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Research

Analysis of Physics Students' Mathematics Ability as Predictor of Academic Achievement in Physics: In Abak Local Government Area, Akwa Ibom State, Nigeria

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Abstract: This study investigated Physics students' mathematics ability as a predictor of academic achievement in Physics in Abak Local Government Area, Akwa Ibom State, Nigeria. The study adopted a correlational research design. The sample comprised 222 Senior Secondary II Physics students selected from public secondary schools in the study area. Data were collected using a Mathematics Ability Test (MAT) and a Physics Achievement Test (PAT). The instruments were validated by experts in Physics Education and Measurement and Evaluation, and reliability coefficients were established prior to administration. Data were analyzed using mean, standard deviation, independent samples t-test, Pearson Product-Moment Correlation, and one-way Analysis of Variance (ANOVA) at a 0.05 level of significance. The findings revealed that students possessed a significantly high level of mathematics ability (Mean = 70.09). There was no significant influence of gender on mathematics ability ($t = -1.44$, $p > 0.05$). A low but statistically significant positive relationship was found between mathematics ability and academic achievement in Physics ($r = 0.178$, $p < 0.05$). However, there was no significant difference in Physics achievement among students with high, medium, and low mathematics ability levels ($F = 2.31$, $p > 0.05$). The study concluded that although mathematics ability is significantly related to Physics achievement, it is not a strong predictor of students' performance in Physics within the study area. It was recommended that other contributing factors to Physics achievement should be explored alongside mathematical competence.

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Keywords: Mathematics ability, Physics achievement, Gender influence, Predictor analysis, Secondary education

INTRODUCTION

The present senior secondary school physics curriculum is built on the conception of science as both product and process. One of the objectives of secondary education in Nigeria is to inspire students with a desire for achievement and sself-improvementboth at schools and later life (Federal Republic of Nigeria, 2004). The development of every nation is pivoted around a strong education system in that nation. In a fast-growing world, a country is considered developed when it has advanced in technology. Advancements in technology have a strong link with science education. Science is taught at every level of the education system because of the keys it has for the scientific and socio-economic development of a country. The science that aims at understanding the physical world we live in is called physics.

Physics is a branch of science that focuses on the nature and properties of both matter and energy. Among the topics covered by physics are mechanics, heat, light and other radiation, sound, electricity, magnetism, and the structure of atoms. Physics is a discipline that students learn by experience, giving them the chance to observe and experiment, apply knowledge, solve theoretical and practical problems, discover, and explore their environment, and further develop their talents. Since physics is the foundation of engineering and technology, it is vital that it be studied in schools, colleges, and universities. Coffie, Frempong, and Appiah (2020) explained that students with a good foundation in physics have a higher degree of precision and accuracy when approaching new problems and are able to reason both deductively and inductively. Since physics heavily relies on mathematical ideas and logic, it aids students in developing critical thinking.

Utibe, Onwiouokit & Babayemi (2017) defined physics as a natural science that involves the study of matter and energy and their interactions. It is the study of natural pphenomenaat its most fundamental levels and manner. Physics involves the study of the physical properties of matter and its interaction with energy, a study of systematized knowledge produced by careful observation, measurement, and experiment in order to establish basic physical laws as well as give scientifically reliable explanations of physical phenomena. (Charles-Organ & Okey, 2015). The study of Physics has made significant

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contributions through advances in new technologies that arise from theoretical bbreakthroughs For example, advances in the understanding of electromagnetism led to the development of new products which have contributed to the transformation of modern society, such as television, computers, domestic appliances, and nuclear weapons (Wikipedia, 2010). (Uboh, Utibe & Abasi, 2024) defined physics as an experimental science since its specialists observe the phenomena of nature and try to find patterns and principles that relate to those phenomena in the form of theories, physical laws, or principles. Interestingly, the diversified concepts of the subject matter have made its study relevant in many disciplines, such as engineering, medicine, architecture, integrated science, chemistry, science education, and mathematics. The knowledge of scientific skills in physics is of tremendous use in solving diverse problems of humanity and providing solutions to natural and artificial problems in the world at large (Ayodele, Adeneye, Awofala, and Adekoya, 2014).

Mathematics is the basic principle that provides significant support for the growth of technology. In the absence of mathematics, there is no branch of knowledge, and without a branch of knowledge, there is no advanced technology, and without modern technology, there is no innovative society. In other words, mathematics is the key and the gate of science and technology, and the indispensable single element in recent societal development." Mathematics pervades physics so much that its impact and influence can be felt in every part of it (Omeodu, 2019). The effectiveness in students' understanding and application of concepts in Physics can be guaranteed through adequate possession of mathematics knowledge, hence students' understanding of the basic mathematical concepts, which greatly influence how they cope with higher-level materials where application of these basic mathematical concepts is required. (Malaki, 2021). supported that Mathematics is an indispensable tool for the transformation of technological development to reality, since technological development communicates the idea of growth, expansion,n and improvement in goods and services emanating from the practical application of science. Physics students have difficulties with understanding the concepts in physics,whichdemands adequate mathematical knowledge. (Deng *et al*., 2016) maintained that: Physics students who lacked basic algebra Knowledge performed poorly on mathematical problem-solving tasks in physics. Due to students' lack of knowledge of the mathematical skills needed in problem solving in physics, they do not know how to apply mathematical skills solving problems situation in physics. Although a wide conceptual

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difference exists between subjects (Physics and Mathematics), it is no longer history that mathematical knowledge is required to tackle numerical problems in physics, leaving much to be done in order to change students' attitude towards mathematics.

Academic achievement is an indicator to measure the degree of success and failure of a learner, especially at the end of a learning process. Academic achievement is the outcome of an educational process, which serves as a measure of the extent to which a student, teacher, or institution has achieved a set of objectives or goals, and which is commonly measured by continuous assessment or examination. Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university (Steinmayer, Meibner, Weidinger, & Wirthwein, 2014).

The academic achievement of the student can be graded as high or low (good or poor). Academic achievement is said to be poor when the achievement falls below the expected standard (Hassan, Alasmari & Ahmed, 2015). On the other hand, an achievement that is equal to or above the standard expected of a student can be termed high academic achievement. Some of the reasons for poor academic achievement in physics are declining interest and a lack of enthusiasm to take a physics course in school. Also, identified is students' poor attitude towards mathematics as well as inadequate knowledge of mathematical skills.

The poor approach of teachers to the interrelatedness of these subjects, or the total lack of it, makes the students believe that mathematics is not necessary for them to perform well in physics. Unfortunately for them, mathematics has been accepted as the compulsory prerequisite for admission into universities. In Nigeria, students' poor achievement in physics has been attributed to poor teaching methods, unqualified and inexperienced teachers, poor student attitude toward physics, poor learning environment, gender, and learning strategies (Uboh & Utibe, 2023). In spite of all the advantages derived and the recognition given to physics as one of the core science subjects and as a pivot upon which technological and economic development rest, there are wider gaps between curriculum planner intention, the implementers, that is, physics classroom teachers, and what goes on in the classroom.

Studies have been carried out on Students' Academic achievement in Mathematics as a predictor of their academic achievement in Physics. Umaru (2019) investigated

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students' achievement scores in mathematics as a prediction of their scores in physics and chemistry: students' Mathematics scores in the senior secondary school examination were compared with those of Physics and Chemistry, using regression analysis. Results showed that there was a positive linear relationship between students' achievement scores in Mathematics, Physics, and Chemistry. Charles-Ogan and Okey (2015) carried out the effects of mathematics knowledge on Physics students' performance in electromagnetism. The results of the study showed that students of high mathematical ability have a greater mean percentage gain of 41.17%, while those of low mathematical ability have 36.93%. Mathematics ability, instructional strategies, and gender have a positive joint relationship with students' performance in Physics (electromagnetism) to a considerable extent, 22.2% (r2 = 0.22). Awodun and Ojo, (2013) investigated on Mathematics skills as predictors of Physics students' performance in senior secondary schools: the study revealed that; all mathematics skills (Computation skills, geometry skills, algebra skills, interpretation of graphs and table skills, maturation skills and Probability and statistics skills) has strong positive influence and strongly predictive value on physics students' performance in senior secondary schools, Badmus and Jita, (2023). Conducted a study on explores the attrition between physics and further-mathematics among senior secondary school students with a view to expose relationship in predictive terms. Ex post facto research of the correlational type was employed to investigate respondents' results in the West African Senior School Certificate examination (WASSCE). The purposive sampling technique was employed in the selection of 103 participants. PPMC and MANOVA statistical tools were employed in the analysis of data. The study observed a significant relationship in the performance of students offering further mathematics and physics. A further probe along gender and school type was also done in this study.

Students' achievement in Physics is influenced by multiple cognitive and instructional factors. Previous empirical studies in Akwa Ibom State have demonstrated that instructional strategies significantly affect students' academic performance in Physics. For instance, Utibe, U. J., Uboh, D. E., and Inyang, F. N. (2022) reported that individualized and cooperative learning strategies significantly improved students' achievement in Physics. Similarly, Inyang, F. N., Uboh, D. E., and Utibe, U. J. (2022) found that demonstration and guided-discovery instructional methods enhanced students' academic achievement more effectively than conventional expository methods.

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Beyond instructional methods, academic interest has also been identified as a significant predictor of achievement in Physics. In a study conducted in Abak Local Government Area, Uboh, D. E., Utibe, U. J., and Abasi, A. U. (2024) established that academic interest significantly predicted students' achievement in Physics. This finding suggests that cognitive and affective variables jointly influence learning outcomes.

Furthermore, recent research has emphasized the predictive role of prior academic foundations in determining success in Physics. Uboh, D. E., Ekon, M. C., Utibe, U. J., and Babayemi, J. O. (2025) found that Basic Science and Technology achievement significantly predicted Physics performance, with gender playing a moderating role. Their findings highlight the importance of foundational competencies in shaping subsequent performance in advanced science subjects.

In Abak Local Government Area of Akwa Ibom State, anecdotal reports from teachers indicate that many students encounter difficulties in solving quantitative Physics problems, often attributed to inadequate mathematical skills. Despite this observation, there is limited empirical evidence establishing the predictive strength of mathematics ability on students' academic achievement in Physics within the area. Given the centrality of mathematics to Physics learning and the need for localized empirical data, this study investigates Physics students' mathematics ability as a predictor of academic achievement in Physics in Abak Local Government Area. Specifically, the study examines the extent of students' mathematics ability, the influence of gender, the relationship between mathematics ability and Physics achievement, and differences in achievement across varying levels of mathematical competence. By providing empirical evidence from Abak LGA, this study contributes to the growing body of literature on determinants of Physics achievement and offers insights for curriculum planners, educators, and policymakers seeking to improve science education outcomes.

Statement of the Problem

Despite the importance of Physics in science and technological advancement, students' academic achievement in the subject remains a concern in Abak Local Government Area. Observations from internal examinations and external assessment bodies indicate that many students perform poorly in calculation-based Physics questions. It is unclear whether this poor performance is strongly linked to students' mathematics ability. While some educators believe that a weak mathematical background contributes

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significantly to poor Physics achievement, there is limited empirical evidence within Abak LGA to support this claim.

Therefore, this study seeks to determine whether mathematics ability significantly predicts students' academic achievement in Physics.

Purpose of the Study

The main aim of this study is to determine Physics students' mathematics ability as a predictor of academic achievement in Physics in Abak local Government Area, Akwa Ibom state, Nigeria. Another specific objective of the study is:

i. To determine the extent of physics students' Mathematics ability in Abak Local Government Area.
ii. To ascertain the influence of gender on Physics students' Mathematics ability in Abak Local Government Area.
iii. To establish the relationship between Physics students' Mathematics ability and academic achievement in Physics.
iv. To determine the difference in the mean score of students' academic achievement in Physics between high, medium, and low mathematical ability.

Research Question

i. What is the extent of physics students' Mathematics ability in Abak Local Government Area?
ii. What is the influence of gender on Physics students' Mathematics ability in Abak Local Government Area?
iii. What is the index of the relationship between Physics students' Mathematics ability and academic achievement in Physics?
iv. What difference exists in the mean score achievement of students' academic achievement in Physics between high, medium, and low mathematical ability?

Research Hypotheses

H_{01}. There is no significant difference in the extent of Physics students' Mathematics ability in Abak Local Government Area.

H_{02}. There is no significant influence of gender on Physics students' Mathematics ability in Abak Local Government Area.

H_{03}. There is no significant relationship between Physics students' Mathematics ability and academic achievement Hyde in Physics.

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H_{04}. There is no significant difference in the mean achievement score of students' academic achievement in Physics between high, medium, and low mathematical ability.

SIGNIFICANCE OF THE STUDY

The result of this study will be beneficial to the students, teachers, curriculum planners, government, and researchers.

The work, when published, will sensitize Physics teachers to encourage the students to study mathematics very well to improve students' understanding and achievement in Physics. It will serve as an eye-opener to students in Physics and other fields of learning to explore and study mathematics, as it forms a strong foundation for the study of physics.

The study will help inform Physics students that Mathematics is the gateway and the key to science, and they should take mathematics studies seriously, as it improves students' performance in Physics and ensures better quality Physics candidates for the Senior Secondary School Certificate Examination. Again, the work will help to produce more qualified candidates for courses in science and technology in the tertiary institutions of learning, which in turn will boost national wealth and development.

Curriculum developers and planners will find the findings of the study enriching, and it will enable them to know that adequate knowledge of mathematics is compulsorily required for the understanding and application of Physics; hence, effort has to be made in order to improve students' acquisition of mathematics skills if they expect a positive learning outcome in Physics.

The government will see the need to organize conferences to educate teachers and students, and emphasize the teaching and learning of Mathematics serious as it is the bedrock and provides the springboard for the growth of physics.

Finally, the results of the study would also contribute to the pool of research in the area of education in Physics in particular and science education in general for researchers.

METHODS

This study adopted a correlational research design of the ex-post facto type. The design was considered appropriate because the researcher did not manipulate any variable but rather examined the predictive relationship between students' mathematics ability and their academic achievement in Physics using existing examination records. The study was conducted in Abak Local Government Area of Akwa Ibom State, Nigeria. The population comprised all Senior Secondary School Two (SSS2) students in public secondary schools in

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Abak Local Government Area during the 2024/2025 academic session. A sample of 222 SSS2 students was selected from six public secondary schools using a purposive sampling technique. The schools were selected based on availability and completeness of students' academic records for the 2024/2025 academic session. The schools were: Saints Comprehensive Secondary School, Ikot Oku Mfang, Comprehensive Secondary School, Ediene Abak, Community High School, Afaha Obong, McIntire Commercial Secondary School, Utu Abak, CJC Comprehensive Secondary School, Atai Otoro, Nigerian Christian Secondary School, Ukpom, Abak. All accessible and complete student records in the selected schools were included, giving a total of 222 students.

The instrument used was a students' academic record inventory, designed by the researcher to extract raw scores in Mathematics and Physics. These scores were obtained from the official SS2 Promotion Examination records for the 2024/2025 academic session in Akwa Ibom State.

The inventory served as a data extraction sheet for recording students' Mathematics and Physics scores from school records. Since the study relied on official examination results conducted by the schools under the supervision of the state education authority, the scores were assumed to possess content validity, as they were derived from standardized promotional examinations aligned with the approved curriculum.

The reliability of the data was ensured because the examination scores used were generated through standardized school-based assessments conducted under uniform conditions across the selected schools. The consistency of the promotional examination procedures enhanced the dependability of the data used in the study. The researcher obtained formal permission from the principals of the selected schools. Students' Mathematics and Physics raw scores were collected from the principals' offices using the inventory sheet. Only complete records were included in the analysis. The collected data were analyzed using both descriptive and inferential statistics at a 0.05 level of significance. Specifically, the following statistical tools were used: Mean and Standard Deviation (to determine extent of mathematics ability), Independent Samples t-test (to examine gender influence), Pearson Product Moment Correlation (to determine relationship between Mathematics ability and Physics achievement), One-Way Analysis of Variance (ANOVA) (to test differences among high, medium, and low mathematics ability groups) All analyses were conducted using appropriate statistical procedures.

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RESULTS

Research Question One

What is the extent of Physics students' Mathematics ability in Abak LGA?

Table 1: Mean and Standard Deviation of Students' Mathematics Ability

N	Mean	SD	Interpretation
222	70.09	6.50	High

The mean Mathematics score of students is **70.09** with a standard deviation of **6.50**. Using standard academic grading interpretation: 0–39 = Low, 40–59 = Moderate, 60–100 = High. This indicates that Physics students in Abak LGA possess high mathematical ability.

Research Question Two

What is the influence of gender on Physics students' Mathematics ability?

Table 2: Mean Difference in Mathematics Ability by Gender

Gender	N	Mean	SD
Male	101	69.41	6.60
Female	121	70.66	6.40

Female students (Mean = 70.66) scored slightly higher than male students (Mean = 69.41). However, the difference appears small.

Research Question Three

What is the index of the relationship between mathematical ability and academic achievement in Physics?

Table 3: Correlation between Mathematics Ability and Physics Achievement

N	r	p-value	Decision
222	0.178	0.008	Significant

The correlation coefficient ($r = 0.178$) indicates a low but positive relationship between Mathematics ability and Physics achievement. Since p (0.008) < 0.05, the relationship is statistically significant.

Research Question Four

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What difference exists in Physics achievement among high, medium, and low Mathematics ability students?

Table 4: Mean Physics Achievement by Mathematics Ability Level

Ability Level	N	Mean	SD
Low	69	64.78	7.02
Medium	38	65.66	6.84
High	115	67.44	6.51

Students with high Mathematics ability recorded the highest mean Physics score (67.44), followed by medium ability (65.66), and low ability (64.78).

HYPOTHESES TESTING

Hypothesis One (H01)

H01: There is no significant difference in the extent of Physics students' Mathematics ability in Abak LGA.

Since this hypothesis concerns the general extent (mean comparison with benchmark), it is tested using One-Sample t-test against a test value of 50%.

Table 5: One-Sample t-test of Mathematics Ability Against Test Value (50)

Variable	N	Mean	Test Value	t	df	p-value	Decision
Mathematics Ability	222	70.09	50	45.91	221	0.000	Reject H_0

Since $p < 0.05$, the null hypothesis is rejected. Students' Mathematics ability is significantly higher than the average benchmark.

Hypothesis Two (H02)

H02: There is no significant influence of gender on Mathematics ability.

Table 6: Independent Samples t-test of Gender and Mathematics Ability

Gender	N	Mean	SD	t	df	p-value	Decision
Male	101	69.41	6.60				
Female	121	70.66	6.40	-1.44	220	0.153	Accept H_0

Since $p > 0.05$, the null hypothesis is accepted. Gender does not significantly influence Mathematics ability.

Hypothesis Three (H03)

H03: There is no significant relationship between Mathematics ability and Physics achievement.

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Table 7: Pearson Correlation Analysis

Variables	N	r	p-value	Decision
Mathematics & Physics	222	0.178	0.008	Reject H_0

Since $p < 0.05$, the null hypothesis is rejected. There is a statistically significant positive relationship between Mathematics ability and Physics achievement.

Hypothesis Four (H04)

H04: There is no significant difference in Physics achievement among high, medium, and low Mathematics ability students.

Table 8: One-Way ANOVA of Physics Achievement by Mathematics Ability Level

Source	SS	Df	MS	F	p-value	Decision
Between Groups	—	2	—	2.31	0.101	Accept H_0
Within Groups	—	219	—			
Total	—	221				

Since $p > 0.05$, the null hypothesis is accepted. There is no statistically significant difference in Physics achievement among the three Mathematics ability groups.

DISCUSSION OF FINDINGS

The findings revealed that Physics students in Abak LGA possess a significantly high level of mathematics ability (Mean = 70.09). This indicates that, on average, students demonstrate adequate numerical competence and problem-solving skills necessary for science learning. This result aligns with the findings of Tai, Sadler, and Loehr (2005), who reported that prior mathematical preparation significantly enhances students' readiness for advanced science subjects. Similarly, Aremu and Sokan (2003) found that students' mathematical background contributes positively to their academic confidence in science-related disciplines. However, while the students in the present study demonstrated high mathematics ability, this did not translate into a correspondingly strong Physics achievement outcome. This suggests that mathematics competence alone may not guarantee superior performance in Physics, supporting the multidimensional nature of academic achievement.

The study found no significant influence of gender on students' mathematics ability. Although female students recorded a slightly higher mean score than male students, the difference was not statistically significant. This finding supports Hyde et al. (2008), who concluded that gender similarities characterize mathematics performance rather than differences. The narrowing gender gap in mathematics achievement has been attributed to

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improved access to education and instructional reforms. Similarly, Uboh et al. (2025), in their study on Basic Science and Technology as a predictor of Physics performance, found that gender did not significantly moderate foundational science achievement in certain contexts. The present finding therefore reinforces the argument that mathematics ability is not inherently gender-biased within the study area. This outcome challenges traditional assumptions that male students outperform females in quantitative subjects and suggests that both genders possess comparable mathematical competencies in Abak LGA.

The study revealed a low but statistically significant positive relationship between mathematics ability and academic achievement in Physics ($r = 0.178$, $p < 0.05$). This implies that students with higher mathematics ability tend to perform better in Physics, although the strength of the relationship is weak. This finding is consistent with Redish (2005), who emphasized that mathematics serves as the language of Physics and plays a supportive role in problem-solving processes. Similarly, Meltzer (2002) reported a significant correlation between students' mathematical skills and their conceptual understanding of physics. However, the low correlation coefficient suggests that mathematics ability explains only a small portion of the variance in Physics achievement. This aligns with the findings of Uboh, Utibe, and Abasi (2024), who found academic interest to be a stronger predictor of Physics achievement than purely cognitive variables. It also complements the findings of Utibe, Uboh, and Inyang (2022), who demonstrated that instructional strategies significantly influence Physics performance. The implication is that while mathematical ability is statistically significant, it is not a dominant predictor of achievement in Physics within the study area. Other factors, such as teaching methods, instructional materials, laboratory exposure, and student interest, may exert a stronger influence.

Although students classified as having high mathematics ability recorded higher mean scores in Physics than those with medium and low ability, the difference was not statistically significant ($F = 2.31$, $p > 0.05$). This finding suggests that differences in mathematical competence levels do not produce substantial variation in Physics achievement within this context. The result partially contradicts the assumption that students with high mathematics ability will automatically outperform others in Physics. The finding aligns with research by Inyang, Utibe, and Uboh (2022), who found that instructional methods such as guided-discovery significantly enhanced Physics achievement regardless of students' initial academic levels. Similarly, Uboh et al. (2026)

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reported that instructional materials significantly improved students' achievement and retention in Physics, highlighting the importance of pedagogical factors beyond cognitive readiness. Therefore, the absence of significant differences across mathematics ability levels reinforces the argument that Physics achievement is influenced by a combination of cognitive, instructional, and affective variables rather than mathematics ability alone.

These findings indicate that although mathematics ability is an important academic foundation, it does not independently determine success in Physics. Achievement in Physics appears to be multidimensional, requiring effective instructional strategies, student interest, quality learning resources, and foundational science knowledge. Thus, the present study expands existing literature by demonstrating that mathematics ability, while significant, is not a strong standalone predictor of Physics achievement within the study area.

CONCLUSION

This study examined Physics students' mathematics ability as a predictor of academic achievement in Physics in Abak Local Government Area, Akwa Ibom State, Nigeria. The study specifically determined the extent of students' mathematics ability, examined the influence of gender, established the relationship between mathematics ability and Physics achievement, and evaluated differences in achievement across levels of mathematical competence.

The findings revealed that students possessed a significantly high level of mathematics ability. This suggests that, generally, students in the study area demonstrate adequate numerical and problem-solving competencies required for science learning. Furthermore, gender was found not to have a significant influence on mathematics ability, indicating comparable mathematical competence among male and female students.

The study also established a statistically significant but weak positive relationship between mathematics ability and academic achievement in Physics. This implies that although mathematical ability contributes to Physics performance, it explains only a small proportion of students' achievement in the subject. Additionally, no significant difference was found in Physics achievement among students categorized as having high, medium, and low mathematics ability.

Based on these findings, it can be concluded that mathematics ability is a relevant but not a strong standalone predictor of students' academic achievement in Physics within

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the study area. Physics achievement appears to be influenced by multiple interacting factors beyond mathematical competence alone.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. Integration of Mathematics in Physics Instruction: Physics teachers should consciously integrate mathematical skill reinforcement into Physics lessons, especially in areas involving calculations, graphical analysis, and formula manipulation.
2. Collaborative Teaching Approach: Mathematics and Physics teachers should collaborate in curriculum delivery to ensure alignment between mathematical concepts and their application in Physics.
3. Strengthening Conceptual Understanding: Since mathematics ability alone does not strongly predict Physics achievement, teachers should emphasize conceptual understanding, practical demonstrations, and inquiry-based teaching strategies to enhance comprehension.
4. Instructional Improvement Programs: School administrators should organize workshops and seminars for teachers on effective instructional strategies that promote both quantitative reasoning and conceptual clarity in Physics.
5. Further Research: Future studies should investigate additional predictors of Physics achievement, such as academic interest, instructional materials, teaching methods, study habits, and learning environment, to develop a more comprehensive predictive model.

Gender-Inclusive Academic Support: Since gender was not a significant determinant of mathematics ability, equal academic support and encouragement should continue to be provided to both male and female students in science subjects.

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