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Sustaining Students' Interest in Practical Physics: Factors of Teachers' Experience, Availability of Laboratory Facilities and Educational Simulation Games

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Abstract

The overall estimate of physics students' interest in practical physics raised doubt for inclusion of variables that fosters interest in physics. Therefore, the study examined the indices that sustains students' interest in practical physics as factors of teachers' experience, availability of laboratory facilities and educational simulation games in Enugu Education Zone of Enugu State. Four research questions and four null hypotheses formulated and tested at 0.05 level of significant guided the study. A correlational survey research design was adopted for the study. A simple random sampling procedure was used in selecting three hundred and twenty (320), Senior Secondary II (SS II) Physics students from twelve selected schools in the Zone. Practical Physics Interest Scale (PPIS) and Factors for Sustaining Students' Interest (FSSI) were used for data collection. The PPIS was adapted from Wong and Wong (2019), The FSSI was a structured questionnaire developed by the researchers. The instruments (PPIS) and (FSSI) was validated by three experts and tested for reliability using Cronbach's alpha with the reliability indices of 0.89, 0.72, 0.87 and 0.86 respectively. Data were analyzed using path analysis for the research questions and to test the proposed hypotheses. The findings of the study amongst others showed that teachers' experience, availability of instructional facilities and use of educational simulation games positively influenced the practical interest of secondary school physics students. Based on these findings, it was recommended that physics teachers should be encouraged to embark on in-service training that will glare the facet of ICT enhanced education, thereby fostering interest in practical physics.

Keywords: *Physics, Interest, Simulation games, Laboratory facilities, Teachers experience and Location*

1. Introduction

Physics is the blueprint of the universe, uncovering the intricate symphony of matter and energy that orchestrates

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everything from the dance of galaxies to the whisper of quantum particles. Physics is a foundational subject that plays a crucial role in understanding the world around us and in shaping technological advancements. In secondary schools, physics education aims to equip students with a fundamental understanding of scientific principles, problem-solving skills, and critical thinking abilities. Onah and Anamezie (2022), noted that physics is the most fundamental and the root of every field of science. Serway and Jewett (2016), Physics is the most fundamental of the sciences, concerning itself with energy, matter, space and time, and their interactions. Physicists study a wide range of phenomena spanning from the subatomic particles from which all ordinary matter is made (particle physics) to the behavior of the material universe as a whole (cosmology). While physics is a fundamental subject in the secondary school curriculum, there are challenges in effectively teaching and learning the subject (Onah, 2023). Many students perceive physics as a difficult and abstract subject due to its complex concepts and mathematical nature. Additionally, traditional teaching methods often focus on rote memorization rather than fostering deep understanding and critical thinking skills. The traditional methods of teaching physics often fail to engage students and may not adequately prepare them for real-world applications or higher education in Science, Technology, Engineering, Mathematics (STEM) fields. Students may struggle to grasp abstract concepts without practical demonstrations or real-life examples. As a result, there is a need to explore more effective and engaging teaching techniques that promote active learning and application of physics principles. It is known that while teachers are undergoing training they engage in teaching practice and are exposed to the different techniques of teaching, but when sent out to teach, they fail to apply what they have learnt to the classroom situation. As a result of this, it leads to the poor performance of students in WASSCE Examination. In addition, during the May/ June 2025 SSCE. A total of 1,969,313 candidates took physics in the said examination, of this figure 754,545 (38.32%) passed between Alpha and Credit, and 61.68% made F9 grade. Again in 2017, 704,504 candidates took physics examination, 47.0% had Alpha and Credit, and 53% failed (WAEC Chief Examiners Report, 2017). This information indicates the performance in West African Examination Council in physics is discouraging. Record of students 'achievement at Senior School Certificate Examination (SSCE) in physics conducted by West African Examination Council (WAEC), according to Onah and Achufusi (2022), the failure trends continued in 2015, 2020 and 2021 (47.83%, 41% and 36% respectively). National examination reports indicate a growing decline in students' achievement which engendered poor interest in physics practical.

Interest, in the educational context, refers to students' intrinsic motivation, curiosity, and psychological investment in a subject (Hidi and Renninger, 2016). Where interest is lacking, especially in practical learning, students become disengaged, resulting in superficial learning and poor academic outcomes. Achor *et al.* (2018) found that students who actively participated in practical physics outperformed their peers who relied only on theoretical instruction. This underscores the need to examine the factors that contribute to or inhibit students' interest in physics practical (Hidi and Renninger, 2023).

In many Nigerian secondary schools, particularly those in factors such as insufficient laboratory facilities, teacher-centered instructional strategies, lack of qualified personnel, and poor infrastructure have been identified as obstacles to meaningful practical engagement. These deficiencies often result in minimal student participation, reducing enthusiasm and hindering effective learning. As emphasized by Adigun and Ogunleye (2017), schools with poorly maintained or underutilized laboratories tend to record lower student interest and performance in science-related subjects.

Teacher qualification and instructional strategy are also key determinants in sustaining students' interest in physics practical. Physics teachers must be proficient in experimental methods and able to employ inquiry-based strategies that actively involve learners. Nwankwo and Obinna (2018) argue that teacher-driven instructional models that neglect student participation diminish learner motivation and reduce the effectiveness of physics practical sessions. Moreover, simulations and educational games are emerging tools that enhance student engagement by making abstract physics concepts more interactive and relatable (Adebayo and Onwuegbuzie, 2022).

The availability and application of digital tools such as simulations, virtual laboratories, and educational games are also serving as critical determinants of interest in physics practical. Eze and Okafor (2020) observed that students exposed to ICT-based practical tools demonstrate greater motivation, participation, and achievement. However, adoption of such tools is inconsistent due to disparities in technological access and teacher training, especially across rural and urban school settings.

Disparities in educational infrastructure across school locations further influence students' interest in physics practical. While urban schools may benefit more from modern laboratories and better-trained teachers, rural schools often lack these essentials. Abonyi *et al.* (2018) maintain that access to well-equipped laboratories, regardless of school location, significantly boosts student interest and performance. Therefore, investigating how factors like school location moderate these determinants is essential for formulating effective interventions (Jokodola, 2021). Understanding these determinants will help education stakeholders, teachers, school administrators, and policymakers to develop targeted strategies to address gaps and improve the delivery of physics practical in secondary schools. This study, therefore, seeks to explore the key determinants that influence and sustain students' interest in physics practical in Enugu Education Zone of Enugu State.

1.1. Statement of the Problem

There is growing concern over the declining level of students' interest in physics practical across many secondary schools in Nigeria. This unpleasant situation had stirred up researcher on how to have a lasting solution to the problem. The attempt ranged from exploring innovative cognitive approaches to psychological variables. This reduction in interest often results in low enthusiasm for laboratory-based activities, minimal involvement in scientific tasks, and a weakened connection between theoretical content and real-life application. Students who lack interest in physics practical are more likely to disengage during instructional activities, view experiments as unimportant, and exhibit poor retention of scientific concepts.

The implications of declining interest in physics practical are significant. Students with low engagement in practical learning are less likely to develop the analytical skills, creativity, and scientific curiosity needed for success in physics and other science-related disciplines. This disinterest contributes to a reduction in the number of students pursuing careers in medicine, agriculture, biotechnology, and environmental science fields vital to national development and innovation. Additionally, it weakens the pipeline of future professionals equipped to advance science and technology in Nigeria. Without understanding and addressing the key determinants that foster sustained interest in physics practical, educational outcomes may continue to decline. Therefore, the problem of this study is put in the question form, "What are the factor that are responsible for fostering students' interest in practical physics?"

1.2. Purpose of the Study

The primary purpose of this study is to examine the determinants for sustaining students' interest in physics practical in secondary schools in Enugu Education Zone of Enugu State. Specifically, the study seeks to determine the:

1. Beta weight between the path of the availability and adequacy of laboratory facilities and students' interest in physics practical.
2. Beta weight between the path of teachers' experience, effectiveness of instructional strategies, and students' interest in physics practical.
3. Beta weight between the path of the use of educational simulations and games and students' interest in physics practical.
4. Moderating influence of location on big factors to sustain students' interest and their interest in physics practical in secondary school.

1.3. Research Questions

1. What is the beta weight between the path of availability and adequacy of laboratory facilities and students' interest in physics practical in secondary schools?
2. What is the beta weight between the path of teachers' experience and instructional strategies and students' interest in physics practical in secondary schools?
3. What is the beta weight between the path of educational simulations and games and students' interest in physics practical in secondary schools?
4. What is the moderating influence of location on the factors that sustains students' interest in physics practical in secondary school?

1.4. Research Hypotheses

The following null hypotheses were formulated and tested at the 0.05 level of significance:

$H0_1$: There is no significant influence of the availability and adequacy of laboratory facilities on students' interest in physics practical in secondary schools in Enugu South LGA.

$H0_2$: There is no significant influence of teachers' experience, effective use of instructional strategies on students' interest in physics practical in secondary schools in the area.

$H0_3$: The influence of educational simulations and games on students' interest in physics practical in secondary schools is not significant.

$H0_4$: The moderating influence of location on the factors that sustains students' interest in physics practical is insignificant.

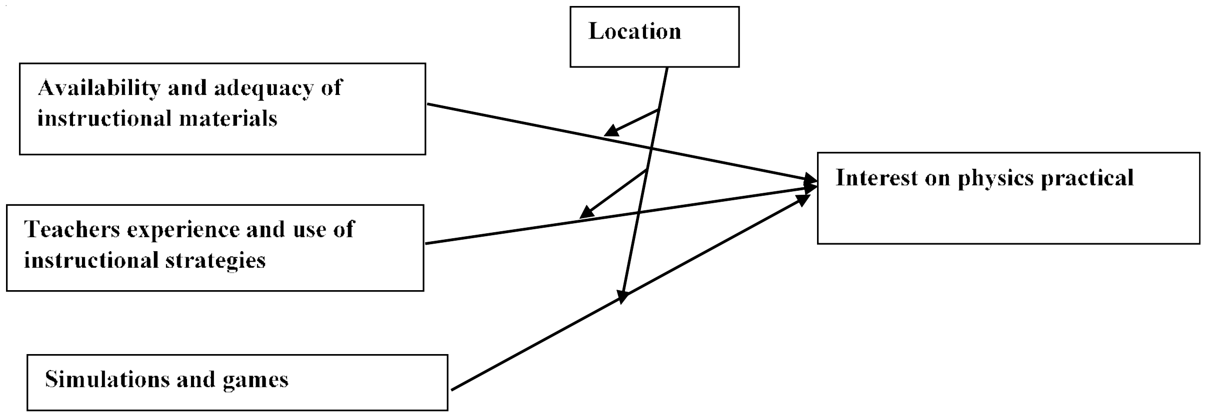

Figure 1: Conceptual Model

The schematic diagram presented in this study illustrates the conceptual model guiding the investigation into factors influencing students' interest in physics practical (Figure 1). At the core of the diagram is the dependent variable, "Students' Interest in Physics Practical," which is hypothesized to be influenced by several interrelated factors.

Firstly, the availability and adequacy of instructional materials such as laboratory equipment, reagents, and specimens are positioned as critical components. These resources are essential for engaging students in hands-on scientific inquiry and facilitating meaningful practical experiences. A well-equipped laboratory environment is expected to foster curiosity and active participation, thereby enhancing student interest.

Secondly, the diagram highlights the role of teachers' experience and instructional strategies. The professional expertise of physics teachers and their use of student-centered teaching methods—such as inquiry-based learning, guided discovery, and cooperative activities—are seen as instrumental in shaping students' attitudes and engagement during practical lessons.

Furthermore, the use of simulations and educational games is identified as a contributing factor. These tools serve as innovative alternatives or supplements to traditional laboratory exercises, particularly in resource-constrained schools. By promoting interactive and experiential learning, simulations can make abstract physics concepts more tangible and enjoyable for learners.

Finally, the school location; whether urban semi-urban or rural is included as a contextual variable that potentially moderates access to educational facilities and qualified personnel. Geographic disparities in educational infrastructure can significantly influence the quality of practical instruction and, consequently, student interest.

Collectively, the schematic diagram captures the dynamic interaction among these variables, providing a structured representation of how material, pedagogical, and contextual factors converge to influence students' interest in physics practical. This framework underpins the research objectives and serves as a guide for data collection and analysis throughout the study.

2. Method

This study adopted a correlational survey research design. A correlational survey according to Nworgu (2018), is the relationship between two or more variables without manipulation. It allows the researchers to examine associations among naturally occurring variables through structured data collection methods. The design was appropriate for this study as it enabled the researchers to investigate into how variables such as the availability of laboratory facilities, teachers' experience and instructional strategies, the use of simulations and games, and school location relate to students' interest in physics practical in secondary schools. The study was carried out in Enugu Education Zone, located East of Enugu State, Nigeria. Enugu State has six Education Zones which include: Enugu, Awgu, Agbani, Nsukka, Obollo-Afor and Udi. Enugu Education Zone consists of three local government areas; namely: Enugu North, Enugu East and Isi-Uzo local government area. The area is predominantly urban, semi-urban and rural in nature with basic amenities such as good roads, hospitals, electricity, schools and markets. Most people living in the zone were civil servants, students, traders and many farmers. The researchers chose Enugu Education Zone due to the fact that most of the secondary schools have qualified physics teachers, laboratories and instructional materials and yet students experience difficulties in answering questions in physics especially practical physics in their external examinations which was evident in their final achievement scores and grades in WAEC results hence the need for the study in the area. Therefore, this research will inform the teachers, education stakeholders and government agencies on the fundamental factors that fosters students' interest in practical physics which will in turn enhance good academic achievement. The population for the study was 3,321 SS2 Physics students from 33 public secondary schools in the zone. Three hundred and twenty (320) SS2 physics students (111 urban, 109 semi-urban and 100 rural) drawn through simple random sampling procedure from twelve secondary schools in Zone, four schools were randomly sampled from each stratum. The three local government areas were purposively sampled as it represents urban, semi-urban and rural location. Purposive sampling was used to select twelve secondary schools in the zone with four schools from each of the local government areas based on the existence of well-equipped physics laboratories and experienced physics teachers with teaching qualification in the school. Simple random sampling technique (precisely balloting) was next used to select 320 students. The instruments used for data collection were two the Physics Practical Interest Scale (PPIS) and Researchers structured questionnaire titled "Factors for Sustaining Students' Interest" (FSSI). PPIS was adapted from Wong and Wong (2019). PPIS comprises 5 items adapted from a 27-item Mathematics Interest Inventory. The scales were originally for students' general interest inventory for mathematics students but the researchers modified the instrument specifically for physics practical interest. It is a four-point scale, ranging from 1 = strongly disagree to 4 = strongly agree, which was used for all items in this instrument. 3 = items were positively cued and scored in order. 2 = question items had negative cue in the instrument, precisely 1 and 5. These negatively cued items were reverse-scored. FSSI consisted of 15 items from 3 clusters. Each of the clusters assessed the opinions of students on the relevance of the cluster. The instrument employed four-point scale, ranging from 1 = strongly disagree to 4 = strongly agree, with positive and negative constructs alike. PPIS and FSSI were face validated by three experts from Enugu State University of Science and Technology (ESUT) and tested for reliability using Cronbach alpha which yielded a coefficient of 0.89, 0.72, 0.87 and 0.86 indices respectively. The instrument was distributed to the respondents upon selection through the help of the research assistants who doubled to be their physics teachers in their respective schools. This method enabled the researchers to have 283 questionnaires properly filled (88.44%) return of the filled instruments. The proposed research questions and hypotheses, a path analysis in AMOS version 22 was employed, and all estimates were calculated using the maximum likelihood with bootstrapping (5000 resampling at 95% bias corrected confidence intervals (CI95%).

3. Results and Measures

This result also showed in path diagram and its goodness of fit measured with CMIN (920.106), DF (66), GFI (0.964), AGFI (0.822), CMIN/DF (13.941), CFI (0.858), TLI (0.843), IFI (0.858), SRMR (0.464), RMSEA (0.189) and Pclose (0.000). All these fit indices of model showed perfect for good model.

Research Question 1: What is the beta weight between the paths of availability and adequate of laboratory facilities and students' interest in physics practical in secondary schools in the area?

Table 1 shows that availability and adequacy of laboratory facilities contributed approximately 12% determination of physics students' interest sustainability of the interest level in physics practical. On the other hand, 82% factors that determines physics students' interest sustainability in practical physics is counted for other factors other than availability and adequacy of laboratory facilities.

Table 1: The Coefficient of Linear Regression between the Path: Availability and Adequate of Laboratory Facilities and Students' Interest in Physics Practical in Secondary Schools in the Combined Model

Linear Regression Path	Beta-Weight
Availability and adequate of laboratory facilities and students' interest physics practical	0.121

Research Question 2: what is the beta weight between the path of teachers' experience, effective use of instructional strategies and students' interest in physics practical in secondary schools?

Table 2 shows that teachers' experience, effective use of instructional strategies contributed approximately 50% to determination of physics students' interest in physics practical. On the other hand, 50% factors that determines physics students' interest and its sustainability in practical physics is counted for other factors other than teachers' experience, effective use of instructional strategies.

Table 2: The Coefficient of Linear Regression between the Paths: Teachers' Experience, Effective Use of Instructional Strategies and Students' Interest in Physics Practical in Secondary Schools in the Combined Model

Linear Regression Path	Beta-Weight
Teachers' experience, effective use of instructional strategies and students' interest in physics practical	0.449

Research Question 3: What is the beta weight between the paths of educational simulation and games and students' interest in physics practical in secondary schools?

Table 3 shows that educational simulation and games contributed approximately 70% determination of physics students' interest and sustainability of the interest level in physics practical. On the other hand, 30% factors that determines physics students' interest sustainability in practical physics is counted for other factors other than educational simulation and games.

Table 3: The Coefficient of Linear Regression between the Path: Educational Simulation and Games and Students' Interest in Physics Practical in Secondary Schools in the Combined Model

Linear Regression Path	Beta-Weight
Educational simulation and games and students' interest in physics practical	0.696

Research Question 4: What is the moderating influence of location on the factors that sustains students' interest in practical physics in secondary school?

Table 4 shows that moderating influence of location on the factors that sustains students' interest contributed approximately 0.5% determination of physics students' interest and sustainability of the interest level in physics practical. On the other hand, 99.5% factors that determines physics students' interest sustainability in practical physics is counted for other factors other than location.

Table 4: The Coefficient of Linear Regression between the Path: Moderating Influence of Location on the Factors that Sustains Students' Interest in Physics Practical in Secondary Schools in the Combined Model

Linear Regression Path	Beta-Weight
Moderating influence of location on the factors that sustains students' interest in physics practical	0.005

3.1. Hypotheses

The following null hypotheses were tested at .05 level of significance:

$H0_1$: There is no significant influence of availability and adequacy of laboratory facilities on the students' interest in physics practical in secondary schools.

Table 5 shows that the probability of getting a critical ratio as large as 2.771 in absolute value is less than 0.006. The result figured out that Availability and adequacy of laboratory facilities determined the measures of physics students' interest in physics practical ($\beta = 0.071$, t (283) = 2.771, P < 0.05 [0.010]). In other words, the null hypothesis is rejected. Thus: the regression weight for Availability and adequacy of laboratory facilities in the influence of students' interest in physics practical in secondary schools is significantly different from zero at the 0.010 level (two-tailed).

$H0_2$: There is no significant influence of teachers' experience, effective use of instructional strategies on students' interest in physics practical in secondary schools.

Table 5 shows that the probability of getting a critical ratio as large as 9.383 in absolute value is less than 0.000. The

Table 5: Summary of Regression Weights of the Observed Cariables

Observed Variables			Estimate	S.E.	C.R.	P	Decision
Interest in physics Practical	<---	Teachers' experience, effective use of instructional strategies	0.267	0.028	9.383	***	**S**
Interest in physics Practical	<---	Availability and adequacy of laboratory facilities	0.071	0.026	2.771	0.006	**S**
Interest in physics Practical	<---	Educational simulation and games	0.664	0.094	7.086	***	**S**
Interest in physics Practical	<---	Location	0.003	0.022	0.123	0.902	NS

result figured out that the influence of teachers' experience, effective use of instructional strategies determined the measures of physics students' interest in physics practical ($\beta = 0.267$, t (283) = 9.383, P < 0.05). In other words, the null hypothesis is rejected. Thus: the regression weight for teachers' experience, effective use of instructional strategies in the influence of students' interest in physics practical in secondary schools is significantly different from zero at the 0.010 level (two-tailed).

H0$_3$: The influence of educational simulation and games on students' interest in physics practical is not significant.

Table 5 shows that the probability of getting a critical ratio as large as 7.086 in absolute value is less than 0.000. The result figured out that the influence of educational simulation and games determined the measures of physics students' interest in physics practical ($\beta = 0.664$, t (283) = 7.086, P < 0.05). In other words, the null hypothesis is rejected. Thus: the regression weight for educational simulation and games in the influence of students' interest in physics practical in secondary schools is significantly different from zero at the 0.010 level (two-tailed).

H0$_4$: The Moderating influence of location on the factors that sustains students' interest in physics practical in secondary school is insignificant.

Table 5 shows that the probability of getting a critical ratio as large as 0.123 in absolute value is greater than 0.05. The result figured out that location of physics students' does not influence interest in physics practical in secondary schools ($\beta = 0.003$, t (283) = 0.123, P < 0.05). In other words, the null hypothesis is not rejected. Thus: the regression weight for location of secondary school physics students in the influence of their Interest in physics practical is not significantly different from zero at the 0.902 level (two-tailed).

4. Discussions

The finding of the study revealed that availability and adequacy of laboratory facilities contributed a modest 12% to sustaining students' interest in practical physics. This finding was supported by Adigun and Ogunleye (2017) and Onah and Anamezie (2022), who reported that schools with well-equipped laboratories had students who demonstrated higher enthusiasm and competence in physics practical. Secondly, the study found that teachers' experience and instructional strategies significantly determined 45% of students' interest in physics practical. This is consistent with Nwankwo and Obinna (2018), who emphasized that student-centered strategies like inquiry-based learning and guided discovery were more effective in maintaining students' interest. Effective teachers not only facilitate learning but also create an engaging environment through the use of structured demonstrations and interactive questioning, which aligns with Kolb's Experiential Learning Theory. Again, the finding was observed that educational simulations and game-based learning accounted for a high 70% contribution to student interest in practical physics. This agrees with Eze and Okafor (2020) who concluded that digital tools and interactive simulations significantly enhance students' engagement and understanding in sciences. The integration of digital resources, especially in physics, fosters visual learning and experimentation even in the absence of physical labs. This is in consonance with Adebayo and Onwuegbuzie (2022), who observed that digital tools enhance students learning outcome. The strong beta weight confirms simulations as a potent determinant. It was found that school location had an insignificant influence on the interest of physics students with a beta weight of 0.5%, revealing a minimal moderating effect on the relationship between the determinants and student interest. This contrasts with Jokodola (2021) and Abonyi *et al.* (2018) who observed that urban schools often had more resources and exposure. However, in this current study, the similarity in resource constraints across both rural and urban schools in Enugu Education Zone may have led to this negligible effect. The overall findings confirm that while infrastructure is essential, instructional quality and modern teaching aids such as simulations and games play a more substantial role in fostering student interest. This reaffirms the importance of capacity-building for teachers, investment in technology, and active teaching strategies as sustainable measures for improving student engagement in physics practical.

5. Conclusion and Recommendation

The study concluded that student interest in physics practical with factors of educational simulations, teachers' instructional strategies, and laboratory adequacy significantly influenced students' engagement and learning outcome. Location, however, showed no major effect. For physics practical interest to be sustained, a multifaceted approach involving infrastructure improvement, teacher development, and use of modern instructional tools is essential. It was recommended that government and education stakeholders should equip schools with infrastructures that will foster global trend. Teachers should be encouraged to embark on in-service training that will glare the facet of ICT enhanced education. School authorities should engage the services of ICT personnels o train her teachers on the use of simulation enhanced education. More so, Physics teachers should arrange learning activities in such a way that it will help students to be self-regulated in their learning; which will help them apply all the interest for both situational; personal and academic interest in the learning of physics.

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