Published by

British Journal of Contemporary Research

BEXFORD PUBLISHING

ARTIFICIAL INTELLIGENCE SIMULATIONS AND STUDENTS' ENGAGEMENT IN PHYSICS PRACTICAL SESSIONS IN ADAMAWA STATE, NIGERIA

Case Study | Volume 1 | Issue 1 | 2026 | Article Number: 001

Accepted: 06 June 2026 | Published: 10 June 2026 | ISSN: 2979-8582 (Online)

Crossref doi : **https://doi.org/10.67693/BJCR-5MZK8XQR**

Abraham Aderemi Adetutu[1] , Reuben Benson[2]

[1]Department of Physics, School of Sciences, Adamawa State College of Education, Hong, Nigeria

[2]Curriculum and Instructional Technology, School of General Education, Adamawa State College of Education, Hong, Nigeria

RB, 0000-0003-4484-3408

Correspondence: Abraham Aderemi Adetutu, teyananya@gmail.com

Abstract

By improving student engagement, interaction, and comprehension of real-world concepts, artificial intelligence (AI) simulations are progressively revolutionizing science teaching. AI-powered simulations in physics education offer interactive, virtual learning environments that let students carry out experiments, change variables, and successfully visualize abstract ideas. The impact of AI simulations on students' participation in physics practical sessions was investigated in this study. Three research questions served as the study's compass, and a descriptive survey research design was used. Structured questionnaires were used to gather data from physics teachers and students, and mean scores and standard deviation were used for analysis. The results showed that during physics practical sessions, AI simulations enhance students' interest, involvement, teamwork, conceptual comprehension, and practical skills. However, challenges including poor internet connectivity, inadequate ICT infrastructure, incompetent teachers, and restricted access to digital devices make it difficult to successfully apply AI simulations in classrooms. According to the study's findings, AI simulations greatly improve students' participation and educational opportunities during physics practical sessions. For successful AI integration in physics education, the research recommended more funding for digital infrastructure, teacher preparation, and innovative curricula.

Keywords: Artificial Intelligence, AI Simulations, Physics Education, Students' Engagement, Practical Sessions, Virtual Laboratories

Introduction

Globally, the use of digital technologies in education has drastically changed how people teach and learn (Holmes et al., 2019). Artificial Intelligence (AI) has become one of the most significant developments in contemporary education among these technologies. According to Russell and Norvig (2021), AI is the ability of computer systems to carry out tasks like learning, reasoning, problem-solving, and decision-making that are associated with human intelligence.

AI technologies are being employed more and more in science education, especially physics, to improve instructional delivery and hands-on learning opportunities. Because of its abstract ideas, mathematical computations, and experimental nature, physics is frequently seen as a challenging topic (Adeyemo, 2010). Through experimentation and observation, practical sessions are crucial in assisting students in comprehending theoretical concepts. However, a lot of schools face issues like poor lab facilities, equipment shortages, packed classrooms, and a lack of teaching resources (Aina & Adedo, 2013).

By developing dynamic digital learning environments that encourage experimentation and inquiry-based learning, AI-driven simulations provide creative answers to these problems. Without being constrained by physical laboratory conditions, AI simulations allow students to perform virtual experiments, adjust scientific variables, watch results in real time, and repeatedly rehearse experimental procedures (Holmes et al., 2019; Zawacki-Richter et al., 2019). Additionally, AI-supported simulation technologies provide individualized and adaptable learning experiences that enhance students' comprehension of scientific ideas and the development of practical skills (Hwang & Tu, 2021; Reuben & Kabilan, 2024).

By adjusting instructional content to students' learning needs and speed, AI simulations also facilitate individualized learning (Luckin, 2018). Until they grasp practical methods and scientific concepts, students can engage with virtual laboratory environments on a regular basis. AI technologies encourage students' active learning, creativity, and digital competency, according to UNESCO (2021).

Despite these advantages, there are a number of obstacles to integrating AI simulations into physics practical sessions in developing nations like Nigeria. These obstacles include inadequate ICT infrastructure, poor electricity supply, limited internet connectivity, insufficient teacher competence, and financial constraints (Obidiebube et al., 2025). As a result, it is necessary to look into how AI simulations affect students' participation in physics practical sessions.

Statement of the Problem

Practical physics classes are crucial for assisting students in comprehending scientific ideas and honing their experimental abilities. However, a lack of equipment, poor laboratory facilities, and inefficient practical teaching techniques plague many secondary schools and universities (Aina & Adedo, 2013). These difficulties frequently lower students' motivation, engagement, and participation in hands-on activities.

Through interactive virtual experiments and individualized instructional support, artificial intelligence simulations offer chances to enhance real-world learning experiences (Woolf, 2010). Students can actively participate in learning processes, change experimental variables, and visualize abstract concepts thanks to AI simulations. However, despite the increasing importance of AI technologies in education, a lack of infrastructure, insufficient teacher proficiency, and restricted access to digital resources make it difficult for many schools to deploy AI simulations (Obidiebube et al., 2025).As a result, it is yet unclear how much AI simulations improve students' participation in physics practical sessions. Thus, this study looks at students' participation in physics practical sessions and AI simulations.

Objectives of the Study

The objectives of this study are to:

1. Examine the influence of AI simulations on students' engagement in physics practical sessions.
2. Identify the challenges affecting the use of AI simulations in physics practical sessions.
3. Determine strategies for enhancing effective utilization of AI simulations in physics education.

Research Questions

The following research questions guided the study:

1. How do AI simulations influence students' engagement in physics practical sessions?
2. What challenges affect the use of AI simulations in physics practical sessions?
3. What strategies can enhance effective utilization of AI simulations in physics education?

Literature Review

Concept of Artificial Intelligence Simulations

Artificial intelligence simulations are computer-based programs that use intelligent technologies to mimic real-world tasks and procedures (Russell & Norvig, 2021). AI simulations are used in education to develop interactive learning environments where students may solve issues, try new things, and get feedback right away (Holmes et al., 2019). AI simulations are frequently utilized in scientific classrooms to improve students' engagement, practical learning, and conceptual comprehension. These technologies include interactive simulations, augmented reality, intelligent tutoring systems, and virtual labs (Luckin, 2018).

AI Simulations in Physics Practical Sessions

In physics practical sessions, experiments and exercises are utilized to help students understand scientific topics through observation and variable manipulation (Adeyemo, 2010). AI simulations improve practical physics learning by providing virtual environments where students can carry out experiments safely and regularly (Woolf, 2010). According to Reuben and Kabilan (2024), AI-supported students' simulations engagement, participation, and effectiveness in learning processes. In a similar vein, Holmes et al. (2019) highlighted how AI technologies support dynamic, learner-centered learning environments that increase student engagement and comprehension.

AI-supported learning environments, according to Luckin et al. (2016), offer individualized learning experiences that boost students' motivation and scientific concept retention. Furthermore, Zawacki-Richter et al. (2019) noted that through adaptive instruction and increased learner engagement, artificial intelligence applications in education lead to better learning outcomes. Additionally, Hwang and Tu (2021) discovered that AI-assisted learning environments enhance students' motivation in science-related courses and collaborative learning experiences. Furthermore, AI simulations enhance students' conceptual comprehension and practical proficiency by helping them envision difficult concepts like electromagnetism, wave motion, optics, and mechanics (Chen et al., 2020).

Students' Engagement in Physics Practical Sessions

The degree of focus, involvement, curiosity, and interest that students exhibit during educational activities is referred to as their level of engagement (UNESCO, 2021). Active experimentation, questioning, peer collaboration, and increased passion for learning are all characteristics of engaged pupils.

By making practical sessions interactive, learner-centered, and adaptable, AI simulations raise student engagement (Holmes et al., 2019). Additionally, customized learning experiences that promote engagement and a deeper comprehension are supported by adaptive AI systems.

Challenges of AI Simulations in Physics Education

Despite its advantages, there are a number of implementation issues with AI simulations. According to Obidiebube et al. (2025), the main obstacles to integrating AI in schools are a lack of qualified teachers, inadequate technology infrastructure, bad internet access, and financial limitations.

In a similar vein, Badmus, Jita, and Jita (2026) observed that many schools lack the electrical supply and ICT infrastructure required for successful digital learning. The effective use of AI-powered educational technology is further hampered by teachers' lack of digital competency (Srinivasan et al., 2025).

Methodology

In order to gather information from respondents about the impact of AI simulations on students' involvement in physics education, the study used a descriptive survey research design (Creswell, 2018). The population of the study comprised physics teachers and senior secondary school students in selected secondary schools in Adamawa State. To guarantee equitable representation of the study population, a sample size of 120 respondents- 40 physics teachers and 80 students- were chosen using random selection techniques. A systematic questionnaire called the "AI Simulations and Students' Engagement Questionnaire (AISSEQ)" was used to gather data. To ascertain the responses and variances among respondents, the gathered data were examined using mean scores and standard deviation.

Results and Discussion

Research Question 1:

How do AI simulations influence students' engagement in physics practical sessions?

S/N	Influence of AI Simulations	Mean	Decision
1	AI simulations improve students' participation during practical sessions	3.69	Agree
2	AI simulations enhance conceptual understanding of physics experiments	3.75	Agree
3	AI simulations increase students' motivation toward practical activities	3.74	Agree
4	AI simulations encourage collaborative learning among students	3.66	Agree
5	AI simulations improve students' practical skills	3.68	Agree

Source: Field Survey, 2026

Discussion

The results showed that during physics practical sessions, AI simulations greatly increase students' motivation, engagement, participation, and conceptual understanding. This result is consistent with the findings of Reuben and Kabilan (2024), who found that AI-supported students' simulations engagement, participation, and effectiveness in learning processes. The outcome corroborates the findings of Holmes et al. (2019), who highlighted how AI technologies improve learner-centered and active training. In a similar vein, Luckin et al. (2016) contended that the use of AI in education fosters individualized learning experiences that raise student engagement and retention. Furthermore, Zawacki-Richter et al. (2019) noted that by promoting adaptive instruction and student engagement, AI applications in teaching and learning enhance educational results.

Additionally, Hwang and Tu (2021) discovered that, especially in science-related fields, AI-assisted learning environments improve students' motivation and collaborative learning experiences. The results are also in line with Chen et al. (2020), who pointed out that by offering interactive and instantaneous feedback mechanisms, intelligent learning systems enhance conceptual understanding. Thus, the current research indicates that AI simulations can be useful teaching tools for enhancing students' learning experiences and performance in hands-on physics exercises.

Research Question 2:

What challenges affect the use of AI simulations in physics practical sessions?

S/N	Challenges of AI Simulations	Mean	Decision
1	Inadequate ICT infrastructure	3.78	Agree
2	Poor internet connectivity	3.62	Agree
3	Insufficient teacher competence	3.73	Agree
4	High cost of digital technologies	3.82	Agree
5	Limited access to computers and smart devices	3.68	Agree

Source: Field Survey, 2026

Discussion

The results demonstrated that the efficient application of AI simulations is severely hampered by inadequate infrastructure, bad internet access, a lack of qualified teachers, and a lack of digital resources. This result is consistent with that of Obidiebube et al. (2025), who found that insufficient financing and inadequate infrastructure were the main obstacles to the adoption of AI in Nigerian schools.

Research Question 3:

What strategies can enhance effective utilization of AI simulations in physics education?

S/N	Strategies for Effective Utilization	Mean	Decision
1	Provision of adequate ICT facilities	3.87	Agree
2	Training and retraining of teachers	3.78	Agree
3	Improved internet connectivity in schools	3.68	Agree
4	Government funding for digital technologies	3.75	Agree
5	Integration of AI technologies into the curriculum	3.74	Agree

Source: Field Survey, 2026

Discussion

The results indicate that efficient use of AI simulations in physics education requires sufficient infrastructure, teacher training, enhanced connectivity, and regulatory backing. Sustainable AI integration necessitates institutional support and ongoing teacher professional development, according to UNESCO (2021).

Conclusion

During physics practical sessions, AI simulations have the potential to significantly increase students' motivation, engagement, participation, and conceptual understanding. Students can repeat experiments and gain practical skills in learner-centered settings through interactive simulations and virtual laboratories. Effective implementation is hampered by issues such inadequate ICT infrastructure, poor internet access, a lack of qualified teachers, and a lack of financing. To maximize the advantages of AI simulations in physics education, these obstacles must be addressed by strategic investments, policy support, and teacher training.

Recommendations

1. Schools should provide sufficient ICT facilities and digital laboratories for AI-supported practical learning.
2. Physics teachers should receive continuous training on the use of AI simulations in teaching.
3. The government should improve internet connectivity and electricity supply in schools.
4. Educational institutions should integrate AI technologies into physics curricula.
5. Public-private partnerships should support digital innovation in science education.

References

Adeyemo, S. A. (2010). Teaching and learning physics in Nigerian secondary schools: The curriculum transformation, issues, problems and prospects. *International Journal of Educational Research and Technology, 1*(1), 99–111.

Aina, J. K., & Adedo, G. A. (2013). Perceived causes of students' poor performance in physics in secondary schools in Nigeria. *International Journal of Research in Applied, Natural and Social Sciences, 1*(5), 85–90.

Badmus, O. T., Jita, L. C., & Jita, T. (2026). Beyond readiness: ICT integration and simulation use in secondary physics classrooms. *Humanities and Social Sciences Communications, 13*, 270.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access, 8*, 75264–75278.

Creswell, J. W. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Hwang, G. J., & Tu, Y. F. (2021). Roles and research trends of artificial intelligence in mathematics education: A bibliometric mapping analysis and systematic review. *Mathematics, 9*(6), 584.

https://doi.org/10.3390/math9060584

Luckin, R. (2018). *Machine learning and human intelligence: The future of education for the 21st century*. UCL Institute of Education Press.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.

Obidiebube, J. I., Ikwelle, A. C., Iwuagwu, B. O., Okwuba, J. I., & Ikana, E. S. (2025). Prospects and challenges of AI integration into Nigerian educational systems. *International Journal of Library Science and Educational Research.*

Reuben, B., & Kabilan, M. K. (2024). Assessment of university lecturers' readiness to adopt artificial intelligence (AI) technology in North-East of Nigeria. *International Journal of Advanced Research in Education and Society, 6*(2), 482–490. http://myjms.mohe.gov.my/index.php/ijares

Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson Education.

Srinivasan, H., McCraney, M., Penny, R., & Mohan, S. (2025). Empowering Nigerian secondary physics teachers through information and communication technology integration. *Journal of Education and Practice, 16*(2).

UNESCO. (2021). *AI and education: Guidance for policy makers*. UNESCO Publishing.

Woolf, B. P. (2010). *Building intelligent interactive tutors*. Morgan Kaufmann.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Where are the educators? *International Journal of Educational Technology in Higher Education, 16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0