprehensive training programs to equip educators with skills required to effectively integrate AI into their teaching processes.

**Keywords:** Artificial Intelligence Integration, Pedagogy, Science Education Mathematics

### **Introduction**

Pedagogy is the Art and science of teaching. Pedagogy in education is the study of teaching methods that educators used to help students meet learning objectives. Three elements involved in pedagogy, according to researchers and Gemini (2025) are educators, students and subject matter which in this case imply integration of AI in science teaching and learning. The researchers are worried that learners are always with their smart phones pressing usefulness materials and need to be redirected by educators to

using the internet tools positively to enhance understanding.

The adoption of portable electronic devices in teaching and learning is called for in this digital age that needs innovative pedagogy such as use of AI to enhance understanding by students of what is being taught. Most Nigerian University Educators and students have smart phones which can enable easy integration of Artificial intelligence in mobile technology. Availability of network connectivity are also needed for functionality

of the smart phone. Application of Artificial Intelligence (AI) have been seen by many researchers to promote teaching and learning (Afonughe, Onah, Uzoma, Andor and Orisakwe, 2021). Teachers are curriculum implementer and the way teachers perceive the use of AI in teaching and learning is of great importance for discussion. Teachers are expected to direct students aright for effective use of AI. Meta AI for instance, is designed to assist with wide range of topics, including science education. Meta AI stated that it has its own limitations, that it cannot replace human teacher or expert, that one has to consult a qualified educator or professional for specific or advanced questions. This is proof that educators should not see Artificial Intelligence as a replacement for talent, but as a tool for learning enhancement.

Innovative pedagogy using electronic devices in teaching and learning is called for in this digital age to make the learners more engaging in science class. This is why National Teachers Institute (NTI) (2020) indicated that students in Nigerian society are digital natives and that most educators are digital migrate that need to embrace digital technology and be trained and retrained to effectively teach science and arts subjects to the learners. Integration of AI in teaching contribute a lot to students as seen in United Nations Educational ,Scientific and Cultural Organization (UNESCO) (2025). Some benefits of AI adoption in teaching and learning include: Personalized Learning since AI can tailor educational content to individual student needs, enhancing learning outcomes; Improved Engagement since Interactive AI tools can make learning more engaging for students, fostering a deeper understanding of complex concepts and Facilitated Assessment: AI can streamline the assessment process, providing immediate) feedback and identifying areas where students need improvement. Meanings of complex science concepts can be found using Meta AI.

Although AI is full of advantages, there are some challenges in AI adoption in teaching and learning which include: Bias in AI Algorithms. Some educators including Meta AI expressed concerns about potential biases in AI tools, which could affect the fairness and accuracy of educational outcomes. In some contents, a particular AI may be more accurate than another. It is the duty of the educators in the field to suggest preferred AI to be used for each lesson topic. Another challenge is Need for Training and Support: There is a significant need for comprehensive training programs to equip educators with the skills required to effectively integrate AI into their teaching practices (Afonughe,

Onah, Uzoma, Andor & Oriskwe, 2021) . If Educators have high perception on AI Integration, students will be highly motivated and actively involved in learning contents on all Science, Technology, Engineering Arts and Mathematics (STEAM) Education concepts. Having mastered the fundamental concepts in Mathematics and Biology which are basics as the concepts are daily used by everyone, knowingly or unknowingly. Educators' efforts and the way Science educators perceive Fundamental concepts in Mathematics and Biology need to be high for better integration of AI leading to better understanding by students as anticipated by the researchers. The fundamental concepts are transferred to other areas to portray meaning to what is being discussed. According to Onah, Ugwuanyi, Okeke, Nworgu, Agwagah & others (2020), no one can do anything meaningfully without number and numeration found in Mathematics. Similarly, Ude and Onah (2017) indicated that Biology is life since education is for the living and not for the dead. The researchers have observed that Mathematical concepts are seen in Biology and other subjects and hence this study. To exist effectively, therefore, one has to teach or learn basic concepts very well using current technology resources in the areas of Science, Technology, Engineering Arts and Mathematics (STEAM) education are needed to be taught using AI. According to the researchers and Metal AI (2025), some fundamental concepts in mathematics and biology education respectively include:

- Number Sense: Understanding numbers, their relationships, and operations.
- Algebraic Thinking: Recognizing patterns, relationships, and functions.
- Geometric Reasoning: Understanding shapes, spatial relationships, and measurements.
- Measurement: Understanding units, scales, and calculations.
- Data Analysis: Collecting, organizing, and interpreting data.
- Problem-Solving: Applying mathematical concepts to real-world problems.
- Mathematical Modeling: Using mathematics to represent real-world situations.
- Reasoning and Proof: Developing logical arguments and justifying conclusions.
- Communication: Expressing mathematical ideas clearly and precisely.
- Equity and Access: Ensuring that all students have opportunities to learn mathematics.

- The above are ten in number for Mathematics.

Similarly, there exist ten fundamental concepts in Biology education as shown:

- ✓ Cell Biology: Understanding the structure, function, and processes of cells.
- ✓ Genetics: Understanding heredity, variation, and the transmission of traits.
- ✓ Evolution: Understanding the principles of natural selection, adaptation, and speciation.
- ✓ Ecology: Understanding the interactions between organisms and their environment.
- ✓ Biological Molecules: Understanding the structure and function of bio-molecules such as carbohydrates, proteins, and nucleic acids.
- ✓ Homeostasis: Understanding the mechanisms that maintain stable internal environments in living organisms.
- ✓ Biodiversity: Understanding the variety of life on Earth, including species, ecosystems, and genetic diversity.
- ✓ Structure and Function: Understanding the relationships between the structure and function of biological molecules, cells, and organisms.
- ✓ Interdependence: Understanding the relationships between living organisms and their environment.
- ✓ Scientific Inquiry: Understanding the processes of scientific investigation, including observation, experimentation, and evidence-based reasoning.

The above fundamental concepts respectively form the foundations of Mathematics and Biology education and are essential for students to develop a deep understanding of Mathematical and Biological principles needed for Sustainable Developmental Goals (SDGs) attainment. Skill acquisition by every student and applying AI knowledge in real-world contexts especially in all Science, Technology, Engineering, Arts and Mathematics (STEAM) Education concepts are called for to produce skilled manpower in different arrears of life.

Integrating AI as innovative pedagogy in teaching and learning in Nigerian Universities need to be adopted because every lecturer and most students have AI tools and using Artificial Intelligence (AI) is currently in vogue and should be adopted by educators in the field. Some Generative AI (GAI) such as Gemini, being AI for Google, Meta AI, Chat GPT and the like can quickly summarize solutions to many science subjects including Mathematics and Biology

concepts needed for daily living. Most generative AI are available for usage making their adoption easy. Meta AI for instance arrived many phone's WhatsApp on its own and has to be explored. Researching on the topic: Integration of AI in Pedagogy of Science Education: Perceptions of Mathematics and Biology Educators in Nigerian Universities is called for so as to carry our digital native students along and aright (NTI/FME, 2020). The integration of Artificial Intelligence (AI) in education has gained significant attention globally according to UNESCO (2025) and its potential to revolutionize teaching and learning processes in Nigerian Universities where every educator and almost every student has a Smart Phone is called for. The students, when directed aright, are expected to use smart phones for useful learning instead of negative use of smart phones. This study focuses on the perceptions of Mathematics and Biology educators in Nigerian universities regarding the adoption of AI, particularly Generative AI (GAI) tools such as Gemini, Meta, and ChatGPT to enhance teaching and learning because AI continues to transform various sectors as earlier highlighted and its impact on pedagogy in science education remains a critical area of interest and hence the need for this study because students need proper direction from University Lecturers on the use of AI tools for meaningful study. Mathematics and Biology educators in Nigerian Universities embraced ICT and may equally perceive the integration of AI highly. This is why Ude and Onah (2017) highlighted the need for science innovative Educators in the field for technological development.

### Significance of the Study

Students, Educators, Parents and Curriculum Planners will benefit from the result of the findings of this Study as the work will be published in a reputable Journal which will be accessible to everyone. Students will find a better way of learning at one's pace and not waiting for the teacher who has introduced the lesson on the type of AI to learn each time. Students will also learn positively when the educators direct them aright. Educators will widen their scope of knowledge as unknown concepts' meaning can always be found. When the work is published in a reputable Journal, everyone including students, educators, parents will have access to the work. Curriculum planners will benefit by including integration of AI in pedagogy materials. Learning, which is a continuous process will then develop higher since additional source of information will be available.

### Purpose of the Study

The main purpose of this study is to find out how Science University educators perceive the integration of AI as tool for teaching and learning. Specifically, the researchers sort the perception of: Mathematics and Biology educators on integration of AI in teaching and Learning processes.

### Scope of the Study

The scope of this study covers University educators in Nigeria who are involved in marking exercise in National Open University of Nigeria (NOUN), Enugu Study Center who were either in Mathematics Education or Biology Education, Total number of Mathematical and Biology educators used were respectively 160 and 140. All the fundamental concepts in Mathematics and Biology education as listed above by the researchers were considered.

### Research Questions

1. What is the Mean response as perceived by Mathematics Educators on integration of AI to enhance teaching and learning of fundamental Mathematics?
2. What is the Mean response as perceived by Biology Educators on integration of AI to enhance teaching and learning of fundamental Biology?

### Null Hypothesis

The following null Hypothesis was tested at 0.05 level of significance.

**H<sub>01</sub>:** There is no significant difference in the Mean Response of Mathematics and Biology Educators on their Perception on integration of AI and Pedagogy for enhancement of University Students' understanding of Fundamental science concepts.

### Literature Review

This study was anchored on Cognitive Theory of Multimedia Learning (CTML) by Richard Mayer (2009) which states that people learn better from multimedia materials such as text, images, audio and that when content is presented in a way that aligns with how human brain processes information. This is so because when AI is used in pedagogy of sciences especially Mathematics and Biology Education effectively, and also when educators perceive the use highly and also perceive the integration of Artificial

Intelligence in Pedagogy of Science Education highly, Students in Universities will have the opportunity of personalized learning and Intelligent Tutoring System (Ehizona, 2024). The author is of the view that the AI-powered system can be one on-one support, offering real-time feedback and guidance to the Learner. The present researchers have similar perception as Screen need to be viewed and appropriate texts and diagram observed depending on what is keyed in. Adequate learning contents as directed by educators can be found and appropriate comments may be made by AI in question. AI in education has been explored extensively, highlighting its potential to personalize learning, enhance students engagement and facilitate assessment (UNESCO, 2025). Studies have shown that AI can provide tailored educational experiences by analyzing students data and adapting content to meet individual needs. However the adoption of AI in education also presents challenges, including inconsistency supply of data, potential biases in AI algorithms and the need for adequate training and support for educators leading to skills acquisition.

### Statement of the Problem

Generative AI (GAI) tools such as Gemini, Meta, and ChatGPT can be integrated in Science education pedagogy in Nigerian Universities to enhance teaching and learning. Some students use smart phones which can enable easy integration of Artificial intelligence negatively. Educators are curriculum implementer and can direct students aright. The way the science educators perceive the use of AI determines how readily they are to direct students aright.

### Methodology

The research employs a descriptive research approach using opinion of educators to gather data. Descriptive research design was used because the study involved observing and collecting that on how the educators perceive integration of AI to enhance teaching and learning by students. The 20 item instruments 1 – 10 for Mathematics Educators and 11 – 20 for Biology Educators and empty space for additional information were responded to by 160 and 140 educators were requested to indicate their opinions on how they perceive the use AI in science teaching on a 4 points scale of Very High Perception (VHP), High Perception (HP) = 3 points. Low Perception (LP) = 2 points. Very Low Perception (VLP) = 1 point.

Specifically, Mathematics and Biology educators in Nigerian universities gave response to the



two instruments of 10 items each constructed from the fundamental concepts in Mathematics and Biology. The two instruments used were respectively named Mathematics Fundamental Concepts AI (MAFUC-AI) and Biology Fundamental Concepts AI (BIFUC-AI) and were face validated by three experts in the field of education- Mathematics, Biology and Computer Education before trial testing. The reliabilities were 0.87 and 0.84 using Cronbach Alpha after trial testing.

Also, the respondents on an empty space provided by the researchers were asked to state challenges encountered while using AI in science

teaching which they respond to. The instruments were then administered by the researchers during the National Open University marking exercise and Data gathered were analyzed. Mean and standard deviation were used to answer the two research questions while independent t – test was used to test the hypothesis 0.05 level of significance. Decision were taken thus, mean above 2.5 was accepted as very high perception while t – test value (1.056) is below 1.96 for two-tailed test and was regarded as acceptance of the null hypothesis formulated for Mathematics and Biology educators.

## Results

**Table 1: Mean response and Standard Deviation of Mathematics Educators on the perception on integration of AI to enhance teaching and learning of the Mathematics fundamental Concepts in Nigerian Universities**

Educators	n1	M1	SD1	Decision
Mathematics	160	3.575	0.496	VHP

**Key:** n= Number of Respondents, MI= Mean response of Mathematics Educators, SD1=Standard Deviation, VHP= Very High Perception

**Table 2: Mean response and Standard Deviation of Biology Educators on the perception on integration of AI to enhance teaching and learning of the Biology fundamental Concepts in Nigerian Universities**

Educators	n2	M2	SD2	Decision
Biology	140	3.514	0.052	VHP

**Key:** n2= Number of Biology Educators Respondents, M2= Mean response of Biology Educators, SD2=Standard Deviation, VHP= Very High Perception

**Table 3: Independent t-test of Mean Responses of Mathematics and Biology Educators on their Perception of integration of AI and Pedagogy for enhancement of University students understanding of Fundamental science concepts**

Educator	n	M	Df	Cal-t	t-tab	Decision
Mathematics	160	3.575				
Biology	140	3.514	298	1.056	1.96	Not significant

**Key;** n= (n1,n2), M=M1,M2, Df= Degree of freedom, Cal-t= Calculated –t value, t-tab= Table t value for two tailed test and 298 degrees of freedom.

## Discussion of Findings of the Results

Result presented in Table 1 shows that all the items (1 – 10) for research question 1 have average above 2.5. This means that Mathematics educators perceive highly the need to integrate AI in teaching and learning. Similarly result in Table 2 shows that all the items (1 – 11) for research question 2 have average

above 2.5 showing that Biology educators perceive highly the need to integrate AI in teaching and learning.

Result in Table 3 shows that mean perception of Mathematics Educators is slightly greater than that of Biology Educators but the difference was not statistically significant. This means that the two groups of Science Educators perceive the need for integration of AI in science teaching to be high. However, in the

space in the questionnaire meant for additional information, most educators listed challenges such as need for expert and limitations such as not giving all the needed information. Educators suggested solution to ensure affective integration of AI in science teaching such as need for adequate training on how best to use AI.

The above data collected were analyzed using Meta AI after asking relevant questions and the following findings were made. Results presented in tables 1 and 2 indicated that University Science Educators that responded to the two questionnaires perceived the need for AI Integration very high as seen in their mean response. Although the Mean response from Mathematics Educators was slightly higher than the one from Biology Educators, the difference was not statistically significant as measured by independent t-test. Both groups of Lecturers registered high perception. The Lecturers later highlighted the challenges that need to be addressed for effective integration of AI in Science pedagogy especially, training and retraining of science educators.

On AI Algorithms, Science educators expressed concerns about potential biases in AI tools, which could affect the fairness and accuracy of educational outcomes and the Need for On Training and Support, the Educators emphasized that there is a significant need for comprehensive training programs to equip educators with the skills required to effectively integrate AI into their teaching practice The researchers are of the view that the above Challenges can be taken care of when Nigerian Government put more value to Education.

The educators perceive the use of AI to enhance teaching and learning highly. These are seen from results of data analyses presented in Tables 1 and 2. The responses from the two educators This is in line with Onah, Obe, Ozioko, Enema and Ude (2020). This shows that the use of online teaching and learning is highly perceived by educators in the field. Similarly, Afonughe, Onah, Uzoma, Andor and Oriskwe (2021), found out that the use of AI promote teaching and learning and should be encouraged. The findings also indicate that while educators recognize the potential benefits of AI in enhancing teaching and learning, they also highlight significant challenges that need to be addressed for effective use of AI tools in Teaching and Learning. The readiness of Nigerian universities to adopt AI in science education depends on addressing the challenges of, particularly in terms of providing adequate training and support for educators.

According to respondents include: AI can tailor educational content to individual students needs, enhancing learning outcomes, in Improved Engagement: Interactive AI tools can make learning more engaging for students, fostering a deeper understanding of complex concepts. Finally, for Facilitated Assessment: AI can streamline the assessment process, providing immediate feedback and identifying areas where students need improvement. AI can do many things but experts are needed for adequate training and effective implementation of AI Tools in Nigerian Universities. As regards challenges, the following were observed: this: Challenges of AI Adoption include: Lack of constant supply of Power and funding. Artificial Intelligence (AI) in education has been explored extensively, highlighting its potential to personalize learning, enhance student engagement, and facilitate assessment of students especially when large class is involved. This is in line with UNESCO (2025), that AI should be adopted by every educator to enhance teaching and make students more native. Previous Studies have shown that AI can provide tailored educational experiences by analyzing students' data and adapting content to meet individual needs for better living.

However, the adoption of AI in education also presented challenges, including potential biases in AI algorithms and the need for adequate training and support for educators so that students can be directed accordingly. The way educators perceive the adoption of AI will definitely affect the way they teach students and give assignment on use of AI. This calls for immediate training on strategies to avert challenges on AI integration.

## Conclusion

This study provides valuable insights into the perceptions of Mathematics and Biology educators in Nigerian universities regarding AI adoption in science education. The findings suggest that there is no significant difference in the mean perception of Mathematics and Biology educators on the adoption of AI for teaching concepts. To effectively integrate AI into science education, it is crucial to address the identified challenges and develop strategies that support educators in leveraging AI.

## Recommendations

From the response of science Nigerian Educators, students AI should be adopted in teaching and learning

science concepts especially, mathematic and biology concept.

1. Government should support the university lecturers by training and retraining with financial support.
2. Trained University lecturers should do the needful by guiding, motivating and encouraging students to adopt AI in other to progress with other countries.
3. Students should only use AI to study but discouraged from using such to enter any examination hall. Students' brain would, therefore, be tested instead of Artificial Intelligence(AI)

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