

Correlation Between Students' Performance in Algebra and Trigonometry and Some Selected First-Year Courses among Undergraduate Students in Ekiti State, Nigeria (2020–2024)

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Abstract

This study examined the correlation between students' performance in algebra, trigonometry and some selected first-year courses at Ekiti State University, Oro campus, between 2020 and 2024. A quantitative correlational research design was adopted. Simple random sampling technique was used to select 100 undergraduates' students. An observational template was used as the instrument to collect the data from their academic records. The analysis was conducted using descriptive statistics of mean, standard deviation and multiple linear regression. The findings revealed a strong positive correlations among the selected courses ($R = .705$). The findings showed that students' performance in Mathematics is significantly associated with their performance in other foundational subjects such as Physics, Chemistry, Biology, and Education statistically ($F(4, 95) = 23.406, p < .05$). Based on the study findings, it was recommended that there is need for improved teaching methodologies; integration of problem-solving activities across these subjects; provision of remedial and academic support programmes in Mathematics; promotion of active-student-centred learning approach in science courses; establishment of continuous academic monitoring and early intervention mechanisms that is students who perform poorly in Physics and Chemistry should be to improve overall student performance in STEM-related disciplines..

Keywords: Mathematics, Correlation, Academic Performance, Physics, Chemistry, Biology.

Introduction

Mathematics has been seen by many as a brain thinking exercise but beyond that, mathematics is a phenomenon directed at providing solutions to human problems and it has widely attracted many fields of study ranging from science, technology, engineering, medical, and education and so on. Where stakeholders and high-ranking professionals in the aforementioned field has found it to be an excellent vehicle for the application of their talents and skills. Due to the complexity of the word Mathematics, experts in the field of science are yet to reach an agreement on its definition (Lin, 2023; Sturgeon, 2026).

However, combining all the definition gathered across ages listed in order of complexity by Lin, (2023), we can therefore define mathematics as a branch of science of weight, number, and patterns relation with tentacle in logical reasoning, numerical analysis and problem solving which significantly related to performance in Chemistry and other STEM subjects (Sturgeon, 2026). Some of the reason for teaching mathematics in all level of education include the preparation of students to acquire the relevant knowledge, skills and attitudes so as to positively apply the accumulated knowledge to solve their everyday life problems and as well as to contribute meaningfully to development of the nation.

Mathematics is subject of speed and accuracy which is needed at all levels of our educational system, it involves logical reasoning, measurement and critical thinking and calculations that are useful in our everyday life. It is in view of this that the subject is made compulsory at primary school level and also for all students at the secondary school level. In Nigerian universities, research has shown that student performance in foundation courses such as mathematics, physics, and chemistry is crucial for success in subsequent courses (Krakehl, and Kelly 2024). Furthermore, a study by Alanazi et al. (2024) found that student performance in education courses is also an important predictor of overall academic success. This study aims to investigate the correlation between student performance in Algebra and Trigonometry (MAT 101) and General physics (PHY 101), Algebra and Trigonometry (MAT 101) and General chemistry (CHEM 101), Algebra and Trigonometry and General Biology (BIO 101), and Algebra and Trigonometry (MAT 101) and introduction to teaching profession (EDU 103) at Ekiti State University Oro campus from 2020 to 2024. By examining the relationships between these subjects, this study hopes to provide insights into how student performance in one subject may impact performance in others.

There have been speculations that students that fail MAT 101 also fail PHY 101 and CHEM 101, which stressed the connection between mathematics and other science subjects and research has consistently highlighted the importance of Mathematics as a foundational subject for success in other disciplines. Studies such as those by Li, et al, (2025) revealed a significant positive relationship between Mathematics and Physics, while Hamerská, et al. (2024) reported a similar correlation between Mathematics and Chemistry. Likewise, Pekrun, (2024); Sakaki and Murayama (2024) confirmed that Mathematics achievement strongly predicts performance in core science subjects, reinforcing its role as a cornerstone for learning in science-based fields. However, the majority of these studies have focused on secondary school students, leaving a gap in understanding how these correlations apply to university students in Nigeria.

Wang et al., (2024) also, examined the influence of Education-related courses on students' overall academic performance, little attention has been paid to how these courses relate specifically to Mathematics and the core sciences. This lack of research raises the question of whether the patterns of correlation observed in the sciences also extend to Education, a field that requires more theoretical and reflective skills (Pekrun, 2024). Another limitation of existing studies is that most have concentrated on bivariate relationships, typically

between Mathematics and a single subject. Very few have examined the interconnected correlations among multiple foundational courses, such as Mathematics (MAT 101), Physics (PHY 101), Chemistry (CHM 101), Biology (BIO 101), and Education (EDU 103) within a single study. Without such a comprehensive analysis, it is difficult to determine the full extent to which Mathematics influences performance across disciplines and how these courses are interrelated.

Statement of the Problem

There has been speculations that students that fail MAT 101 also fail PHY 101 and CHEM 101, which stressed the connection between mathematics and other science subjects and research has consistently highlighted the importance of Mathematics as a foundational subject for success in other disciplines. Studies such as those by Li, et al. (2025) revealed a significant positive relationship between Mathematics and Physics, while Sakaki and Murayama (2024) confirmed a similar correlation among Mathematics, Chemistry and other science subjects. Also, Pekrun, (2024) submitted that Mathematics achievement strongly predicts performance in core science subjects, reinforcing its role as a cornerstone for learning in science-based fields. However, the majority of these studies have focused on secondary school students, leaving a gap in understanding how these correlations apply to university students in Nigeria.

Further studies carried out in Nigerian universities revealed that student performance in foundation courses such as physics, and chemistry is crucial for success in subsequent courses (Alanazi et al. 2024; Wang et al., 2024; Wang & Chen, 2025; Alfalasi, 2026). In view of gaps identified on the introduction, there is a clear need for research that investigates the correlation among Mathematics, the sciences, and Education at the university level. This study addresses the need by examining the performance of students at Ekiti State University, with the aim of providing insights that will inform teaching practices, curriculum development, and strategies to enhance student academic success.

Purpose of the Study

The main purpose of this study is to determine the correlation between students' performance in algebra and trigonometry and some selected first year courses at Ekiti state university Oro campus (2020–2024). The study will specifically:

- Determine the level of performance in various selected courses.
- Determine the gender distribution of the undergraduate students.
- To determine the relationship among MAT 101 (Algebra and Trigonometry) and other selected courses (PHY 101, CHM 101, BIO 101 and EDU 103) among undergraduate students in Ekiti State, Nigeria.

Research Questions

The following research questions will guide the study

- a. What is the gender distribution of the respondents among undergraduate students in Ekiti State?
- b. What is the level of performance in various selected courses among undergraduate students in Ekiti State?
- c. Is there relationship among MAT 101 (Algebra and Trigonometry) and other selected courses (PHY 101, CHM 101, BIO 101 and EDU 103) among undergraduate students in Ekiti State, Nigeria?

Research Hypothesis

The only research hypothesis for this study is

H₁: There is no significant relationship among MAT 101 (Algebra and Trigonometry) and other selected courses (PHY 101, CHM 101, BIO 101 and EDU 103) among undergraduate students in Ekiti State, Nigeria.

Literature Review

Several studies have investigated the correlation between mathematics and other science subjects. Notably, Babalola, et al. (2025) research on the correlation between mathematics and chemistry among secondary school students in Nigeria and finding indicates that students who performed well in mathematics also performed well in chemistry. Likewise, Sturgeon, (2026) concludes that Mathematics significantly related to Chemistry in his study of the relationship between Mathematics skills and Chemistry success. Similarly, Yohanna & Mankilik, (2024) investigated the correlation between mathematics and physics among secondary school students in Nigeria. The study found a significant positive correlation between mathematics and physics, indicating that students who performed well in mathematics also performed well in physics.

In addition to the correlation between mathematics and other science subjects, some studies have also investigated the correlation between education courses and other subjects. For example, Anyanwu et al. (2024) conducted a study on the impact of education courses on academic performance among university students in Nigeria. The study found a significant positive correlation between education courses and overall academic performance, indicating that students who performed well in education courses also performed well overall. Other studies have investigated the correlation between multiple subjects. Abiola et al. (2025) conducted a study on the correlation between mathematics, physics, and chemistry among secondary school students in Nigeria and found significant positive correlations between the three subjects, indicating that students who performed well in one subject also performed well in the other subjects. Furthermore, Krakehl & Kelly, (2024) conducted a study on the factors that influence the correlation between students' performance in mathematics and physics. The study found that factors such as student motivation, teacher quality, and school resources influenced the correlation between mathematics and physics. Generally, studies reviewed indicate that there is a significant positive correlation between mathematics, physics, chemistry, and education courses

among secondary school and university students in Nigeria. The studies also highlight the importance of factors such as student motivation, teacher quality, and school resources in influencing the correlation between subjects.

Conceptual Framework

Literature have shown that science subject has interaction linkage with Mathematics, as students who demonstrate high performance in core science subjects do well in Mathematics (Krakehl & Kelly, 2024; Abiola et al., 2025; Wang & Chen, 2025; Alfalasi, 2026; Sturgeon, 2026). But for this presents study, the conceptual framework behind this is anchor on the basis of the literature direction and the researcher conceptual perception. Also, the connection between the core science courses and Mathematics and education courses.

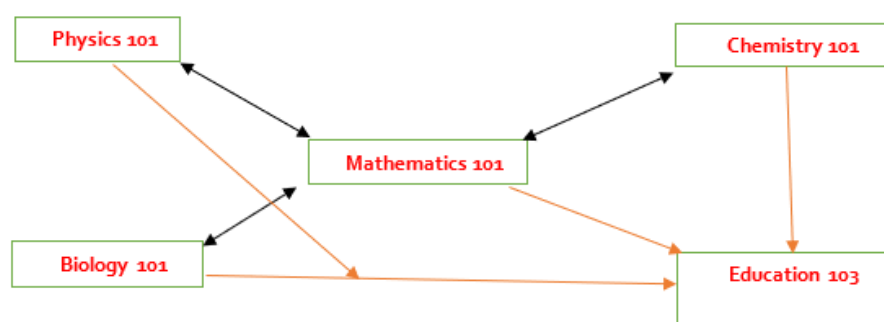


Figure 13: The Researchers Conceptual Perception

The framework depicted by Figure 1 reflect that the three science courses of Physics 101, Chemistry 101 and Biology 101 predict the performance in Mathematics and performance in Mathematics is also associated with the performance in those three science courses. This relationship is indicated by the tow directional black arrows. But both Mathematics 101, Physics 101, Chemistry 101 and Biology 101 predict performance in Education 103 while performance in Education 103 does not predict the four Smart subject which is show by one directional pink arrow. Conceptual framework is considered appropriate for this study because the selected courses in this work study are interwoven and interconnected in terms of concept and logical dimension.

Methodology

Correlation research design was adopted for this study. The research design employed is quantitative in nature and crucial in ensuring that the research objectives are achieved. The population for this study is all undergraduate students in Faculty of Education in Ekiti State University, Oro Campus (Source School Record of Regular degree student population). Purposive sampling technique was used to select 100 level undergraduates' students based on the study objectives and selected courses of MAT 101, PHY 101, CHEM 101, BIO 101, and EDU 103 while simple random sampling techniques was used to select 100 respondents. The

sample size is representative of the population based on research advisor, and it includes students from different Departments of Science Education in the Faculties of Education. The instrument used in this study is observational template which comprised of serial number, matric number, and scores of the selected respondents. For ethical reasons the matric numbers of the selected students were treated with confidentiality and revealed in any way but was only used on the template for data collection so as not misplaced the scores and grades correctly for each student appropriately and nothing more. This was used to access the students' academic records (archival data) obtained from the Examination and Records Unit of Ekiti State University. These official records contained students' scores and grades in the selected foundational courses in MAT 101, PHY 101, CHEM 101, BIO 101, and EDU 103 covering the academic sessions from 2020 to 2024. The use of students' official academic records was appropriate for this quantitative correlational research design, as it provided objective, verifiable, and bias-free data suitable for statistical analysis. Institutional records are highly reliable since they are systematically documented, approved by the university's examination board, and free from researcher manipulation. To ensure ethical consideration, personal details such as names and Matric numbers of the undergraduate's students were not revealed, reported and used in the analysis but only students' scores and grades collected were analysed. Descriptive statistics of minimum score, maximum score, range, mean, median, mode, variance and standard deviation were used to answer the research question one and two while inferential statistics of linear regression analysis was used to test the only research hypothesis at alpha level of 0.05 significance.

Results

Research question one: What is the gender distribution of the respondents among undergraduate students in Ekiti State, Nigeria?

Table 3: Demographic Profile of the Students Respondents profile of the respondents based on gender distribution among undergraduate students in Ekiti State, Nigeria

Gender	Frequency	Percent%
Male	20	20.0
Female	80	80.0
Total	100	100.0

Source: Field Data from Examination and Record units, Ekiti State University 2020-2024

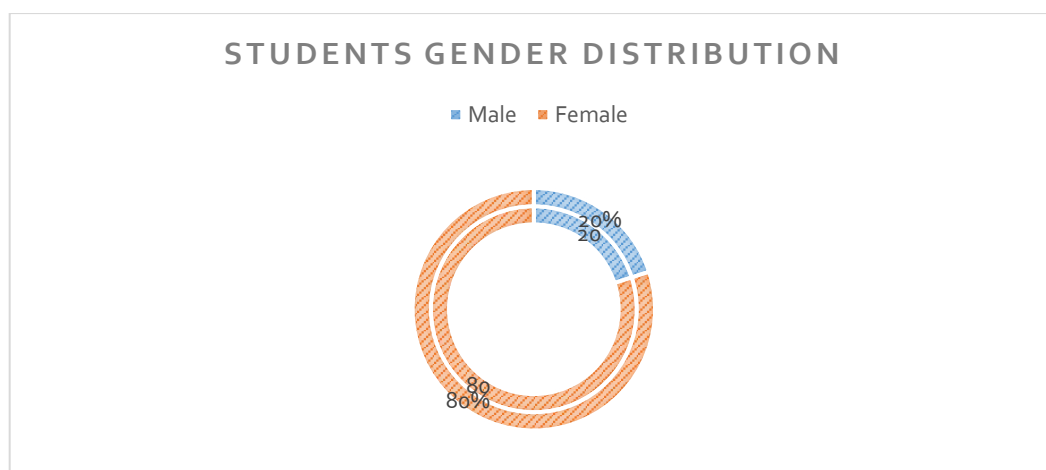


Figure 2: Chart Showing Gender Distribution (Source: Examination and Record units, Ekiti State University 2020-2024)

Table 1 revealed the demographic profile of the respondents by gender. It shows the frequency and percentage of 80 (80.0%); and 20 (20%) respondents were female and male respectively. This implied that the female undergraduates' students are more than their male counterparts in the selected sampled for this study which is further depicted with Figure 2.

Research Question two: What is the level of performance in various selected courses among undergraduate students in Ekiti State, Nigeria?

Table 2: Descriptive Analysis of performance Level in various selected courses among undergraduate students in Ekiti State, Nigeria

Courses	Min	Max	Range	Mean	Median	Mode	S. D	Variance
MAT101	15.00	80.00	65	42.10	44.50	45	14.15	200.091
PHY101	10.00	89.00	79	45.48	46.00	45	18.42	339.161
CHM101	21.00	77.00	56	46.76	47.00	40	13.29	176.649
EDU103	22.00	73.00	51	45.10	45.00	45	11.80	139.141
BIO101	6.00	79.00	73	49.79	51.00	45	17.43	303.865

Source: Field Data from Examination and Record units, Ekiti State University 2020-2024

The Table 2 revealed a minimum score of 22, 21, 15, 10, and 6 for EDU101, CHM101, MAT101, PHY101, and BIO101 respectively while Maximum score of 89, 80, 79, 77, and 73 for PHY101, MAT101, BIO101, CHM101, and EDU101 respectively. The descriptive statistics of Table 2 further reveal that students' performance across the selected courses was generally moderate. Among all courses, BIO101 recorded the highest mean score ($\bar{X} = 49.79$), indicating that students performed better in Biology than in the other courses. MAT101 had the lowest mean score ($\bar{X} = 42.10$), suggesting that Mathematics was the most challenging course for the students. Regarding score dispersion, PHY101 had the highest standard deviation ($SD = 18.42$), indicating greater variability in students' scores.

Conversely, EDU101 had the lowest standard deviation ($SD = 11.80$), implying that students' performances were more homogeneous in this course. The ranges of scores further show substantial differences in performance among students. PHY101 exhibited the widest range (79), while EDU101 had the narrowest range (51). Overall, the statistics suggest considerable variability in students' academic achievement across the selected courses.

Hypothesis Testing

Ho₁: *There is no significant relationship among MAT 101 (Algebra and Trigonometry) and other selected courses (PHY 101, CHM 101, BIO 101 and EDU 103) among undergraduate students in Ekiti State, Nigeria.*

Table 3a: Model Summary

Model	R	R square	Adjust R square	Std. Err.
1.	.705	.496	0.474	10.247

- Predictors: (Constant), BIO101, CHM101, PHY101, EDU103
- Dependent variable: MAT 101

Table 3b: ANOVA Summary

	Model	Sum of Square	Df	M Square	F	Sig
	Regression	9832.233	4	2458.058	23.406	0.000**
	Residual	9976.767	95	272.676		
	Total	19809.000	99			

**This indicate that correlation is significant

Table 3c: Coefficients of Regression Analysis

Model	Coef.	Std. Err.	Beta	T	Sig
Constant	3.967	5.352		.741	0.460
PHY101	.2986**	.075	.385	3.977	0.000
CHM101	.252**	.096	.237	2.616	0.010
EDU103	.108	.108	.090	.999	0.320
BIO101	.160	.081	.197	1.965	0.052

** indicate significance at p value at 5%

Dependent variable: MAT101

Source: *Field Data from Examination and Record units, Ekiti State University 2020-2024*

The Table 3a reveal the multiple correlation coefficient ($R = .705$) which indicates a strong positive relationship between performance of students PHY101, CHM101, EDU103, BIO101 and students' performance in MAT101. The coefficient of determination ($R^2 = .496$) shows that approximately 49.6% of the variation in MAT101 scores is explained jointly by students' performances in PHY101, CHM101, EDU103, and BIO101. The Adjusted R^2 value of .474 indicates that after adjusting for the number of predictors included in the model, 47.4% of

the variance in MAT101 is still explained by the independent variables (PHY101, CHM101, EDU103, and BIO101). The standard error of estimate (10.247) suggests that the predicted MAT101 scores deviate from the actual scores by approximately 10.25 points on average. Therefore, the predictor variables of (PHY101, CHM101, EDU103, and BIO101) collectively account for nearly half of the variation in students' Mathematics101 performance, indicating that the model has substantial predictive power.

Table 3b shows whether the regression model significantly predict the MAT101 performance. With the F-value of (23.406) and $p < .05$; the model is statistically significant. Since the $p < .05$, the null hypothesis is rejected hence, the predictor variables of (PHY101, CHM101, EDU103, and BIO101) jointly influence MAT101 performance. Also, Table 3c revealed individual contribution of PHY101, CHM101, EDU103, and BIO101 to MAT101. That is, Individually, PHY101 and CHM101 significantly predicted MAT101 performance, while EDU103 and BIO101 did not make significant independent contributions. Physics 101 has the strongest predictor of Mathematics achievement among the courses under studied. This suggests that students' success in Mathematics 101 is strongly associated with their performance in Physics 101 and Chemistry 101. But the regression analysis revealed that the predictor variables jointly made a significant contribution to students' performance in MAT101, accounting for 49.6% of the total variance ($R^2 = .496$). The overall model was statistically significant, $F(4, 95) = 23.406$, $p < .05$. The regression equation is $MAT101 = 3.967 + 0.299 (PHY101) + 0.252 (CHM101) + 0.160 (BIO101) + 0.108 (EDU103)$.

Discussion of the Findings

The findings revealed that students' performance across the selected courses was generally moderate, with Biology (BIO101) recording the highest mean score and Mathematics (MAT101) recording the lowest mean score. This suggests that Mathematics was relatively more challenging for the students than the other courses. The difficulty associated with mathematics may be linked to its abstract nature and the higher-order cognitive skills required for problem-solving and logical reasoning. This finding is consistent with the submission of Wang et al. (2023), who identified cognitive and academic factors as major determinants of students' mathematics achievement across educational contexts. Their review further emphasized that mathematics performance is influenced by multiple learner-related and instructional variables.

The descriptive statistics also showed considerable variation in students' achievement across the courses. Physics (PHY101) recorded the highest standard deviation and widest score range, indicating substantial differences in students' understanding and application of physics concepts. In contrast, EDU101 exhibited the least variability, suggesting a relatively homogeneous level of achievement among students. The observed variation in Physics performance may be attributed to differences in students' mathematical competence, analytical reasoning skills, and prior scientific knowledge. Recent STEM education studies have similarly reported that variations in cognitive abilities and

quantitative reasoning significantly influence students' performance in science-related disciplines (Liu et al., 2026; Bayaga, 2025).

The study findings revealed that the predictor variables of PHY101, CHM101, EDU103, and BIO101 jointly made a significant contribution to students' performance in MAT101. Also, there is strong correlation between Mathematics and Physics, moderate correlation with Chemistry and Biology, and weak correlation with Education. This study findings corroborate the submission of Li et al., (2025) that revealed a significant positive relationship between Mathematics and Physics, and Hamerská, et al. (2024) reported a similar correlation between Mathematics and Chemistry. Also, this study finding is in line with the findings of Pekrun, (2024); Sakaki and Murayama (2024) that Mathematics achievement strongly predicts performance in core science subjects, which indicates that Mathematics reinforce the learning of other sciences courses and that Mathematics is the cornerstone for learning in science-based fields. Also, this study revealed that there is a weak relationship between Mathematics and Education which is against the submission of Alanazi et al. (2024) who found out that student performance in education courses is also an important predictor of overall academic success.

In addition, the multiple regression analysis revealed a strong positive relationship between students' performance in PHY101, CHM101, EDU103, BIO101, and their achievement in MAT101 ($R = .705$). The coefficient of determination ($R^2 = .496$) indicated that approximately 49.6% of the variance in Mathematics performance was jointly explained by the predictor variables. This finding affirmed that achievement in Mathematics is closely associated with achievement in related science courses. This finding is in line with the Hayford & Asiamah, (2026) and Uboh et al. (2026) studies that emphasizes the interconnected nature of mathematics and science learning, where competence in one domain enhances performance in another due to shared analytical and problem-solving processes. Furthermore, the ANOVA result showed that the regression model was statistically significant, indicating that the predictor variables jointly influenced students' performance in MAT101. The implication is that students' mathematics achievement is not determined solely by mathematical ability but is also influenced by their performance in related science disciplines. This finding corroborates the position of Wang et al. (2023), who reported that academic achievement results from a combination of cognitive, educational, and disciplinary factors rather than isolated subject competencies.

The coefficient analysis further revealed that Physics (PHY101) and Chemistry (CHM101) made significant independent contributions to the prediction of Mathematics performance, whereas Biology (BIO101) and EDU103 did not contribute significantly when the effects of the other variables were controlled. Physics emerged as the strongest predictor of Mathematics achievement. This finding is understandable because Physics relies heavily on mathematical principles, quantitative reasoning, formula manipulation, and problem-solving skills. Consequently, students who perform well in Physics are more likely to demonstrate high achievement in Mathematics. This result agrees with Uboh et al. (2026), who reported that mathematical ability significantly predicts students' achievement in

Physics, emphasizing the strong interdependence between both disciplines. Similarly, recent STEM studies have identified performance in foundational mathematics and science courses as important predictors of academic success in STEM-related programmes (Bayaga, 2025; Hayford & Asiamah, 2026; Liu et al. 2026). Therefore, the study established that students' performance in Physics, Chemistry, Biology, and Education courses collectively accounted for a substantial proportion of the variation in Mathematics achievement. The findings underscore the interdisciplinary nature of learning in science-related courses and highlight the importance of strengthening students' competencies in Physics and Chemistry as a means of improving achievement in Mathematics.

Limitation of the Study

The study is limited in specific scope to ensure focus and depth in the investigation but affect generalizability of the study outcome. The institution of interest is the EKSU ORO campus, which is a specific university in Nigeria. This delimitation allows the researcher to concentrate on a particular context and population, providing insights that are relevant to this institution. Additionally, the study is limited to four specific major courses: MAT 101, PHY 101, CHEM 101, BIO 101 and EDU 103. In addition, this study is also limited to a specific time frame, namely 2020 to 2024 which allows the researcher to focus on a particular period and examine the correlations between the courses during this time. Based on these limitations in those specific areas, the researcher can provide a focused and in-depth examination of the relationship between the courses. The study employs a quantitative research design, using correlation analysis to examine the relationships between the courses instead of experimental data, mixed method of quantitative and qualitative

Conclusion

The study concluded that students' performance in Mathematics (MAT 101) is predicted by Physics (PHY101), Chemistry (CHM101), Biology (BIO 101), and to a lesser extent Education (EDU 103). Statistically, this infers that Physics, Chemistry and Biology performance predicts Mathematics performance in which "Physics emerged as the strongest predictor of Mathematics performance. Therefore, strengthening students' mathematical skills can improve achievement across disciplines in other words Mathematics significantly predicts performance in science-related subjects.

Recommendation

Based on this study, it was recommended that for study to excel in Mathematics as a field they have to be well grounded in science related discipline. Teachers and curriculum developer should integrate problem-solving activities across these subjects which will help students recognize the connections among them and improve their quantitative reasoning skills. Such integration is likely to enhance students' conceptual understanding and academic performance in Mathematics and other science-related courses. Also, schools should provide remedial and academic support programmes in sciences subjects which can

help bridge learning gaps and improve students' confidence and achievement in Mathematics. There is the need to promote active-student-centred learning approach in Science Courses which encourage deeper engagement with course materials, facilitate knowledge retention, and cater to diverse learning abilities, thereby reducing performance disparities among students. This study recommends further the need to establish continuous academic monitoring and early intervention mechanisms that is students who perform poorly in Physics and Chemistry should be identified early and provided with targeted academic counselling, mentoring, and support services. Because, early intervention can prevent academic difficulties from escalating and improve overall student performance in STEM-related disciplines.

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