

Comparative Analysis of Physics Students' Academic Achievement Scores in Physics, and Mathematics in Nasarawa State College of Education, Akwanga, Nigeria

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Abstract

The study explored the comparative analysis of Physics students' academic achievement in Physics and their academic achievement in Mathematics. The purpose of the study is to compare the relationship between Physics students' academic achievement in Physics, and their achievement in Mathematics. The study population comprised all NCE Physics students in College of Education, Akwanga, Nasarawa state. A purposive sampling technique was employed to select a sample of 96 NCE II Physics students. An instrument for data collection was developed by the researcher titled "Physics Students' Academic Achievement Proforma" (PSAAP). The instrument was validated by 3 experts in Physics, and Measurement and Evaluation. The validity index of the instrument was 0.78. The data collected include Physics scores, Mathematics scores, and students' gender obtained from students' record files in the Physics department. Three research questions and three hypotheses were formulated to guide the study. The statistical tools used for data analysis are mean, standard deviation, correlation coefficient, and Pearson Product Moment Correlation. The findings of the study reveal that NCE Physics student academic achievement in Physics has a significant positive relationship with their academic achievement in Mathematics; both Male and Female NCE Physics students' academic achievement in Physics has a significant relationship with their academic achievement in Mathematics. The study recommends that Physics teachers should teach Physics using adequate Mathematics principles and approaches to enhance students' learning and achievement. Students should embrace the use of Mathematics in learning Physics to improve on their achievement.

Keywords: Comparative Analysis, Achievement, Physics, Mathematics, Students

INTRODUCTION

Science education is the key to development of the learners through the acquired scientific concepts, knowledge and skills needed for national development. Science subjects taught at schools include Biology, Chemistry, Physics, Computers Science and Mathematics. The relevance of these subjects to the development of the learners and nation cannot be overemphasized. This has made government policy toward science education to be prioritized at primary, secondary and tertiary level of education. The Nigerian government policy document has outlined a strategic framework for promoting science and technology education in primary, secondary and tertiary levels of education which include improving teachers training, curriculum reform, provision of laboratory facilities and instructional resources to drive national development (Federal Ministry of Education, 2018). Therefore, the teaching and learning of science in schools has been given the desired attention in order to attain the objectives of courses taught in schools.

Physics education is one of the science subjects taught in tertiary institutions and its relevance for acquiring the desired knowledge, and skill have been emphasized in curriculum documents. The teaching of Physics at tertiary institutions has been a great source of empowering students with the skills to become self-reliant and for further studies. Adeniyi et al. (2025) asserts that entrepreneurial education has been integrated into Physics education curriculum so that students can become self-reliant and self-employed aimed at reducing the rate of unemployment among Nigerian graduates. The knowledge of Physics has been found to be useful in everyday life of the learner through its application to solve real-world problems. Its applications have been useful in several aspects of human endeavor to include environment, health, communication, climate, agriculture, mineral mining, weather, warfare and sustainable development (Serway & Jewett, 2019; Ohworho et al., 2026; Adepehin et al. 2026).

The teaching of Physics in tertiary institutions is aimed at achieving the objectives of the course and to produce qualified graduates. Physics as a course is characterized by complex concepts, laws, theories and principles that requires the application of mathematics principles and derivations for adequate comprehension. Badmus & Jita (2024) reported that the difficulty in Physics over the years in schools is linked to the inability of students to apply Mathematics as a tool for understanding physical phenomena and problem-solving. They emphasized the use of symbols and mathematical rigor as essential for effective learning of Physics. Moreover, the teaching of Physics cannot be complete without mathematical derivation of laws, theories, principle and its use in problem-solving. Therefore, Mathematics plays some vital roles in explaining abstract concepts, theories and principles in Physics that helps in understanding the behavior of the universe. Mathematics is viewed as more than a mere tool used in deriving and formulating Physics laws, theories and principles. Norton (2022) asserts that the use of mathematics as an explanatory tool in Physics, enables Physicists to derive theories that describe the universe at all scales. This emphasis on how Mathematical reasoning allows Physicists to move from empirical observation to universal laws, and that topics such as thermodynamics, electromagnetism and cosmology are incomprehensible without their mathematical formulations. The connection between Physics, and Mathematics have helped Physicists to better understand how the universe operates. This could be possible when Mathematics is considered as a language through which physical theories are formulated and understood. Redish & Kuo (2020) noted that Physics relies on Mathematical structures to describe the universe, from Newton's law to quantum mechanics, and that Mathematical formalism enables Physicists to make predictions and explain phenomena that cannot be directly observed. In order to understand the universe through Physics, fluency in the use of Mathematics becomes inevitable. Therefore, Physics is seen to have a strong link to Mathematics in explaining physical phenomena and in problem-solving.

Consequently, Physics experimental data becomes less relevant without applying Mathematics principles

in explaining Physics variables. This is evident in a study by Kryjevskaja, Stetzer & Grosz (2021) whose findings shows that mathematical competence is vital to understanding experimental uncertainties and making sense of data. Therefore, there is the need for teachers to explicitly apply mathematics within laboratory settings to enhance students' experimental skills. In acquiring the knowledge and skills obtainable in Physics such as observation, measurement, collaboration, data analysis, critical thinking, and communication can only be attainable through the application of Mathematics in Physics. Etkina, Planinsic & Van Heuvelen (2022) confirmed that integrating Mathematics in Physics experiments enable students to acquire measurement skills, analyze data, and interpret results. They noted that mathematical tools such as error analysis, graphing, and statistical methods are essential for drawing valid conclusions from the experimental data. In order to analyze data, draw conclusions and make inferences, the roles of Mathematical symbols, equations and formulas come into play in elaborating Physics laws, theories and principles for verification and conceptual understanding. Therefore, Physics is asserted to have a relationship with Mathematics as it has several aspects of application and in problem-solving.

To study Physics at a tertiary institution, candidates are expected to have a minimum requirement of 5 credits in science subjects. Among the requirements, Physics and Mathematics are prerequisites for securing admission into Physics programmes at the College of Education. Students are offered admission based on this requirement. The relevance of Mathematics to Physics cannot be overemphasized because it forms the basis for understanding the subject. Pasigon (2024) found that Mathematical proficiency had a direct effect on students' academic achievement in Physics. This is because students find Physics difficult specifically in solving problems and utilizing mathematical concepts, and a sound foundation in Mathematical proficiency is a strong determinant of success in Physics. Students' proficiency is aimed at producing quality Physics teachers that would teach at primary and junior secondary school. The student teachers are expected to have competencies in Physics at the end of the programme to enable them teach effectively. Competency in Physics is supported by students' mastery of Physics concepts and their ability to apply Mathematical skills in interpreting, representing, and solving Physics problems. Recent evidence indicates that mathematical proficiency, particularly in geometric, calculus and algebraic skills, contributes significantly to students' Physics problem-solving and academic performance (Burkholder et al., 2021; Pasigon, 2024; Tong et al., 2025). Students' competency in applying mathematics in learning of Physics that results in their academic achievement has been an issue of concern. Moreover, the extent to which students' academic achievement in Physics is related to mathematics achievement as they proceed with their study, has been worrisome. Hence, this study intends to compare the relationship between Physics students' academic achievement in Physics, and their academic achievement in Mathematics at College of Education, Akwanga, Nasarawa State.

Studies have been conducted by researchers to compare the extent to which students' academic achievement in Physics relates with their academic achievement in mathematics. The outcome of such studies indicates the extent to which students' academic achievement in Physics relates to that of Mathematics. In a study carried out by Muhammad and Ahmad (2014) on the interrelationship between students' achievement in Mathematics, and Physics in Senior Secondary School Certificate Examination (SSCE) in Birnin-Kebbi Local Government Area, Kebbi State. The study was to investigate the interrelationship between students' performance in Physics and Mathematics. The findings of their study reveals that there is no significant relationship between students' performance in SSCE Physics grade, and their performance in SSCE Mathematics grades. In another study by Taangahar, Fatoki and Joshua (2021), whose study was on students' academic performance in Physics as a correlate to their academic performance in Mathematics in Makurdi Local Government Area, Benue State. The finding of their study reveals that there is a significant relationship between students' performance in Physics and their

performance in Mathematics. Badmus & Jita (2023) investigated further mathematics as a predictor of students' performance in Physics. It was a correlational diagnosis of three years of secondary education. The study explored the predictive relationships and group differences by gender and school type. The outcome of the study reveals that there is a significant positive relationship between further mathematics and Physics. Also, male and female students' performance in further mathematics has a significant positive relationship with their performance in Physics. Another study was conducted by Ma'aruf (2025) on the relationship among some selected senior secondary school students' performance in Computer Science, Mathematics, and Physics in Sabon Gari Local Government Area, Kaduna State. The finding of their study shows that there is a significant relationship between students' performance in Physics and their performance in Mathematics. Ejiga (2022), investigated the knowledge of Mathematics and its impact in learning Physics among Senior Secondary School students in Jos North Local Government Area, Plateau State. The finding of the study shows that students' knowledge of Mathematics has a significant positive relationship with their achievement in Physics. Also, students' knowledge of Mathematics based on gender has a significant relationship with their achievement in Physics. In a study carried out by Sanchez and Ponce (2020) on Physics-Mathematics associations: Evidence from Trends in International Mathematics and Science Study (TIMSS). The study was to determine the extent of the relationship between Physics, and Mathematics based on the result of the 2007, 2011, and 2015 Trends in Mathematics, Science Survey achievement tests. The finding of the study reveals that there is a significant relationship between secondary school Physics students' performance in Physics, and their performance in Mathematics.

The outcome of the review of literature shows that the relationship between students' academic achievement in Physics, and their academic achievement in Mathematics is inconclusive. Therefore, the need for further investigation on the relationship between academic achievement in Physics, and academic achievement in Mathematics to widen the scope of knowledge. Hence, this study intends to compare the relationship between NCE physics students' academic achievement in Physics, and their academic achievement in Mathematics in College of Education, Akwanga, Nasarawa State, Nigeria.

STATEMENT OF THE PROBLEM

The achievement of students in Physics is vital to the attainment of the stipulated objectives. When students are taught with the appropriate methods, strategies, and using adequate Mathematical approaches, it is expected that they would have higher achievement in the subject. The relevance of Mathematics to the learning of Physics has been emphasized as it enhances students' achievement. The extent to which Physics students' academic achievement in Physics that relates to their achievement in Mathematics is not certain in spite of the relevance of Mathematics to Physics. Therefore, the relationship of Physics to Mathematics is worth investigating to establish how students fare in applying Mathematics in learning and how it relates to their achievement in Physics. Moreover, the uncertainty in the relationship between students' academic achievement in Physics, and their academic achievement in Mathematics, if established, would help teachers to improve on the teaching of Physics by applying adequate mathematics principles and approaches to enhance students' learning and achievement. Students' academic achievement in Physics, and Mathematics at College of Education, Akwanga is uncertain. Hence, the need to investigate the relationship between students' academic achievement in Physics, and Mathematics to widen the scope of knowledge. Therefore, this study intends to compare the relationship between students' academic achievement in Physics, and their academic achievement in Mathematics at College of Education, Akwanga, Nasarawa State.

Objectives of the Study

The objective of this study is to compare the relationship between students' academic achievement in

Physics and their academic achievement in Mathematics. Specifically, the study attempt to:

1. determine the extent to which NCE Physics students' academic achievement scores in Physics relates to their academic achievement scores in Mathematics.
2. find out the extent to which Male NCE Physics students' academic achievement scores in Physics relates to their academic achievement scores in Mathematics.
3. To find out the extent to which Female NCE Physics students' academic achievement scores in Physics relates to their academic achievement scores in Mathematics.

Research Questions

The following research questions were raised to guide the study:

1. To what extent does NCE Physics students' academic achievement scores in Physics relate to their academic achievement scores in Mathematics?
2. To what extent do Male NCE Physics students' academic achievement scores in Physics relate to their academic achievement scores in Mathematics?
3. To what extent does Female NCE Physics students' academic achievement scores in Physics relate to their academic achievement scores in Mathematics?

Research Hypotheses

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

H₀₁: There is no significant relationship between NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

H₀₂: There is no significant relationship between Male NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

H₀₃: There is no significant relationship between female NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

Significances of the Study

The outcome of the study would be of eminent benefits to teachers, students and school principals in the following ways:

1. The finding of the study would aid Physics teachers to understand the relevance of Mathematics to the teaching of Physics when the extent of the relationship between Physics and Mathematics is exposed. Teachers would apply more adequate mathematical principles and approach in teaching Physics to enhance students' achievement.
2. Physics students would appreciate how Mathematics could improve their learning and achievement in Physics when they see the extent to which Physics achievement scores relate to their Mathematics achievement scores. Hence, they would be more committed in learning Physics through applying appropriate mathematical principles for higher achievement in Physics.
3. The finding of the study would make school principals to ensure that more qualified Physics teachers are employed to teach Physics, since Physics teaching is indispensable for applying appropriate Mathematics principles to enhance students' understanding of Physics.

METHODOLOGY

The study employed ex-post facto, and correlational design. Ex-post facto design is adopted because the data analyzed were already existing and were not subjected to manipulation. The study also adopted correlational design to compare the relationship between students' academic achievement scores in

Physics, and their academic achievement in Mathematics. The population of the study comprised all Physics students in Nasarawa State College of Education, Akwanga. A Purposive sampling technique was used to select a sample of 96 NCE II Physics students who offer both Physics, and Mathematics courses. In order to determine the relationship between the variables under study, Physics students' data were obtained from their record files in the Department of Physics which include Physics scores, Mathematics scores and students' gender. The data were collected using an instrument designed by the Researcher titled, "Physics Students Academic Achievement Proforma", (PSAAP). The instrument was subjected to face validity by 3 experts in Physics; Measurement and Evaluation. The validity index of the instrument is 0.79. Three research questions were raised and three hypotheses were formulated to guide the study. The statistical tools used for data analysis are mean, standard deviation, and Pearson Product Moment Correlation. The research questions were answered with mean, standard deviation and correlation coefficient while the null hypotheses were tested with Pearson correlation analysis at 0.05 level of significance.

Results

Research Question 1: To what extent does NCE Physics students' academic achievement scores in Physics relate to their academic achievement scores in Mathematics?

Table 1: Correlation Coefficient of Physics Students' Academic Achievement Scores in Physics, and their Academic Achievement Scores in Mathematics

Variables	N	Mean	S.D	r
PHY SCORES	96	28.66	14.99	0.87
MTH SCORES	96	29.59	13.82	

Table 1 reveals the correlation coefficient of the academic achievement of NCE Physics students in Physics, and their academic achievement in Mathematics. The mean score of students' academic achievement in Physics, and their academic achievement in Mathematics were 28.66 and 29.59 respectively while the standard deviations of their academic achievement in Physics, and academic achievement in Mathematics were 14.99 and 13.82 respectively. The correlation coefficient (r) value as indicated on the table is 0.87. This value implies that there is a strong positive relationship (0.87) between NCE Physics students' academic achievement scores in Physics and their academic achievement scores in Mathematics.

Hypothesis One

Ho₁: There is no significant relationship between NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

Table 2: Pearson Correlational Analysis of the Academic Achievement of NCE Physics students in Physics, and their Academic Achievement in Mathematics

Variables	N	Mean	S.D	Df	r	Sig. (2-tailed)	Decision
PHY SCORES	96	28.66	14.99	94	0.87	0.001	NS
MTH SCORES	96	29.59	13.82				

NS = Not Significant, at $P < 0.05$

Table 2 shows the Pearson Correlational analysis of the academic achievement of NCE Physics students in Physics, and their academic achievement in Mathematics. There was a significant positive relationship

between NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics, $r(94) = 0.87$, $P < 0.05$. Therefore, the null hypothesis (H_0) is rejected. The result suggests that NCE Physics students who achieve higher scores in Physics also tend to achieve higher scores in Mathematics.

Research Question 2: To what extent do Male NCE Physics students' academic achievement scores in Physics relate to their academic achievement scores in Mathematics?

Table 3: Correlation Coefficient of Academic Achievement Scores of Male NCE Physics Students in Physics and their Academic Achievement Scores in Mathematics

Gender	Variables	N	Mean	S.D	r
Male	PHY SCORES	56	30.80	15.43	0.90
	MTH SCORES	56	30.84	14.32	

Table 3 reveals the correlation coefficient of the academic achievement of Male NCE Physics students in Physics and their academic achievement in Mathematics. The mean score of students' academic achievement in Physics, and their academic achievement in Mathematics were 30.80 and 30.84 respectively while the standard deviations of their academic achievement in Physics, and academic achievement in Mathematics were 15.43 and 14.32 respectively. The correlation coefficient value (r) as indicated in the table is 0.90. This value implies that there is a strong positive relationship (0.90) between Male NCE Physics students' academic achievement in Physics and their academic achievement in Mathematics.

Hypothesis Two

H_{02} : There is no significant relationship between Male NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

Table 4: Pearson Correlational Analysis of the Academic Achievement of Male NCE Physics students in Physics, and their Academic Achievement in Mathematics

Gender	Variable	N	Mean	S.D	df	r	Sig.(2tailed)	Decision
Male	PHYSORE	56	30.82	15.43	54	0.90	0.001	NS
	MTHSCORE	56	30.84	14.32				

NS = Not Significant at $P < 0.05$

Table 4 reveals the Pearson correlational analysis of the academic achievement of Male NCE Physics students in Physics, and their academic achievement in Mathematics. There was a significant positive relationship between Male NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics, $r(56) = 0.90$, $P < 0.05$. Therefore, the null hypothesis is rejected. The result suggests that Male NCE Physics students who achieve higher scores in Physics also tend to achieve higher scores in Mathematics.

Research Question 3: To what extent does Female NCE Physics students' academic achievement scores in Physics relate to their academic achievement in Mathematics.

Table 5: Correlation Coefficient of Academic Achievement of Female NCE Physics Students in Physics, and their Academic Achievement in Mathematics

Gender	Variables	N	Mean	S.D	r
Female	PHY SCORES	40	25.63	13.98	0.84
	MTH SCORES	40	27.85	13.07	

Table 5 reveals the correlation coefficient of the academic achievement of female NCE Physics students in Physics, and their academic achievement in Mathematics. The mean score of students' academic achievement in Physics, and their academic achievement in Mathematics were 25.63 and 27.85 respectively while the standard deviations of their academic achievement in Physics, and academic achievement in Mathematics were 13.98 and 13.07 respectively. The correlation coefficient value (r) as indicated in Table 3 is 0.84. This value implies that there is a strong positive relationship (0.84) between Female NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

Hypothesis Three

H₀₃: There is no significant relationship between Female NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics.

Table 6: Pearson Correlational Analysis of the Academic Achievement of female NCE Physics students in Physics, and their Academic Achievement in Mathematics

Gender	Variable	N	Mean	S.D	df	r	Sig.(2tailed)	Decision
Female	PHYSORE	40	25.63	13.98	38	0.84	0.001	NS
	MTHSCORE	40	27.85	13.07				

NS = Not Significant at $P < 0.05$

Table 6 reveals the Pearson correlational analysis of the academic achievement of Female NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics. There was a significant relationship between Female NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics, $r(38) = 0.84$, $P < 0.05$. Therefore, the null hypothesis was rejected. The result suggests that Female NCE students who achieve higher scores in Physics also tend to achieve higher scores in Mathematics.

DISCUSSION

The finding of the study as presented in Table 2, indicates that there is a significant positive relationship between NCE Physics students' academic achievement in Physics and their academic achievement in Mathematics. This implies that NCE Physics students' academic achievement in Physics has a significant positive relationship with their academic achievement in Mathematics. This study agrees with the findings of Taangahar, Fatoki and Joshua (2021); Ma'aruf (2025); and Sanchez and Ponce (2020) whose studies reveal that there is significant positive relationship between students' performance in Physics and their performance in Mathematics. Meanwhile, the finding of this study contradicts that of Muhammed and Ahmed (2014) whose study reveals that there is no significant relationship between students' performance in SSCE Physics grade and their performance in SSCE Mathematics.

The result of this study in Table 4, reveals that there is a significant positive relationship between Male

NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics. This implies that Male NCE Physics students' academic achievement in Physics has a significant positive relationship with their academic achievement in Mathematics. The result of this study is in line with the finding of Badmus and Jita (2023) whose study reveals that male secondary school students' performance in Further Mathematics has a significant positive relationship with their performance in Physics. Also, the finding of this study agrees with that of Ejiga (2022) whose study reveals that students' Knowledge of Mathematics based on gender has a significant positive relationship with their achievement in Physics.

The result of this study as presented in Table 6 reveals that there is a significant positive relationship between Female NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics. This implies that female NCE Physics students' academic achievement in Physics has a significant relationship with their academic achievement in Mathematics. The finding of this study agrees with that of Badmus & Jita (2023) whose study reveals that Female Secondary School students' performance in Further Mathematics has a significant positive relationship with their performance in Physics. The finding is also in line with the finding of Ejiga (2022) whose study reveals that students' Knowledge of Mathematics based on gender has a significant positive relationship with their achievement in Physics.

CONCLUSION

The study compared the relationship between NCE Physics students' academic achievement in Physics, and their academic achievement in Mathematics. The relationship between NCE Physics students' achievement in Physics has a significant positive relationship to their achievement in Mathematics. Also, both Male and Female NCE Physics students' academic achievement in Physics has a significant relationship with their academic achievement in Mathematics. The relevance of Mathematics to the learning of Physics cannot be overemphasized as it enhances students' learning and achievement.

The study compared the relationship between NCE Physics students' academic achievement in Physics and their academic achievement in Mathematics in College of Education, Akwanga, Nasarawa state. This study can be replicated in other science subjects and in different geographical locations. Moreover, moderator variables such as school location, ownership of school, and students' characteristics such as age and parental status could be explored to establish the possible relationship of students' achievement in school.

Recommendation

Base on the finding of the study, the followings recommendations were offered:

1. Teachers should teach Physics by using adequate Mathematical principles and approaches to improve on students' learning and achievement in Physics. They should also engage students in problem-solving using a mathematical approach.
2. The learning of Physics can better be achieved when Mathematics are applied in explaining concepts, phenomena and used in problem-solving. Therefore, students should imbibe the use of Mathematics for effective learning of Physics.
3. School principals should ensure that Physics teachers effectively teach Physics by using adequate mathematical approaches to enhance students' learning of Physics.

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