

THE PERFORMANCE OF MATHEMATICS IN RELATION TO PHYSICS. (A CASE STUDY OF TWO SELECTED PRAVITE SCIENCE SECONDARY SCHOOLS IN GOMBE METROPOLIS)

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Abstract

The research was designed to study the correlation between students' academic performance in mathematics and their performance in physics in some selected secondary schools in Gombe metropolis. Senior Secondary school Certificate Examination (SSCE) results for 2006-2011 of the two selected Science schools were used for data collection. The Pearson-product moment correlation coefficient, regression analysis and t-test statistics were used for data analysis. Results showed that there was a statistical significance relationship between mathematics and physics students' academic performance at $P \leq 0.05$. This suggests that physics students must understand that mathematics play commentary role to physics performance since physics involves calculations. Also correlations of $r = 0.37$ and 0.23 were found in the two Secondary Schools respectively which indicates that there was positive relationship between physics and mathematics. The researchers recommended among others that sufficient and qualified mathematics and physics teachers should be recruited, students should be made to realize that the knowledge of Mathematics enhance good performance in Physics. An average student in mathematics is expected to perform averagely in Physics.

Keywords: Correlation, Performance, Qualitative and Regression

Introduction

The relationship between mathematics and physics has been a subject of study of philosophers, mathematicians and physicists since Antiquity, and more recently also by historians and educators. Generally considered a relationship of great intimacy, mathematics has already been described as "an essential tool for physics" and physics has already been described as "a rich source of inspiration and insight in mathematics".

<https://en.wikipedia.org/wiki/relationship>

Therefore, physics students need to be good in Mathematics so as to understand Physics as well as their environment in general. This will help learner to be very good in physics.

The importance of Physics can be realized in about everything and the beauty of its

application can be seen everywhere. For example in the home, it is useful in approximating and measuring of materials and food stuff in home, budget and even simple calculation of money counting, physics can be more appreciated in the beauty of design and construction of building, furniture, clothes and decorating items in the home.

The amount of time allocated to the teaching of Physics and Mathematics virtually all schools are generally higher than that of other subjects apart from the core subjects (Akinsola, 2011). Due to the importance attached to the disciplines, the spring board for Science and Technology among other is well grounded knowledge in physics and mathematics, which is regarded as the soul of science and conscience that propels all the science and Technology, oriented discipline.

Physics is the branch of Science which is largely concern with fundamental ideas about nature and attempt to establish simple relationship between different quantities as precise as possible (Otuka, 2015). Physics is concerned mainly with matter in relation to virtually all aspect of life (Falmata, 2014).

Akinbuwa (2001), opined that every physics procedure is useful, has also found as importance application in life science and that of mathematics, known as the "Ilingua franca" of Physics rears its head in the microscopic level in which fundamental physical principles involved are those of quantum, mechanics stress that oneness of scientific knowledge notwithstanding the fact that for many years science has been taught in a fragmented way compartmentalized into physics. It was also suggested that no knowledge of science could be deemed to be adequate without the inclusion of mathematics.

Physics is also taught as a descriptive subject which depends on mathematics and vice versa. This attributed the students under achievement in physics and mathematics is due to many factors such as, poor learning habit, lack of motivation, and poor quality staff (Oguntunde, 2014).

Henceforth, the focus of this paper will be on the knowledge of mathematics and its relation with performance in sciences especially physics.

Statement of the Problem

Students in secondary school usually run away from science subjects and mathematics, only few of them used to develop interest in taking science courses moreover, even those that has decided to go for science class, and there was high rate of failure especially in Mathematics and Physics (Otuka, 2003). These problems had drew the attentions of researchers to take up the matter to find out the performance of Mathematics in Relations to Physics.

Nature of Mathematics and Physics

It is interesting to let the students in secondary schools to recognize the roles of physics and mathematical in our society, also the two subject demands a lot of thinking from learners and it requires thinking critically and analytically for scientific and technological development (Obodo, 1997).

These students equally share interest in science and physics recognizing through exposure the role it plays in the accusation utilization and the development in science and technology. Hence, most would want to be part of the action.

In this work Physics, one of the topics treated by Aristotle is about how the study carried out by mathematicians differs from that carried out by physicists. Considerations about mathematics being the language of nature can be found in the ideas of the Pythagoreans: the convictions that "Numbers rule the world" and "All is number", and two millennia later were also expressed by Galileo Galilei: "The book of nature is written in the language of mathematics". Before giving a mathematical proof for the formula for the volume of a sphere, Archimedes used physical reasoning to discover the solution (imagining the balancing of bodies on a scale). From the seventeenth century, many of the most important advances in mathematics appeared motivated by the study of physics, and this continued in the following centuries (although, it has already been appointed that from the nineteenth century, mathematics started to become increasingly independent from physics). The creation and development of calculus were strongly linked to the needs of physics: There was a need for a new mathematical language to deal with the new dynamics that had arisen from the work of scholars such as Galileo Galilei and Isaac Newton. During this period there was little distinction between physics and mathematics; as an example, Newton regarded geometry as a branch of mechanics. As time progressed, increasingly sophisticated mathematics

started to be used in physics. The current situation is that the mathematical knowledge used in physics is becoming increasingly sophisticated, as in the case of superstring theory (<https://en.wikipedia.org/wiki/relationship>)

Human beings need the knowledge of mathematics to help them to understand the universe, we have used mathematics to analyze, explain and understand the universe (Oyeneyin, 1981). The most important skill in physics is useful analysis and clear reasoning. These skills can help people to solve difficult puzzles but we cannot read it unless we have first learned this language and the characters in which it is written. It is written in mathematical language, the characters are triangle, circles and other geometric figures. Physics is based on logic starting from widely accepted statements, the used of logic to draw conclusion to come up with complete and meaningful solution to the problems. It is belief that someone with the knowledge of mathematics can study physics very well.

As a result of teacher's behaviors, many students who would perform very satisfactory tend to run away from the subject, this attitude and behavior of teachers can have an adverse effects on the resultants attitudes of their performance in physics. Also the level of teaching the subject helps in understanding it by the students.

Purpose of the Study

The purpose of the study is to fine the correlational between students' academic performance in mathematics and physics in the two selected science secondary schools in Gombe metropolis.

Aim of the study

The aim of the study to find out the relationship between academic performance of students in Physics and Mathematics at Secondary School level.

Objectives of the study

The following are objectives of the study:

- (i) To find out the student's performance in Physics in some selected secondary schools.
- (ii) To find out the student's performance in Mathematics in some selected secondary schools.
- (iii) To correlate the relationship between academic performance of students in Physics and Mathematics at Secondary School Level.
- (iv) To find out the influence of mathematics in learning physics.

Research Question

One research question was formulated to guide the study.

1. To what extent does students' academic performance in mathematics help students in learning physics?

Research Hypothesis

One null hypothesis was formulated and tested at 0.05 level of significance

1. There is no significant relationship between students' performance in Physics and Mathematics at SSCE level.

Significance of the Study

This research work is very important because the outcome of the performance of students will hopefully be of great help to the school administrators, teachers, students and the society at large. It can be used as a guide to physics students on how learning Mathematics will enhance the learning of Physics.

This study could also help to inform school administrators of the areas which need to be emphasized at various seminar and workshops which will in turn help students to perform better in Physics. It could also help for further research.

Methodology

This research was a correlational study designed to find the relationship between students' academic performance in mathematics and its effects on physics academic performance at SSCE level.

Population of the Study

Population of the study comprises four thousand three hundred and fifty (4,350) students from the two selected science secondary schools for six sets of graduated students i.e IQMIC (2,275) and JIBWIS (2,075) students.

Sample and Sampling Techniques

The sample size of 340 students from IQMIC and 335 students from JIBWIS were drawn for the purpose of this research work using stratified sampling technique.

Research Instrument

The instrument used was the students' results of senior secondary certificate examination (SRSSCE) for mathematics and physics from 2006-2011.

Results and Discussion

Results of the findings were discussed as follows:

Research question one

To what extent does students' academic performance in mathematics help students in learning physics?

Table 1: Summary of the Pearson Product Moment Coefficient on the relationship between students' academic performance in mathematics (X) and their performance in physics (Y) at SSCE level in IQMIC

N	ΣX	ΣY	ΣXY	ΣX^2	ΣY^2	r-cal
6	1026	1068	184630	181164	195226	0.37

Table 1 show that there is positive but weak correlation with r-value of 0.37 between students' academic performance in mathematics and their physics performance at SSCE from 2006-2010 in IQMIC secondary school.

Table 2: Regression Analysis of students' academic performance in mathematics and physics in IQMIC

Year	2006		2007		2008		2009		2010		2011	
Subject	M	P	M	P	M	P	M	P	M	P	M	P
No. Pass	121	205	182	192	131	115	195	182	198	192	195	182
Mean Pass of The Schools	96.5	115.5	143.5	136.5	191.5	94.0	194.5	167.0	145.0	167.0	204.0	142.5

Table 3: Summary of the Pearson Product Coefficient on the relationship between students' academic performance in mathematics (X) and their performance in physics (Y) at SSCE level in JIBWIS

N	ΣX	ΣY	ΣXY	ΣX^2	ΣY^2	r-cal
6	928	577	93264	171182	66443	0.23

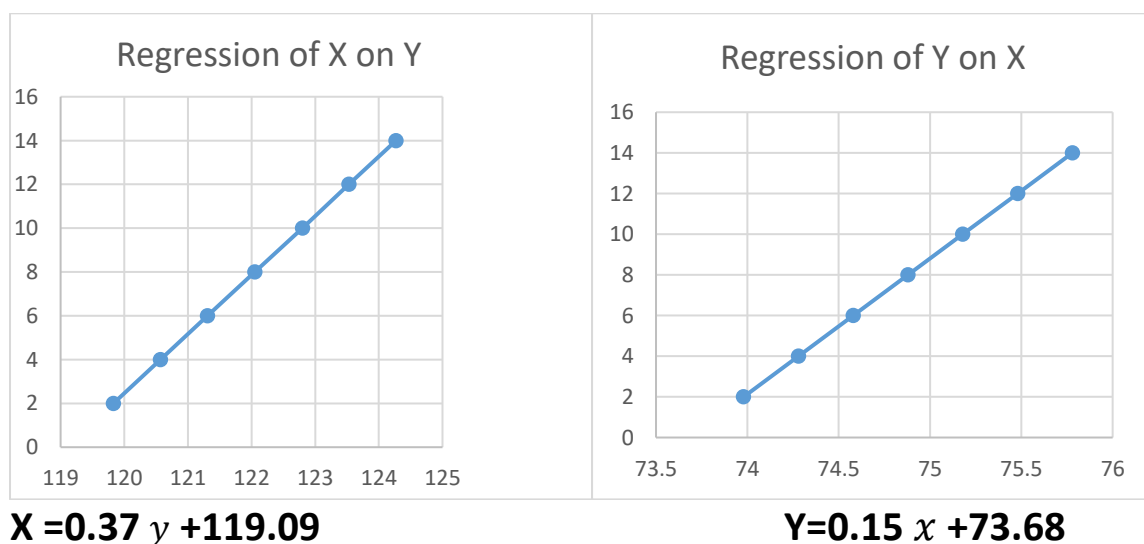
There is positive but weak correlation between students' academic performance in mathematics and that of physics at SSCE level in JIBWIS from 2006-2011.

Table 4: Regression Analysis of students' academic performance in mathematics and physics in JIBWIS

Year	2006		2007		2008		2009		2010		2011	
Subject	M	P	M	P	M	P	M	P	M	P	M	P
No. Pass	72	26	105	81	252	73	194	152	92	142	213	103
Mean Pass of	96.5	115.5	143.5	136.5	191.5	94.0	194.5	167.0	145.0	167.0	204.0	142.5
The Schools												

Regression equation of Y on X was calculated as $Y = 0.15x + 73.68$, which predicts the mean percentage of Y and a straight line graph.

Regression equation of X on Y was calculated as $X = 0.37y + 119.09$, which predicts the mean percentage of X and a straight line graph.



H₀₁: There is no significant relationship between student's performance in Physics and Mathematics at SSCE level.

Table 5: t-Test Analysis of the Relationship between students' academic performance in mathematics and physics at SSCE level.

n	df	r-cal	t-cal	t-critical	Remark
6	4	0.23	1.645	0.41	$P \leq 0.05$

From Table 5, the results showed that the t-cal value of 1.645 and t-critical value of 0.41 at $P \leq 0.05$. Since t-cal (1.645) is greater than t-critical (0.41) at $P \leq 0.05$. Therefore the null hypothesis is rejected and the alternative hypothesis is upheld. This shows that there is significant relationship between students' academic performance in mathematics and physics at SSCE level in both schools.

Conclusion

This study revealed that the performance of students in Mathematics have great influence on their performance in Physics at SSCE level in all schools, with r-values 0.37 and 0.23 in IQMIC and JIBWIS respectively. Also, the mean percentages of 191.5 and 94.0 which are very close in 2008 for mathematics and physics respectively, the regression of X on Y and Y on X which gives straight line graph; these suggested that there is positive relationship between mathematics and physics in both schools at SSCE level. Therefore physics students need the knowledge of mathematics in order to excel very good in their academic performance.

Recommendations

The following recommendations were made to determine the relationship between the performance of students in Physics and mathematics at SSCE level:

1. Mathematics teaching methods should be improved to enhance the

transferring of knowledge to other science subjects especially Physics.

2. There should be a consideration in the time allocated for teaching science subject especially mathematics as the backbone of all science subjects.
3. Students should be made to realize that the knowledge of Mathematics enhance good performance in Physics. An average student in mathematics is expected to perform averagely in Physics.
4. Sufficient and qualitative Mathematics and Physics teachers should be recruited.

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APPENDIX

Year	School	Number of Candidate	No. of Cand. Pass Maths	No. of Cand. Pass Phy.	Percent age. Pass Maths	Percentage Pass Phy.	Mean Pass Maths	Mean Pass Phy.
2006	IQMIC	261	121	205	47.89	78.54	96.50	115.50
	JIBWIS	311	72	26	23.15	8.36		
2007	IQMIC	450	182	192	40.44	42.67	143.50	136.50
	JIBWIS	318	105	81	33.02	25.47		
2008	IQMIC	303	131	115	43.23	37.95	191.50	94.00
	JIBWIS	345	252	73	73.04	21.16		
2009	IQMIC	503	195	182	38.77	36.18	194.50	167.00
	JIBWIS	303	194	152	64.03	50.17		
2010	IQMIC	308	198	192	64.29	62.34	145.00	167.00
	JIBWIS	393	92	142	23.41	36.13		
2011	IQMIC	450	195	182	43.33	40.44	204.00	142.50
	JIBWIS	405	213	103	52.59	25.43		