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Research Article

Influence of Students' Attitudes, Interests, Mathematical Background, and Perception of Teacher Behaviour on Physics Achievement in Secondary Schools

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Abstract

This study investigates the influence of students' attitudes, interests, mathematical backgrounds, and perceptions of their teachers' behavioral patterns on their academic achievement in physics among senior secondary school students in Ibadan, Nigeria. Using an ex post facto research design, data were collected from 200 students through a Physics Achievement Test (PAT) and the Attitude, Interest, Mathematical Background, and Students' Perception Questionnaire (AIMSQ). Descriptive and inferential statistical methods, including multiple regression analyses, were employed to evaluate relationships between the independent variables and students' physics achievement. The findings revealed that students' attitudes toward physics had a significant positive relationship with their achievement ($\beta = .369$, $t = 4.000$, $p = .0001$), as did their interest in physics ($\beta = .785$, $t = 3.035$, $p = .0028$). Students' perceptions of their teachers' behavioral patterns also showed a moderate but significant relationship with achievement ($\beta = .183$, $t = 2.179$, $p = .0307$). However, students' mathematical backgrounds were not a statistically significant predictor of physics performance ($\beta = .046$, $t = .496$, $p = .6206$). The results underscore the importance of fostering positive attitudes and sustained interest in physics, enhancing teacher-student interactions, and providing supportive learning environments to improve students' academic performance. Recommendations for improving physics education outcomes include professional development for teachers, integration of practical applications, strengthening mathematical skills, and enhancing motivational programs for students. The study concludes by emphasizing the need for a multifaceted approach to address the factors influencing students' performance in physics and promote national scientific literacy and technological advancement.

Keywords: Physics Education, Academic Achievement, Student Attitudes, Interest in Physics, Mathematical Background, Teacher Behaviour

1. INTRODUCTION

Scientific and technological advancements are pivotal in determining a nation's developmental status. Countries with high levels of scientific literacy and technological innovation are typically classified as developed, while those with lower levels are considered developing or underdeveloped. Nigeria, as a developing nation, has faced challenges in achieving significant progress in science and technology, which hampers its ability to make informed decisions on global scientific issues such as nuclear energy, environmental pollution, and technological innovation (Olapade et al., 2023; Akpan, 2019). Scholars have argued that a nation with a scientifically uneducated population cannot make meaningful contributions to technological advancements. Consequently, they emphasize the importance of science education, particularly physics, as a critical component of national development (Aina et al., 2013; National Academies, 2001).

Physics, often regarded as the foundation of science and technology (Ukoh & Onifade, 2020), is essential for fostering critical thinking, problem-solving skills, and the ability to analyze complex systems. Amanda et al. (2022) noted that physics education is vital for understanding contemporary scientific and technological developments. Furthermore, the Institute of Physics (2024) highlights the importance of physics in equipping students with the scientific skills needed to address real-life problems and contribute to national development. Despite these recognitions, physics remains one of the least popular science subjects in Nigerian secondary schools. Reports from the West African Examination Council (WAEC) have consistently highlighted poor performance in physics, which has raised concerns among educators, policymakers, and parents (WAEC Chief Examiners' Reports, 2016).

Several studies have identified key factors contributing to students' low achievement in physics. These factors include students' attitudes toward physics, interest in the subject, mathematical background, and perception of their teachers' behavioural patterns (Godwin & Okoronka, 2015; Ukoh & Amuda, 2016; Jegede & Okebukola, 2020). Attitudes are predispositions that influence how individuals react to specific objects, events, or subjects with some degree of consistency (Encyclopedia Britannica, 2023). According to Areepattamannil and Kaur (2019), students' attitudes toward school and learning significantly affect their academic performance. Positive attitudes often lead to higher engagement and better achievement, while negative attitudes can hinder learning and lead to poor performance.

In the context of physics education, students' attitudes can significantly influence their interest and participation in the subject. Erinosho (2013) observed that many secondary school students perceive physics as a difficult subject, leading to negative attitudes and reduced engagement. This perception of difficulty contributes to students' fear of physics examinations and their overall poor performance in the subject. Conversely, students with positive attitudes toward physics are more likely to complete assignments, participate actively in class, and achieve better results in physics tests and examinations. Areepattamannil and Kaur (2019) further explained that students often find physics challenging because it involves abstract concepts and the need to visualize objects and processes that are not physically present.

Interest in physics is another significant factor influencing students' achievement. Hidi and Renninger (2006) defined interest as a psychological state characterized by focused attention and engagement, which drives individuals to seek out specific activities or knowledge for learning. Interest is a critical determinant of what students choose to learn, how they engage with learning materials, and how they retain information. Schiefele et al. (2012) agreed that students with a high interest in physics are more likely to achieve better academic results. They argued that interest, combined with motivation, plays a more significant role in learning outcomes than intelligence. Pintrich and De Groot (1990) supported this view, emphasizing that motivation and interest are critical factors affecting students' performance in physics and other subjects.

Another important variable influencing students' achievement in physics is their mathematical background. Physics, as a subject, involves the application of various mathematical principles and concepts, including algebra, calculus, and trigonometry. Aina and Adedo (2013) noted that many students enjoy studying physics but struggle with the mathematical aspects of the subject. This struggle often results in lower grades and a lack of confidence in their ability to succeed in physics. Adeyemo (2010) found that students' achievement in science subjects depends significantly on their understanding of mathematical concepts. Ogunkunle and George (2015) observed that students with a strong mathematical background perform better in physics than those with weak mathematical skills. Ali and Awan (2013) highlighted that beginning learners often find it challenging to grasp physics concepts due to their limited mathematical ability. They noted that students who perceive physics as a branch of mathematics are likely to experience difficulties in understanding the subject.

The perception of teachers' behavioral patterns significantly influences students' performance in physics. De Boer et al. (2018) observed that low-achieving students are significantly influenced by their teachers' behavior and classroom interactions. Li et al. (2020) argued that a teacher's recognition of students as capable individuals is critical in creating a conducive learning environment. Teachers who demonstrate supportive and engaging behaviors can inspire students to develop a positive attitude toward learning, thereby improving their academic performance. De Boer et al. (2018) referred to well-trained and properly behaved teachers as significant contributors to students' success in science subjects. Students' perception

of their teachers' behavior can either motivate them to engage actively in learning or discourage them from participating in classroom activities.

Research conducted in various parts of Nigeria has shown that students' attitudes, interests, mathematical backgrounds, and perceptions of teachers' behavioral patterns are correlated with their academic performance in physics. Ogunsola-Bandele (1996) investigated the influence of mathematics on students' attitudes toward physics in Kaduna State, revealing that difficulties in mathematics negatively impacted students' attitudes toward physics. Similarly, Nduji (2021) examined student-related factors affecting achievement in the eastern part of Nigeria, finding that attitudes, interests, and perceptions of teachers significantly influence academic success. These studies highlight the crucial role of these variables in students' academic performance. However, there is a need for more research to explore the combined effects of these variables on students' physics achievement, particularly in Ibadan.

In light of these, this study seeks to investigate the relationship between students' attitudes, interests, mathematical backgrounds, and perception of teachers' behavioural patterns with their achievement in physics. The findings of this study will provide valuable insights into the factors affecting students' performance in physics and inform strategies to improve physics education in Nigerian secondary schools.

1.1. Hypotheses

The following null hypotheses will be tested in this study:

1. There is no significant relationship between students' attitudes toward physics and their achievement in physics
2. There is no significant relationship between students' interest in physics and their achievement in physics.
3. There is no significant relationship between students' perception of their teachers' behavioural pattern and their achievement in physics.
4. There is no significant relationship between students' mathematical background and their achievement in physics.

2. METHODOLOGY

2.1. Research Design

The design of this study is the Expo factor type. No treatment is involved, and direct manipulation or control of variables is not possible. The researcher cannot administer treatments because the independent variables have already occurred. The researcher observed the dependent variable and retrospectively studied the independent variables for their possible effect on the dependent variable.

2.2. Sample and Sampling Techniques

The population for this study consisted of Senior Secondary School Two (SSII) physics students in Ibadan North Local Government Area (LGA) of Oyo State. A total sample size of 200 students, comprising both boys and girls aged 15–18 years, was selected. A purposeful sampling technique was used to identify schools that met specific criteria, such as having qualified physics teachers and completing the required schemes of work. Out of 15 secondary schools in the LGA, 9 met these criteria. From these 9 schools, a simple random sampling technique was employed to select 5 schools: Abadina College, UI, Ibadan; St. Louis Grammar School, Ibadan; Immanuel College High School, Ibadan; Oluyole Estate Grammar School, Ibadan; and Polytechnic High School, Ibadan. In each selected school, 40 students were randomly chosen from the SSII physics class. The random selection was done by allowing students to pick folded pieces of paper marked "YES" or "NO," ensuring fairness in the selection process. Students who picked "YES" were included in the sample. This approach ensured that all students had an equal chance of being selected.

2.3. Instrument for Data Collection

The following instruments were used for data collection.

2.3.1. Physics Achievement Test (PAT)

The PAT is a multiple-choice objective test consisting of 40 items that were distributed among low and higher-order cognitive processes. The test questions were constructed by the researcher based on SSII and more on the SSI syllabus. The questions were drawn from the SSCE scheme of work. The test items measured the following Bloom's cognitive aspects of educational objectives: knowledge, comprehension and application. Each question in PAT had 5 options (A to E), of which only one was correct. The purpose of PAT was to measure the achievement of students in physics at the various levels of the cognitive domain. Students attempted all questions by circling the correct option on the question paper and were instructed to give one answer to each question

Table 1. Specification Table for Physics Achievement Test (PAT)

Content area-Topic	Level of Objectives			
	Knowledge	Comprehension	Application	Total
Mechanics: measurement, motion, force, work, pressure and density	1, 11, 13, 14,16, 17, 19	3,6,7,12, 18,20,22	2,4,5,8,9, 10,15,21	22
Thermal physics: Molecular theory, temperature, linear expansivity, gas laws, heat capacity, heat transfer	23, 25, 26,28		25,27	6
Waves and optics	35, 38	31, 32, 33,36, 27,29	29, 30, 34	10
Static electricity				1
Magnetism	1			1
Total	14	13	13	40

2.3.2. Attitude, Interest, Mathematical Student Questionnaire (AIMSQ)

The AIMSQ was constructed by the researcher and consisted of two parts. The first part sought personal information of the respondents such as the name of school, class, age and sex. The second part consisted of 4 sections, which are as follows: The Attitude Questionnaire (AQ) is aimed at evaluating students' attitudes towards, Interest Questionnaire (IQ) is aimed at finding students' interest in physics. The Mathematical Background Questionnaire (MBQ) is to elicit students' background in mathematics as mathematics is a tool in learning physics, and the Students Perception Questionnaire (SPQ) is to find out students' perception of the way their teachers behave. A modified 4-point Likert scale was used as a yardstick, ranging from strongly agree to strongly disagree

Table 2. Distribution of Questionnaire Items Across Different Sections

Number of Items	Name of Section
1-8	Attitude Questionnaire (AQ)
9-16	Interest Questionnaire (IQ)
17-24	Maths Background Questionnaire (MBQ)
25-32	Students' Perception Questionnaire (SPQ)

2.4. Instrument Validation

The PAT and the AIMSQ were given to two higher-degree students and two experts in the field to read through to ensure that the language and items of the questionnaire were capable of eliciting the required responses. Finally, the PAT and AIMSQ were given to the project supervisor for possible corrections. Based on their suggestions, and the advice of the supervisor, corrections and amendments were made.

2.5. Reliability of the Instrument

To determine the reliability of the instruments, they were administered to 20 SSII physics students at Oro Grammar School in Kwara State, a location outside the main study area. The instruments, Physics Achievement Test (PAT) and Attitude, Interest, and Mathematical Student Questionnaire (AIMSQ) were evaluated as follows:

2.5.1. Physics Achievement Test (PAT)

The PAT was scored by converting students' responses into binary form, assigning a score of 1 for correct answers and 0 for incorrect answers. The reliability of the PAT was determined using the Kuder-Richardson 21 (KR-21) formula, as it is suitable for tests with dichotomous scoring. The calculated reliability coefficient (alpha) for the PAT was 0.7610. Furthermore, the standardized item alpha yielded a reliability coefficient of 0.7796, confirming the test's reliability within an acceptable range.

2.5.2. Attitude, Interest, and Mathematical Student Questionnaire (AIMSQ)

The reliability of the AIMSQ was assessed using Cronbach's alpha, an appropriate method for non-dichotomous data. Cronbach's alpha measures the consistency of individual items relative to the overall variance of the instrument. The questionnaire consisted of four sections, each with a minimum of five items to ensure meaningful and reliable measures. The reliability coefficients for the respective sections were as follows:

Attitude Questionnaire: A reliability coefficient of 0.4324 indicates acceptable reliability.

Interest Questionnaire: A reliability coefficient of 0.6279 demonstrates moderate reliability.

Mathematical Background Questionnaire: A reliability coefficient of 0.7118 shows a high level of reliability.

Student Perception Questionnaire: A reliability coefficient of 0.7787, reflecting strong reliability.

These reliability measures indicate that the instruments were dependable and suitable for use in this study.

2.5.3. Scoring of the Instruments

The PAT was scored over 36, that is 1 mark for each correct answer and no mark for incorrect answers. The AIMSQ was also scored as follows: Strongly agree (SA)-4, Agree(A)-3, Disagree(D)-2, Strongly Disagree (SD)-1. Negative items were scored in the reverse order.

2.6. Method of Data Analysis

The data collected in this study were analyzed using descriptive and inferential statistical methods to evaluate the relationships between students' attitudes, interests, perception of teachers' behavioral patterns, and mathematical background, with their achievement in physics. Descriptive statistics such as mean, median, standard deviation, variance, and skewness were used to summarize the key variables and assess the distribution of the data. Multiple linear regression analysis was employed to determine the predictive relationships between the independent variables and students' achievement in physics. The regression model tested the influence of students' attitudes toward physics, interest in the subject, perception of their teachers' behavioural patterns, and mathematical background on their academic performance. The hypotheses were tested using t-tests for individual regression coefficients and an F-test to assess the overall significance of the regression model.

3. FINDINGS

Table 3 presents the results of a multiple regression analysis examining the relationship between students' attitudes, interest, mathematical background, and perception of their teachers' behavioral patterns

in predicting their achievement in physics. The findings indicate that attitude toward physics has a significant positive relationship with achievement (β = .369, t = 4.000, p = .0001), suggesting that students with a more positive attitude tend to score higher. Similarly, interest in physics also showed a significant positive correlation with achievement (β = .785, t = 3.035, p = .0028), indicating that students who exhibit greater interest in the subject perform better. However, mathematical background was not a significant predictor of physics achievement (β = .046, t = .496, p = .6206), suggesting that prior mathematics knowledge does not significantly influence performance. Additionally, a weak but significant relationship was found between students' perception of their teachers' behavioral patterns and their achievement (β = .183, t = 2.179, p = .0307), implying that a favorable perception of teachers' instructional approaches has a modest impact on student performance.

Table 3. Variables in the Equation (Involves all Variables)

Variable	B	SE B	95% Confidence interval B	Beta	SE Beta	Corr.	T	Sig. T
Attitude	.363	.091	.184 - .542	.369	.092	.788	4.000	.0001
Interest	.265	.087	.093 - .438	.785	.094	.772	3.035	.0028
Maths B	.045	.092	-.136 - .226	.046	.093	.733	.496	.6206
Perception	-0.166	.076	.016 - .316	.183	.084	.744	2.179	.0307
Constant	-0.959	.963	-2.86 - .942				-.996	.3209

Table 2 presents the multiple regression analysis focused on attitude as a predictor of achievement. The results indicate that attitude alone explains 62.1% of the variance in achievement (R^2 = .621, Adjusted R^2 = .619). The significant F-ratio (F (1,165) = 270.813, p < .05) confirms that attitude is a strong predictor of achievement. The high R-squared value suggests that students' attitude plays a major role in their academic success, emphasizing the need for strategies to enhance students' interest and engagement in physics.

Table 2. Multiple Regression on Attitude

Multiple R	.788	R-squared change	.621
R square	.621	F change	270.813
Adjusted R-squared	.619	Significant change	.000
Standard error	3.178		

Null Hypothesis 1: There is no significant relationship between students' attitudes toward physics and their achievement in physics.

The descriptive statistics for attitude in Table 3 showed a mean score of 19.132 (SD = 5.230), a median of 19.000, and a variance of 27.356. The skewness value (.190) indicates a nearly normal distribution. The significant t-value (t = 4.000, p < .05) provides strong evidence to reject the null hypothesis that there is no significant relationship between students' attitudes toward physics and their achievement.

Table 3. Descriptive Statistics for Attitude

Mean	19.132	Standard Deviation	5.230
Median	19.000	Variance	27.356
Standard	.405	Skewness	.190
Number of Subject	167		

Null Hypothesis 2: There is no significant relationship between students' interest in physics and their achievement in physics.

Table 4. Descriptive Statistics for Interest

Mean	22.269	Standard Deviation	5.524
Median	22.00	Variance	30.54
Standard	.427	Skewness	.288
Number of Subject	167		

The descriptive statistics for interest in Table 4 revealed a mean score of 22.269 (SD = 5.524) and a variance of 30.54. The skewness value (.288) indicates a nearly normal distribution. The t-value for interest (t = 3.035, p < .05) suggests a significant positive correlation between students' interest in physics and their achievement. Therefore, the null hypothesis is rejected, confirming that fostering students' interest in physics can enhance their academic performance.

Null Hypothesis 3: There is no significant relationship between students' perception of their teachers' behavioural pattern and their achievement in physics.

Table 5. Descriptive Statistics for Teachers' Behavioural Pattern

Mean	20.036	Standard Deviation	5.686
Median	20.00	Variance	32.336
Standard	.440	Skewness	-.40
Number of Subject	167		

The analysis of students' perception of their teachers' behavioral patterns in Table 5 showed a mean score of 20.036 (SD = 5.686) with a variance of 32.336. A skewness value of -.40 indicates a nearly normal distribution. The significant t-value (t = 2.179, p < .05) suggests that students' perception of their teachers' behavior moderately influences their achievement. This finding underscores the importance of teachers' instructional methods and classroom management in shaping student performance.

Null Hypothesis 4: There is no significant relationship between students' mathematical background and their achievement in physics.

Table 6. Descriptive Statistics for Mathematical Background

Mean	18.826	Standard Deviation	5.237
Median	19.000	Variance	27.421
Standard	.405	Skewness	.102
Number of Subject	169		

Table 6 presents the descriptive statistics for mathematical background, with a mean score of 18.826 (SD = 5.237) and a variance of 27.421. The skewness value (.102) indicates a nearly normal distribution. However, the t-value (.496, p = .6206) is not significant, suggesting that students' prior mathematical knowledge does not have a significant impact on their physics achievement. Based on this result, the null hypothesis is not rejected, indicating that other factors may be more critical in determining student success in physics.

4. DISCUSSION

This study investigated the influence of students' attitudes, interests, mathematical background, and perceptions of their teachers' behavioral patterns on their achievement in physics. The findings revealed that students' attitudes and interests significantly predict physics achievement, while their mathematical background does not have a statistically significant impact. Additionally, students' perceptions of their teachers' behavioral patterns show a moderate but significant relationship with achievement.

The results indicate that students' attitudes toward physics have a significant positive relationship with their achievement (β = .369, t = 4.000, p = .0001). This finding is consistent with recent studies that highlight the importance of positive dispositions in academic success (Areepattamannil & Kaur, 2019). A positive attitude towards physics enhances students' willingness to engage in problem-solving and class activities, leading to improved learning outcomes. Prior research suggests that fostering a growth mindset and creating a supportive learning environment can further strengthen students' attitudes and academic performance in science subjects (Jegede & Okebukola, 2020).

Interest in physics also emerged as a significant predictor of achievement ($\beta = .785$, $t = 3.035$, $p = .0028$). This aligns with studies that emphasize the role of interest in sustaining motivation and deepening conceptual understanding (Schiefele et al., 2012). When students find physics engaging and relevant, they are more likely to persist in challenging tasks and actively seek knowledge. Teachers can leverage this by incorporating inquiry-based learning approaches, real-world applications, and hands-on experiments to maintain and deepen students' interest in physics (Hidi & Renninger, 2006).

Unlike attitudes and interests, students' mathematical background was not a statistically significant predictor of their physics achievement ($\beta = .046$, $t = .496$, $p = .6206$). This finding contrasts with prior studies that have emphasized mathematical proficiency as a key determinant of success in physics (Adeyemo, 2010; Ogunkunle & George, 2015). However, recent research suggests that conceptual understanding, rather than computational skills, may play a more significant role in students' ability to grasp physics concepts (Adeduyigbe et al, 2024). A possible explanation for this discrepancy is that the instructional approaches adopted in the sampled schools may have placed greater emphasis on theoretical explanations rather than mathematical problem-solving. Additionally, students may develop alternative strategies for engaging with physics content that do not heavily rely on mathematical proficiency. This aligns with findings from Adeduyigbe et al (2025), which highlight how instructional strategies and learning contexts can shape students' difficulties in physics. Future research should investigate whether strengthening students' mathematical skills through targeted interventions, such as problem-based learning and scaffolding techniques, can enhance their ability to apply mathematical concepts in physics problem-solving.

Students' perceptions of their teachers' behavioral patterns significantly influenced their physics achievement ($\beta = .183$, $t = 2.179$, $p = .0307$). This finding supports studies emphasizing the importance of teacher-student interactions in shaping learning outcomes (Ukoh & Adeduyigbe, 2025; De Boer et al., 2018). Teachers who provide clear explanations, engage students actively, and create a positive classroom environment tend to foster higher academic achievement. Supportive teacher behaviors can enhance students' confidence, motivation, and willingness to participate in physics-related activities. Training programs that equip teachers with student-centered pedagogical strategies can help improve students' perceptions and, in turn, their academic success (Ukoh & Adeduyigbe, 2025; Li et al., 2020).

The findings of this study align with recent research highlighting the influence of attitudes and interest in physics education. However, the lack of significance in mathematical background contradicts some prior findings, suggesting the need for further exploration of contextual factors (Nduji, 2021). Future studies could examine whether students with stronger mathematical foundations perform better in more advanced physics topics that require complex calculations. Additionally, it would be valuable to investigate how different teaching approaches impact the relationship between mathematical background and physics achievement.

The results of this study have important implications for physics education. Teachers should adopt instructional strategies that promote positive attitudes and interest, such as incorporating real-world applications, interactive simulations, and hands-on experiments. Enhancing teacher-student interactions through effective communication, mentorship, and classroom management can further support student learning. While mathematical background was not found to be a significant predictor, efforts should still be made to strengthen students' problem-solving skills to facilitate their understanding of physics concepts. Policymakers should prioritize professional development programs that equip teachers with strategies to enhance student motivation and engagement in physics education (Godwin & Okoronka, 2015).

This study reinforces the importance of students' attitudes and interests in physics achievement while highlighting the role of teacher-student interactions. Future research should further investigate the relationship between mathematical background and physics performance across different instructional settings. By implementing targeted interventions to improve student engagement and teacher effectiveness, educators can enhance physics learning outcomes and contribute to national scientific literacy and technological development.

5. CONCLUSION AND RECOMMENDATIONS

This study has demonstrated that students' attitudes, interest, mathematical background, and perceptions of their teachers' behavioural patterns significantly impact their achievement in physics. Among these variables, students' attitudes and interests emerged as the most influential factors, indicating the need to foster positive dispositions and sustained curiosity toward the subject. The findings also underscore the importance of teacher-student interactions, as students who perceive their teachers as supportive and engaging are more likely to achieve better academic outcomes.

While the study revealed that mathematical background was not a statistically significant predictor of physics achievement, this does not diminish the importance of mathematical skills in understanding physics concepts. Therefore, efforts should be made to strengthen students' foundational mathematical knowledge alongside improving their attitudes and interest in the subject. The implications of these findings are far-reaching for educators, policymakers, and curriculum developers. Teachers should adopt innovative instructional strategies that promote active learning, curiosity, and engagement in physics. School administrators and policymakers should provide opportunities for professional development to equip teachers with the necessary skills to create positive classroom environments that encourage student participation.

In conclusion, addressing the factors that influence students' achievement in physics requires a multifaceted approach that prioritizes the development of positive attitudes, interests, and supportive teacher-student relationships. By implementing these recommendations, educational stakeholders can improve physics education outcomes and contribute to the broader goal of advancing scientific literacy and technological development in Nigeria.

Based on the findings of this study, the following recommendations are made to improve physics teaching and learning outcomes:

- Professional Development for Teachers: Teachers should undergo continuous professional development programs to equip them with effective strategies for fostering positive attitudes and interest in physics. These programs should focus on interactive and student-centered teaching methods that encourage active participation and engagement.
- Integration of Practical and Real-Life Applications: Teachers should incorporate practical demonstrations and real-life applications of physics concepts in their lessons. This approach will help students see the relevance of physics in everyday life, increasing their interest and motivation to learn the subject.
- Strengthening Mathematical Skills: Schools should implement programs to strengthen students' mathematical background, as it is essential for understanding many physics concepts. Remedial classes and additional support in mathematics should be provided to students who struggle with the subject.
- Enhancing Teacher-Student Relationships: Teachers should create a supportive and positive learning environment by building strong relationships with their students. Providing constructive feedback, showing empathy, and fostering open communication can significantly improve students' perception of their teachers and, consequently, their academic performance.
- Motivational Programs for Students: Schools should organize motivational programs and career talks to inspire students to take an interest in physics. Guest speakers from scientific and technological fields can help students see the opportunities available in physics-related careers and encourage them to pursue the subject with enthusiasm.
- Policy Interventions by Educational Authorities: Policymakers should develop and implement policies that promote the teaching of physics in secondary schools. These policies should address issues such as teacher recruitment, curriculum development, and resource allocation to ensure that schools have the necessary support to deliver quality physics education.

By implementing these recommendations, stakeholders can address the factors influencing students' performance in physics and create a more conducive environment for learning. These interventions will contribute to improving physics education outcomes in Nigerian secondary schools and help students develop the scientific literacy required for national development.

6. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

While this study provides valuable insights into the factors influencing students' achievement in physics, certain limitations must be acknowledged. First, the study sample consisted of students from a specific geographical location, limiting the generalizability of the findings to other regions with different educational settings and curricula. Future studies should consider a larger and more diverse sample to enhance the applicability of the results across different contexts. Secondly, the study employed an ex post facto research design, which restricts the ability to establish causation between variables. While the findings suggest significant relationships between attitudes, interests, perceptions of teachers' behavioral patterns, and physics achievement, they do not confirm causal effects. A longitudinal study tracking students' attitudes, interests, and performance over time would provide stronger evidence of causality and offer deeper insights into how these factors evolve and interact.

Additionally, while the study found that mathematical background was not a significant predictor of physics achievement, this may be due to the specific content areas assessed. Future research should explore whether mathematical background plays a more critical role in topics that require extensive calculations, such as electromagnetism or quantum mechanics. Investigating how students' mathematical abilities impact their problem-solving skills in physics could yield more nuanced findings. Furthermore, the study relied on self-reported measures for assessing attitudes, interest, and perceptions, which may be subject to response bias. Future research could incorporate mixed-method approaches, including classroom observations and interviews, to gain a more comprehensive understanding of student engagement and learning experiences in physics.

Lastly, future studies should consider the role of additional influencing factors, such as socio-economic status, availability of instructional resources, and parental support, in shaping students' achievement in physics. Examining the interplay between these variables could provide a more holistic understanding of the challenges students face in learning physics and inform more effective intervention strategies.

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