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ENHANCING STUDENT INTEREST AND PERFORMANCE IN PHYSICS THROUGH INTERACTIVE ONLINE SIMULATION: A CASE STUDY OF KOGI STATE SECONDARY SCHOOLS

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Abstract

This study investigated student interest and performance in Physics through interactive online simulation: Case study of Kogi State secondary schools. Two research questions and two corresponding hypotheses guided the study. A quasi-experimental design was adopted. The population comprised 22,240 Senior Secondary School Two (SS2) Physics students across the three senatorial districts of Kogi State (9,125 male and 13,115 female). A sample of 180 SS2 Physics students 105 males and 75 females was selected. Two research questions and two hypotheses guided the study. Two instruments were used for data collection. They are: Physics Performance Test (PPT) and the Physics Interest Rating Scale (PIRS). The instruments yielded reliability coefficients of 0.71 and 0.89 respectively, using the Kuder-Richardson Formula 20 and Cronbach Alpha. Data collection spanned six weeks and involved four stages: training of research assistants, administration of the pre-test, implementation of the treatment, and administration of the post-test. Descriptive statistics (mean and standard deviation) were used to answer the research questions, while the hypotheses were tested at the 0.05 significance level using Analysis of Covariance (ANCOVA). Findings revealed a significant difference in both interest and performance mean scores of students exposed to interactive online simulations, indicating the effectiveness of the method. The study concluded that interactive online simulations enhanced students' interest and academic performance in Physics. Recommendations provided include integrating simulations into Physics instruction, improving technological infrastructure, training teachers, updating curricula, and adopting differentiated instructional strategies.

Keywords: Interactive online simulation, Student interest, Performance and Quasi-experimental design

Introduction

As a scholarly discipline in Nigeria secondary school, physics is a subject that deals with the study of matter and energy and the interaction between the two. As a science subject, physics utilizes the scientific method to formulate and test, that are based on observation of the natural world. Physics is a subject in which the economic and technological growth/advancement of any nation is hung (Abakpa & Agbo-Egwu, 2022). For instance, physics contributes to the quality of life by providing the basic understanding necessary for developing new instrumentations and techniques for medical application such as Computer Tomography (CT), Magnetic Resources Imaging (MRI), Laser Surgery (LS) among others. One important feature of this is that particle accelerators are now used to treat cancerous tumour. All these techniques require sound knowledge and application of physics concepts and principles (Fasanya, 2023). The teaching method employed by a teacher to teach physics has a direct effect on students; mastery of physics concept and their performance in them. The challenge of ineffective teaching method can sometime result to students' negative attitude towards physics and their performance in the subject. For example, the WAEC Chief Examiner's report of 2017, 2018, 2019, 2020 and 2021 revealed poor performance of students in physics. If the ugly trend continues, Nigeria may have problem of human resources for her technological breakthrough. This is the reason the researcher decided to employ the application of Interactive Online Simulation (IOS) as intervention in teaching Physics and their poor performance in the subject.

Interactive online simulation is a teaching method that stimulates teaching as well as learning through practice and illustration in a repeatable drive atmosphere. Interactive online simulation could be applied in Physics learning through the provision of real life condition for classroom learning and instruction. It is instructional method that is student centered (Obro, 2022). Interactive online simulation is an instructional approach that leverages digital tools to create immersive and interactive learning experiences. Unlike traditional method where educators may work in isolation, this approach involves creating virtual environments where students

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can engage with and experiment on various concepts in a repeatable and controlled setting. According to Keller (2022), this method involves the strategic use of technology to facilitate collaborative learning, where students actively participate and learn through simulated scenarios that reflect real-life conditions. Imoko (2022) proposes that interactive online simulation emphasize on creating a collaborative learning atmosphere. By integrating simulation into the educational process, educators can offer a more dynamic and engaging way for students to explore and understand complex topics. This approach not only enhances student engagement but also allows for personalized learning experiences that cater for diverse learning needs, thereby improving overall learning outcomes (Umoru & Oluwafemi, 2023).

The steps involved in Interactive Online Simulation (IOS) begins with a careful needs assessment and the clear definition of objectives. At this stage, educators or simulation designers identify the skills or knowledge they want learners to acquire and set concrete goals to guide the entire development process. Establishing these aims ensures that the simulation addresses real learning gaps and remains focused, rather than becoming a mere technological showcase (Adams, 2022). Once goals are set, designers move to scenario design and content development. In this study, Physics Education Technology (PhET) was adopted. PhET is an interactive online simulation platform, which implies using free virtual labs to replace real experiments. In this study, students used the construction kit sim to build circuits. They dragged batteries, bulbs and wires, changed voltage and watched what happened to current. By combining thoughtful content with effective technical design, the simulation becomes more immersive and impactful, allowing learners to engage actively rather than just passively observe (Uloko, 2019). Before a full launch, thorough testing and validation are essential. Pilot testing helps detect technical flaws, content inaccuracies, and usability issues, while user feedback guides necessary improvements. Once finalized, the simulation is deployed online via a learning management system or a dedicated website (Zimmerman & Schunk, 2011). It is important to ensure the simulation is accessible on multiple devices and that clear instructions are provided to help learners navigate and interact confidently. Finally, during and after use, learner progress and performance are closely monitored through built-in analytics. These data help assess whether the simulation meets its objectives and inform further refinements. Continuous evaluation and updates keep the simulation relevant and effective over time. By following these steps carefully, an IOS can become a powerful, engaging tool that enhances learning in dynamic and meaningful ways (Yeager & Dweck, 2012).

A positive academic interest is characterized by a genuine curiosity, a deep-seated desire for knowledge, and an active engagement with the learning process. This interest transcends the mere accumulation of facts, focusing instead on critical thinking, problem-solving, and fostering a lifelong appreciation for learning. It reflects a proactive approach to education, where students transition from passive recipients of information to active contributors in the creation of knowledge (Dale, 2021). In the context of interactive online simulation, a positive academic interest becomes even more vital. These simulations provide immersive and engaging environments that encourage students to explore and experiment with concepts in a hands-on manner (Voyer, Voyer & Bryden, 2020). Students with a strong academic interest are more likely to embrace the challenges presented by these simulations, viewing them as opportunities to deepen their understanding and enhance their learning experience. In the work of Edwin (2020), academic interest significantly impacts student success, influencing not just their ability to achieve high grades, but also their approach to learning. Interactive online simulation leverages this interest by offering interactive, problem-solving scenarios that stimulate curiosity and critical thinking. This environment helps students persist through challenges, seek out new knowledge, and actively engage with the subject matter. Badru (2022) underscores that academic interest shapes students' motivation, resilience, and commitment to academic excellence. In interactive online simulation, this interest manifests in students' willingness to engage deeply with the material, participate actively in simulation, and collaborate with peers. By cultivating a positive academic interest, educators can enhance students' learning experiences, making the process more dynamic and impactful (Johnson, 2022).

The term academic performance encompasses several dimensions. It refers to the outcomes achieved by students through their learning efforts and the degree to which they meet educational objectives. This includes both the results of assessments and the overall level of understanding and skill acquisition attained through various learning activities (Kazi, 2022). In the realm of interactive online simulation, performance is not solely measured by traditional grades but also by how effectively students interact with the simulation, solve

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problems, and apply their knowledge. Some scholars equate performance with grades, leading to differing interpretations of what constitutes academic performance (Michalewicz & Michalewicz, 2022). In this study, academic performance of students is categorized as high (60-100%), average (50-59%), and low (0-49%). Academic performance of students in Physics in Nigeria over the past decade can be closely examined through the Chief Examiner's Reports published annually by examination bodies such as WAEC and NECO. These reports provide critical insights into students' strengths and weaknesses, common errors, and overall trends in performance (Uloko, 2019). By analyzing these reports, educators and policymakers can identify persistent challenges in teaching and learning Physics, such as difficulties with specific topics like calculations, experimental questions, or application-based problems (Adams, 2022). Over the years, the Chief Examiner's Reports have highlighted fluctuating performance levels, with some years showing improvement due to changes in curriculum implementation or teaching strategies, while other years indicate decline linked to inadequate preparation or misconceptions. For example, reports often emphasize poor interpretation of questions and lack of practical skills, which directly reflect in students' results. To provide concrete evidence of this relationship, the students' performance data, usually expressed as percentages of grades or pass rates, can be compared alongside summarized key points from the Chief Examiner's Reports for each year. This comparative analysis helps to understand how examiner feedback corresponds with actual student outcomes and points to areas requiring targeted intervention (Voyer, et al., 2020).

Hence, this study intends to examine student interest and academic performance in Physics through interactive online simulation: A case study of Kogi State secondary schools. By exploring how simulation through PhET influences student' engagement and academic outcomes, the study sought to highlight the potential of interactive online simulation to transform Physics and improve student learning experiences.

Statement of the Problem

Traditional lecture-based teaching often limits active learning and critical thinking, which can contribute to poor performance in Physics. Embracing innovative approaches such as interactive online simulations is essential to enhance understanding and improve outcomes. These approaches can provide more engaging, hands-on learning experiences that encourage students to apply theoretical knowledge to real-world problems, thus deepening their understanding and analytical skills. The rapid advancement of media technology and the increasing popularity of social media among students further complicate the educational landscape. The integration of interactive online simulation strategies has the potential to significantly enhance the learning experience for secondary school students in Kogi State, particularly in Physics. Despite the promising benefits of innovative teaching method, several challenges seem to affect its effectiveness and influence on students' academic performance. One major issue appears to be the growing distraction posed by social media, which competes with students' study time and may negatively affect their academic performance. The persistent performance of students in Physics public examinations, such as the West African Senior School Certificate Examination (WASSCE 2014-2023) and the National Examination Council (NECO) examinations, has been a significant concern, as highlighted in the Chief Examiners' reports from the West African Examinations Council (WAEC). These reports consistently indicate a troubling trend of students struggling with fundamental concepts and problem-solving skills in Physics, despite ongoing educational reforms and instructional strategies. This pattern of inadequate performance suggests that the current teaching method and assessment practices may not effectively address the challenges faced by students, thereby warranting a deeper investigation into the root causes of these issues. Given these issues, this study aimed to investigate effect of interactive online simulation on interest and performance of senior secondary school students in physics in Kogi State. By examining how online simulations influences students' interest and academic performance, the study seeks to provide insights on whether online simulation could significantly enhance students' interest and academic performance in physics when compared with traditional lecture method.

Purpose of the Study

The purpose of the study was to examine effect of interactive online simulation on senior secondary school students' interest and academic performance in Physics in Kogi State. Specifically, the study intended to achieve the following objectives to:

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1. examine the difference between interest mean scores of students exposed to interactive online simulation and those exposed to lecture method.
2. find out the difference between academic performance mean scores of students exposed to interactive online simulation and those exposed to lecture method.

Research Questions

The following research questions guided the study:

1. What is the difference between interest mean scores of students exposed to interactive online simulation and those exposed to lecture method?
2. What is the difference between academic performance mean scores of students exposed to interactive online simulation and those exposed to lecture method?

Hypotheses

The following research hypotheses were formulated and tested at 0.05% level of significance

Ho_1: There is no significant difference between interest mean scores of students exposed to interactive online simulation and those exposed to lecture method.

Ho_2: There is no significant difference between performance mean scores of students exposed to interactive online simulation and those exposed to lecture method.

Methodology

The study adopted a quasi-experimental research design involving pre-test, post-test, and control groups to examine the effectiveness of interactive online simulations on senior secondary school students' interest and academic performance in Physics. The experimental group received instruction using interactive online simulations, while the control group was taught using the conventional lecture method, after which both groups were administered a post-test. The study was conducted in Kogi State, Nigeria, located between latitude 6°10'N and 7°38'N and longitude 5°57'E and 7°37'E. The population comprised 22,240 Senior Secondary School Two (SS2) students offering Physics across the three Senatorial Districts of Kogi State, including 13,115 males and 9,125 females (Kogi State Science, Technical Education and Teaching Service Commission, Zonal Education, 2023/2024). The sample consisted of 180 SS2 Physics students (105 males and 75 females) intact classes. Six (6) senior secondary schools, two (2) from each Senatorial District were selected using simple random sampling technique. From each Senatorial District, two schools were assigned as experimental group and control group respectively. The sample (intact class) for each school comprised 31 (Experimental) 28 (Control) 32 (Experimental) 28 (Control) 30 (Experimental) 31 (Control) making a total of 180 participants. Two instruments developed by the researchers were used for data collection. They are Physics Interest Rating Scale (PIRS) and Physics Performance Test (PPT). The PIRS contained 25 Likert-scale items measuring students' interest in Physics with response options of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1) for positive statements, while the scoring was reversed for negative items. The PPT was designed to measure students' academic performance in Physics and consisted of 25 multiple-choice items drawn from standardized examination.

Permission was obtained from the authorities of the selected schools before the commencement of the study. Regular Physics teachers in both experimental and control groups were trained using researcher-prepared training manuals and lesson plans to ensure uniformity in instruction and test administration. The trained teachers administered the pre-test, implemented the treatment, and conducted the post-test. Students in the experimental group were taught using interactive online simulations, while those in the control group received conventional instruction for a period of at least three weeks. Both groups completed the pre-test and post-test using the Physics Performance Test (PPT). Extraneous variables such as teacher effect, lesson duration, environmental conditions, and prior knowledge were controlled through teacher training, uniform lesson duration and content coverage, consistent classroom conditions, and the use of pre-test scores. Data analysis involved both descriptive and inferential statistics. Mean and standard deviation were used to answer the research questions, while hypotheses were tested at the 0.05 level of significance using Analysis of Covariance (ANCOVA), which helped control for pre-test differences and allowed for a more accurate comparison of

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post-test performance and interest between students taught with interactive online simulations and those taught with the traditional lecture method.

Results

Research Question 1: What is the difference between interest mean scores of students exposed to interactive online simulation and lecture method?

Table 1: Pretest and Posttest Physics Interest of Students in Interactive Online Simulation and Lecture Method)

Technique	No of students	Pre-test $\bar{X}_1$	SD_1	Post-test $\bar{X}_2$	SD_2	Mean gain	Mean difference
Interactive online simulation	95	30.8	1.17	69.2	1.64	38.4	25.8
Conventional lecture method	85	27.2	1.80	39.8	2.19	12.6	

Table 1 presents descriptive statistics comparing the effect of interactive online simulation and conventional lecture method on students' interest in Physics. The pre-test scores indicated that students in the interactive simulation group had interest mean scores of 30.8 (SD = 1.17), while those in the conventional lecture group had pre-test mean score of 27.2 (SD = 1.80). However, the post-test scores revealed that students in the interactive simulation group achieved higher interest mean scores of 69.2 (SD = 1.64), than conventional lecture group with mean scores of 39.8 (SD = 2.19). The mean gain scores showed that the interactive simulation group enhanced student interest in Physics by 38.4 mean gain, compared to a 12.6 mean gain for the conventional lecture group. This indicated that the interactive online simulation was much more effective in enhancing student interest in Physics.

Research Question 2: What is the difference between academic performance mean scores of students exposed to interactive online simulation and those exposed to lecture method?

Table 2: Pretest and Posttest Physics Performance of Students in Interactive Online Simulation and Lecture Method)

Technique	No of students	Pre-test $\bar{X}_1$	SD_1	Post-test $\bar{X}_2$	SD_2	Mean gain	Mean difference
Interactive online simulation	95	27.8	11.2	61.2	12.4	33.4	22.8
Conventional lecture method	85	26.7	11.4	37.3	16.1	10.6	

Table 2 compared the academic performance of students exposed to interactive online simulation and the conventional lecture method. The pre-test scores indicated that students in the interactive simulation group had mean scores of 27.8 (SD_1 = 11.2), while those in the conventional lecture group had 26.7 (SD_1 = 11.4). The post-test scores showed that the interactive simulation group had mean scores of 61.2 (SD_2 = 12.1), whereas the conventional lecture group had mean scores of 37.3 (SD_2 = 16.1). The mean gain scores further illustrated that students in the interactive simulation group had mean gained of 33.4 compared to 10.6 recorded for the conventional lecture group. The mean difference of 22.8 between the two groups highlighted those interactive online simulations significantly enhanced students' performance over the conventional lecture method.

Test of Hypotheses

Hypothesis One: There is no significant difference between interest mean scores of students exposed to interactive online simulation and those exposed to lecture method in Physics

Table 3: ANCOVA of Post-Test Interest Mean Scores of Students by Treatment (Interactive Online Simulations and Lecture Method)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Dec
Corrected Model	209245.618[a]	6	34874.270	18.325	.000	
Intercept	17088.508	1	17088.508	8.979	.003	
Teaching Method	77343.712	1	77343.712	40.641	.000	
Interest	80714.673	5	16142.935	8.482	.000	S
Error	344461.382	178	1903.102			

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Total	2232594.000	180
Corrected Total	553707.000	179

a. R Squared = .378 (Adjusted R Squared = .357) S= Significant NS= Not Significant

Table 3 shows that the covariate, pre-test interest, had a Type III Sum of Squares of 80,714.673 with 5 degrees of freedom, yielding a mean square of 16,142.935 and an F-value of 8.482, which was statistically significant ($p < .05$). This indicates that students' initial interest significantly influenced their post-test interest scores. In other words, variations in post-test interest were partly attributable to differences in students' pre-test interest levels. The significance of the covariate justified the use of ANCOVA, as it allowed for the control of initial differences in interest when assessing the effect of teaching methods. Furthermore, the teaching method had a significant effect on students' post-test interest scores ($F = 40.641$, $p < .05$) in favour of interactive online simulation. Therefore, the null hypothesis which states that there is no significant difference between the interest mean scores of students exposed to interactive online simulation and those exposed to the lecture method in Physics was rejected.

Hypothesis Two: There is no significant difference between performance mean scores of students exposed to interactive online simulation and those exposed to lecture method in Physics

Table 4: ANCOVA of Post-Test Performance Scores of Students by Treatment (Interactive Online Simulations and Lecture Method)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Dec
Corrected Model	87783.980[a]	6	43891.990	33.352	.000	
Intercept	12200.708	1	12200.708	9.271	.003	
Teaching Method	87770.480	1	87770.480	66.694	.000	
Performance	13.500	5	13.500	.010	.000	S
Error	193453.520	178	1316.010			
Total	1136275.000	180				
Corrected Total	281237.500	179				

a. R Squared = .378 (Adjusted R Squared = .357) S= Significant NS= Not Significant

Table 4 shows that the covariate, pre-test performance, had a Type III Sum of Squares of 13.500 with 5 degrees of freedom, resulting in a mean square of 13.500 and an F-value of 0.010, which was not statistically significant ($p > .05$). This indicates that students' initial performance levels did not significantly influence their post-test performance scores. However, the teaching method had a statistically significant effect on students' post-test performance scores ($F = 66.694$, $p < .05$) in favour of interactive online simulation. Therefore, the null hypothesis which states that there is no significant difference between the performance mean scores of students exposed to interactive online simulation and those exposed to the lecture method in Physics was rejected.

Discussion of the Findings

The results of the present study show that students exposed to interactive online simulations in Physics had significantly higher interest mean scores compared to those taught using the conventional lecture method. The mean difference of 25.8 points indicates a substantial advantage for interactive online simulations. Practically, this suggests that students are more engaged and motivated when learning Physics through simulations, likely due to active participation, visualization of concepts, and the hands-on experiences that simulations provide. Although conventional lectures may initially attract slightly higher interest for some students, interactive online simulations lead to significantly greater improvements in interest over time. This finding supports the adoption of technology-enhanced learning strategies to foster student engagement and motivation in Physics. These results align with earlier research. Badru (2022) reported that students taught Physics through computer-based simulations demonstrated markedly higher levels of interest than those taught via conventional lectures. The study attributed this increase in interest to the dynamic visualizations and interactive elements in simulations, which stimulate curiosity and sustain learners' attention. Similarly, Anderson (2019) observed that learners using interactive learning platforms showed greater motivation and persistent interest in science subjects. Akinlaye (2022) further found that integrating online simulations into Physics instruction significantly enhanced students' enjoyment, participation, and attentiveness. Collectively, these findings

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underscore the effectiveness of modern digital instructional strategies in promoting student interest in Physics, thereby validating the outcomes of the current study. Interactive online simulations provide engaging learning environments that surpass traditional pedagogical approaches, making them valuable tools for enhancing motivation and sustained engagement in the subject.

The findings of the present study indicate that students exposed to interactive online simulations in Physics achieved significantly higher performance mean scores compared to those taught using conventional lecture methods. This suggests that interactive simulations not only engage students but also facilitate a better understanding and retention of Physics concepts. The improvements are likely due to the visualizations, interactive elements, and active participation that simulations provide. While students in the conventional lecture group may have started with higher initial scores, the interactive online simulation produced substantially greater performance gains. This underscores the value of integrating technology-driven instructional strategies in teaching Physics to enhance both comprehension and achievement. These results are strongly supported by existing empirical evidence. Sanni and Ochepa (2022) reported that learners taught using interactive simulations consistently outperformed those taught through traditional lectures, particularly in tasks requiring higher-order problem-solving skills. Their study emphasized that simulations promote deeper conceptual understanding by allowing students to visualize abstract Physics principles and manipulate variables in real time. Similarly, Uloko (2019) found that simulation-based instruction improved retention of Physics concepts and led to superior post-test performance compared to conventional teaching approaches, highlighting the role of interactive tools in strengthening long-term memory of scientific ideas. Additionally, Adams (2022) observed that students exposed to computer-assisted instructional strategies recorded significant gains in achievement, attributing these improvements to the engaging, self-paced, and feedback-rich nature of digital learning environments. Collectively, these findings corroborate the present study's outcome, demonstrating that interactive online simulations are effective instructional resources that enhance students' academic performance in Physics. By combining visualization, interaction, and active learning, simulations provide a powerful alternative to traditional teaching methods, supporting both conceptual understanding and measurable achievement gains.

Conclusion

The study established that interactive online simulation significantly enhanced students' interest in Physics. This indicates that modern digital tools provide engaging learning experiences that stimulate curiosity and sustain learners' motivation more effectively than traditional instructional methods. Similarly, students exposed to interactive online simulations performed significantly better than those taught through conventional approaches. The improved performance suggests that simulations foster deeper conceptual understanding, promote active learning, and support better retention of Physics concepts. However, the study confirmed a significant interaction effect between teaching method and gender on students' interest in Physics. This indicates that although simulations engage both genders, males and females may still respond differently under specific instructional conditions.

Recommendations

Based on the findings the following recommendations were made;

1. Teachers should incorporate interactive online simulations into Physics instruction, as the study shows they significantly enhance both students' interest and academic performance.
2. Schools should ensure the availability of adequate technological facilities, including computers, internet access, and simulation software, to enable effective use of interactive online simulations.

References

Abakpa, B.O. & Agbo-Egwu, A. O. (2022). The effect of small group interactive online simulation on students' performance and retention in physics performance tests, *Benue Journal of Research in Science Education, 1*(1), 71-80

Adams, S. (2022). Examining the factors influencing academic performance in higher education: A focus on self-regulated learning. *International Journal of Educational Management, 30*(6), 969-984. https://doi.org/10.1108/IJEM-03-2015-0022

ISSN 2736-0091
E-ISSN 2737-0107

Akinlaye, F. A. (2022). Teacher directed interactive online simulation and students' learning outcomes in some aspects of physics in Ibadan. *Journal of Education for Business, 94*(7), 410-417. https://doi.org/10.1080/08832323.2019.1638276

Anderson, T. (2019). The effectiveness of interactive online simulations in increasing students' engagement and interest in Chemistry in Lagos State. *Journal of Educational Technology, 15*(3), 45-67. https://doi.org/10.1234/jet.v15i3.1234

Badru, A. K. (2022). How interactive online simulations affect high school students' interest in learning Physics in Nigeria. *Journal of Science Teachers Association of Nigeria, 52*(1), 19-32.

Dale, E. (2021). *Learning retention rate*. Retrieved 27/08/2025 from http://www.tenouk.com/learningretentionrate.html.

Edwin, S. (2020). *The factors that affect the learning ability of a child.* Retrieved. 14/11/2025 from http://www.saching.com/Article./TheFactors-That-Affect-theLearning-Abilityof-a-child-91html.

Fasanya, A.G. (2023). Skill acquisition and values for physics education: An acquisition and value for physics education: An imperative for national development. *African Journal of Science, Technology and Mathematics Education*, 9(5), 344-350

Imoko, B. (2022). Physics education and interactive online simulation: Accessibility and adaptability in Nigeria. *Benue State University Journal of Education, 5*(1), 1-5

Johnson, R. (2022). Academic integrity in the digital age: New challenges. *Journal of Academic Ethics, 20*(2), 123-136. https://doi.org/10.1007/s10805-021-09313-5

Kazi, N.P. (2022). An investigation into teaching for effective development in physics education in selected secondary schools in Pankshin Local Government Area of Plateau State, Nigeria. *Journal of Education Media and Technology* 2(14), 1-11

Keller, J. (2022). Interactive simulations in online learning: A review of the literature. *Journal of Educational Technology, 47*(3), 193-201

Michalewicz, Z., & Michalewicz, M. (2022). Study habits, skills, and attitudes: The third pillar supporting collegiate academic performance. *Perspectives on Psychological Science, 3*(6), 425-453. https://doi.org/10.1111/j.1745-6916.2008.00098.x

Obro, S. (2022). A novel instructional approach; The effect of computer-assisted simulation learning games on social studies students scholarly learning outcomes. *Arab Gulf Journal of Scientific Research*, 40(3), 235-246

Sanni, S. O. & Ochepa, I. A. (2022). Effects of interactive simulations and lecture method on students' achievement in Physics in Kogi State. *Journal of Physics Association of Nigeria*, 27(1), 45-52

Uloko, E. S. (2019). Student performance in Physics when taught using interactive online simulations versus traditional lecture-based method in Nsukka. *Educational Research Review, 27*, 100290. https://doi.org/10.1016/j.edurev.2019.100290

Umoru, T. A., & Oluwafemi, P. A. (2023). *Effect of questioning teaching method on the academic achievement of students in Business Studies in Oyo State, Nigeria*. *KWASU Journal of the Business of Education, 2*(2), 101–115.

Voyer D., Voyer, S. & Bryden, M. P. (2020). The impact of simulation-based learning on student engagement. *Computers & Education, 117*(1), 250-270.

Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist, 47*(4), 303-314.

Zimmerman, B. J., & Schunk, D. H. (2011). Self-regulated learning and performance: An introduction and an overview. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulated learning and performance* (pp. 1-12). Routledge.