

Correlational Study Of Mathematics And Physics Students' Performance For 2015-2017 Mock Examinations: A Case Study Of Senior Secondary Two (Ss2) Students In Ibesikpo Asutan Local Government Area Of Akwa-Ibom State, Nigeria.

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Abstract

The study correlated the performance of students in Mathematics and Physics in Senior Secondary Two (SS2) mock examinations for 2015, 2016, and 2017 in Ibesikpo Asutan Local Government Area of Akwa Ibom State. Four research questions and four hypotheses were formulated to guide the study. The study adopted correlational design. The population comprises 2561 physics students who partook in mock examinations for 2015, 2016, and 2017 sessions. Purposive sampling technique was used to select four (4) from sixteen (16) secondary schools in the study area. 723 (28.2%) physics students were obtained as sample for the study. Mathematics and Physics scores were extracted from the SS2 mock examination results for 2015-2017 obtained from the Examinations Division, Ministry of Education, Akwa Ibom State for the study. The Data were analyzed using Pearson's Product Moment Correlation (r). The result revealed that students' performance in mathematics and physics in (SS2) mock examinations for 2015, 2016, 2017 and 2015-2017 correlated significantly. It was recommended among others that guidance should be provided to the students on significance of mathematics as an instrument of communication in physics. This will lead to appreciation of mathematical calculations involved in physics and thus raise the performance of students in physics.

Keywords: Mathematics, Physics, Students Performance.

Introduction

Education in Nigeria is oriented towards achieving a better future for its citizens. It is an avenue of training and learning especially in schools or colleges, to improve knowledge and develop skills. According to FGN (2013), Education is a cornerstone for development which forms the basis for literacy, skills acquisition, technological advancement and ability to harness human and materials resources towards the achievement of societal goals.

Education could be termed as a process in which individuals' physical abilities, emotional abilities, social abilities, and intellectual abilities are developed. It is to actualize human potential so that the individual can become something more than what he was before. Hence, Ugwanyi (2003) stated that education is the process were society establishes to assist the young to learn and understand the heritage of the past, participate productively in the society and contribute meaningfully for the development of

the society. It is an element that stimulates social economic development and advances several government policies documents and various scholars (Selina, 2012). Education prepares the individuals for the development of the right type of personality required for living in the society; equipped the individuals with knowledge, skills and values that are cherished and valued by the society.

The importance of education in the development of man cannot be overemphasized. Education is the mainstays through which science and technology tools that form the bedrock for any meaningful development of a nation is achieved. Science and technology is so dominant in the world to that almost everything is now scientific and technological in nature. Science is the basic tool for which the present-day technological development is accomplished. Science is the rational and systematic study of the environment through experimentation and observation with the view to understanding the environment in order to manipulate and control it for betterment of human conditions (Njoku, 2007).

Physics is one of the most important science subjects taught in senior secondary schools and higher institutions throughout the world due to its relevance to science and technological development. The importance of Physics as a subject in our schools and everyday life cannot be overemphasized. As appended in FGN (2013), Physics is a core science subject being offered in Nigerian schools and it forms the basis for the nation's technological advancement and human resource development. In line with this, physics is the rudiment of all scientific careers which include medicine, pharmacy, engineering, and technological studies. It is the scientific study that deals with the relationship between energy and matter, and its knowledge has contributed greatly to the production of instruments and devices of tremendous benefits to human race.

Awodun and Ojo (2013) opined that almost every life fields have relation with Physics such as organisms or inanimate from engineering to mathematics, biology and chemistry. Mekonnan (2014) opined that without the knowledge of physics, human will face difficulties in exploring the universe. Siddiqui and Khatoon (2013) stated that understanding of Physics helps to understand the content of the universe and for students, it helps to develop observation skills, accuracy, analysis ability, creative thinking. Siddiqui and Khatoon (2013) further stated the acquisition of the knowledge of physics is very important for science students. Hence, no science student is admitted into the university, polytechnics, and colleges to pursue any science course among which are science education, engineering, medical and biomedical sciences, technological studies, computer science and pharmaceutical science without a credit level pass in Physics.

It is rather unfortunate that, in spite of the recognitions given to Physics as one of the compulsory science subjects at the secondary school level as contained in National Policy of Education (NPE), the performance of students in physics have been worrisome. This has become a great concern to many which include researchers, teachers, parents, administrators, physicists, mathematicians, physics educators, mathematics educators and government. The search of ways to improve the poor performance of students has resulted to attributing it to various factors which include inadequate resources, teacher's professional commitment, creativity, mechanical skills, initiative and resourcefulness, poor laboratory facilities, poor thinking and learning environment and students' attitude towards physics.

Physics is one of the science subjects that involve a lot of calculations. This is why Kaya and Boyuk, (2011) opined that the choice of science subjects mostly Physics in Nigerian schools is much dependent on the learner's ability on mathematics because proficiency in mathematics is of basic importance to the study of Physics in particular and science in general. Mathematics have some relations with physics such as volumes, pressure, temperature, are revealed through the use of mathematical concepts and change of subject of formula in mathematics helps a great deal in understanding density in physics.

Mathematics is the study of quantity, structure, space and change. Oyedeji (2011) described mathematics as a creative language, a tool and a process. It operates with its own language, with signs, vocabularies, symbols as well as its structures (Effiong, 2015). The language of Mathematics can be looked at as the use of symbols, signs, rules, and formulas to represent ideas, concepts and relationship existing between concepts. It plays the role of verbal symbols, which can represent concepts and be used as stimuli for the internalized manipulation of concepts in science especially physics. However, Mathematics is a body of knowledge, denoted and enacted in terms of a standardized language. Ezenwean (2006) opined that mathematics is a branch of knowledge that seeks to improve on human perception and immediate environment by using clear, logical, precise and exact thinking processes.

Mathematics as a body of knowledge assist in the understanding of other subjects such as the physics. Thorndike and Woodworth (1901) in their theory of identical element stated that transfer of knowledge would take place from one situation to another if the two situations shared identical or common elements. Thus, two tasks which share some set of stimulus features are possible candidates for learning transfer. Looking at the numerous identical elements or features that exist between mathematics and physics, it can be that when learners are properly guided in mathematics learning, there may be the possibility for such group of learners to recall and transfer such concepts into physics learning. Harlow (1949) in his theory of learning to learn stated that individuals usually improve on their ability to learn tasks when they practice on a series of similar or related tasks. Badru (2004) suggested that the choice of science subjects mostly Physics in Nigerian schools is much dependent on the learner's ability on Mathematics because proficiency in mathematics may be of basic importance to the study of Physics in particular and science in general. On this regard, the researchers examined the relationship between mathematics and physics on students' performance.

Statement of the Problem

Nigerian science education system is plagued with lots of problems and one of the most serious problems is continuous poor academic performance of students in Physics particularly and science in general. This result has resulted to the search for various ways to improve the performance of students in physics by researchers, teachers, parents and government. It is on this note that the researchers intended to find if performance of students in mathematics will correlate with their performance in Physics in secondary school level.

Purpose of the Study

The purpose of this study was to investigate the correlation between the performance of students in mathematics and physics in senior secondary two (SS2) mock examinations 2015-2017 in Ibesikpo Asutan Local Government Area, Akwa Ibom State. The study specifically sought the following objectives:

- (1) Ascertain the relationship between the academic performance of students in mathematics and physics in Senior Secondary Two (SS2) 2015 mock examination.
- (2) Determine the relationship between the academic performance of students in mathematics and physics in Senior Secondary Two (SS2) 2016 mock examination.
- (3) Investigate the relationship between the academic performance of students in mathematics and physics in Senior Secondary Two (SS2) 2017 mock examination.
- (4) Examine the relationship between the academic performances of students in mathematics and physics in Senior Secondary Two (SS2) 2015-2017 mock examinations.

Research Questions

In considering the purpose of this work, the following research questions were formulated to guide the study.

- (1) What is the relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) 2015 mock examination?
- (2) What is the relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) 2016 mock examination?
- (3) What is the relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) 2017 mock examination?
- (4) What is the relationship between students' academic performances in mathematics and physics in Senior Secondary Two (SS2) 2015-2017 mock examinations?

Research Hypotheses

For this research work to have focus, the following hypotheses were therefore formulated.

- (1) There is no significant relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) 2015 mock examination.
- (2) There is no significant relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) 2016 mock examination.
- (3) There is no significant relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) 2017 mock examination.
- (4) There is no significant relationship between students' academic performances in mathematics and physics in Senior Secondary Two (SS2) 2015-2017 mock examinations.

Research Methods

Research Design

The study adopted correlational research design. Correlational research design has to do with the measurement of two or more factors to determine the extent to which the values of the factors are related. The design was chosen because the study

intended to examine the relationship between students' performance in mathematics and physics and if there is any relationship, identify both the direction and magnitude of the relationship.

Population of the Study

The population of this study comprises of two thousand five hundred and sixty one (2561) physics students in sixteen (16) secondary schools in Ibesikpo Asutan Local Government Area, who partook in SS2 mock examinations for 2015, 2016 and 2017 sessions. The number of students that took part in the mock examination were 751 physics students, 842 physics students and 968 physics for 2015, 2016 and 2017 respectively making a total of 2561 physics students.

Sample and Sampling Technique

Purposive sampling technique was used by the researchers to select four (4) secondary schools in Ibesikpo Asutan Local Government Area. Two (2) schools out of the four (4) were selected from each of the two clans of the research area. From the two (2) schools selected from each clan, it was shared to be public and private. In summary, the criteria for selection was based on the population of science students in the schools, the location of the school in term of the clans in the study area and the school must be co-educational school. A total of 723 physics students were obtained for the three years making 28.2% of the population. 150 physics students for the years 2015, 269 physics students for 2016 and 304 physics students for 2017.

Instrumentation

Developing an instrument was not necessary because the research was to use secondary data, that is Senior Secondary Two (SS2) mock examination results on mathematics and physics for 2015, 2016, and 2017 obtained from Examinations and Certificates Division, Ministry of Education, Akwa Ibom State as all schools in the state takes a central mock examination coordinated by the ministry.

Validity of the Instrument

The instrument need not be validated because they were secondary data, that is, Senior Secondary Two (SS2) mock examination results on mathematics and physics for 2015, 2016 and 2017 collected from the Examinations and Certificates Division, Ministry of Education, Akwa Ibom State.

Reliability of the Instrument

Reliability was not necessary because there was no developed instrument for the study. Secondary data were used instead, that is, Senior Secondary Two (SS2) mock examination results on mathematics and physics for 2015, 2016 and 2017 collected from the Examination and Certificates Division, Ministry of Education, Akwa Ibom State.

Research Procedure

The research was carried out in four (4) purposive selected secondary schools in Ibesikpo Asutan Local Government Area, Akwa Ibom State. The source of data for this investigation consisted of 2015, 2016 and 2017 Senior Secondary Two (SS2) mock examination results of physics students for mathematics and physics collected from the Examination and Certificates

Division, Ministry of Education, Akwa Ibom State. Photocopies of these results were given to the researchers by the office of Examination and Certificates Division, Ministry of Education, Akwa Ibom State. The Ministry of Education scored the scripts of students as A1, A2 - A3, C4 – C6, P7, P8 and Fail while the researchers decided to use the five points scale to represents the grades as shown below.

- 100% - 75% = A1 = 5 points
- 74% - 65% = A2-A3 = 4 points
- 64% - 50% = C4-C6 = 3 points
- 49% - 45% = P7 = 2 points
- 44% - 40% = P8 = 1 point
- 39% – 0 = fail = 0 point

The grades were presented using the points and the obtained points were used for analysis.

Method of Data Analysis

The data obtained for this study were analyzed using Pearson’s Product Moment Correlation statistics.

Results

The results were based on the research questions and hypotheses.

Research Questions

The research questions are answered using Pearson’s Product Moment Correlation.

Research Question One

What is the relationship between students’ academic performance in mathematics and physics in Senior Secondary Two (SS2) 2015 mock examination?

Table 1: Pearson’s Product Moment Correlation between Students’ Performance in Mathematics and Physics in SS2 Mock examination 2015.

Variables	N	$\sum X \sum Y$	$\sum X^2 \sum Y^2$	$\sum XY$	r-cal
Mathematics (X)	150	423	1495	1321	.40
Physics(Y)	150	428	1486		

Table 1 showed that the calculated r-value is .40. This indicates a positive average correlation between Mathematics and Physics in mock examination 2015. It implies that as performance of students’ in mathematics increases, students’ performance in physics averagely increases.

Research Question Two

What is the relationship between students’ academic performance in mathematics and physics in Senior Secondary Two (SS2) 2016 mock examination?

Table 2: Pearson’s Product Moment Correlation between Students’ Performance in Mathematics and Physics in SS2 Mock examination 2016.

Variables	N	$\sum X \sum Y$	$\sum X^2 \sum Y^2$	$\sum XY$	r-cal
Mathematics (X)	269	1008	4232		
Physics(Y)	269	694	2586	2697	.20

Table 2 showed that the calculated r-value is .20. This indicates a low positive correlation between Mathematics and Physics in mock examination 2016. This implies that as performance of students’ in mathematics increases, students’ performance in physics will increase slowly.

Research Question Three

What is the relationship between students’ academic performance in mathematics and physics in Senior Secondary Two (SS2) 2017 mock examination?

Table 3: Pearson’s Product Moment Correlation (r) between Students’ Performance in Mathematics and Physics in SS2 Mock examination 2017.

Variables	N	$\sum X \sum Y$	$\sum X^2 \sum Y^2$	$\sum XY$	r-cal
Mathematics (X)	304	1107	4401		
Physics(Y)	304	677	2255	2640	.33

Table 3 showed that the calculated r-value is .33. This indicates an average positive correlation between students’ performance in Mathematics and Physics in mock examination 2017. This implies that as performance of students’ in mathematics increases, students’ performance in physics will increase averagely.

Research Question Four

What is the relationship between students’ academic performances in mathematics and physics in Senior Secondary Two (SS2) 2015-2017 mock examinations?

Table 4: Pearson’s Product Moment Correlation (r) between Students’ Performance in Mathematics and physics in SS2 Mock examinations 2015-2017.

Variables	N	$\sum X \sum Y$	$\sum X^2 \sum Y^2$	$\sum XY$	r-cal
Mathematics (X)	723	2538	10128		
Physics(Y)	723	1799	6327	6658	.22

Table 4 showed that the calculated r-value is .22. This indicates a low positive correlation between students’ performance in Mathematics and Physics in mock examinations 2015-2017. This implies that as performance of students’ in mathematics increases, students’ performance in physics will increase slowly.

Hypotheses Testing

The hypotheses were tested using Pearson’s Product Moment Correlation.

Hypothesis 1

There is no significant relationship between students' academic performance in Mathematics and Physics in Senior Secondary Two (SS2) 2015 mock examination.

Table 5: Pearson's Product Moment Correlation (*r*) between Students' Performance in Mathematics and Physics in SS2 Mock examination 2015.

Variables	N	$\sum X\sum Y$	$\sum X^2\sum Y^2$	$\sum XY$	r-cal	r-cri	Decision
Mathematics (X)	269	1008	4232	1321	.40	.20	Rejected
Physics(Y)	150	428	1486				

As shown in Table 5, the calculated r-value (.40) is greater than the critical value (.20). Therefore, the null hypothesis is rejected. This means that there is significant relationship between students' performance in Mathematics and Physics in SS2 mock examination 2015.

Hypothesis 2

There is no significant relationship between students' academic performance in Mathematics and Physics in Senior Secondary Two (SS2) mock examination 2016.

Table 6: Pearson's Product Moment Correlation (*r*) between Students' Performance in Mathematics and Physics in SS2 Mock examination 2016.

Variables	N	$\sum X\sum Y$	$\sum X^2\sum Y^2$	$\sum XY$	r-cal	r-cri	Decision
Mathematics (X)	269	1008	4232	2697	.20	.09	Rejected
Physics(Y)	269	694	2586				

As shown in table 6, the calculated r-value (.20) is greater than the critical value (.09). Therefore, the null hypothesis is rejected. This means that there is significant relationship between students' performance in Mathematics and Physics in SS2 mock examination 2016.

Hypothesis 3

There is no significant relationship between students' academic performance in mathematics and physics in Senior Secondary Two (SS2) mock examination 2017.

Table 7: Pearson's Product Moment Correlation (*r*) between Students' Performance in Mathematics and Physics in SS2 Mock examination 2017.

Variables	N	$\sum X\sum Y$	$\sum X^2\sum Y^2$	$\sum XY$	r-cal	r-cri	Decision
Mathematics (X)	304	1107	4401	2640	.33	.09	Rejected
Physics(Y)	304	677	2255				

As shown in Table 7 the calculated r-value (.33) is greater than the corresponding critical value (.09). Therefore, the null hypothesis is rejected. This means that there is significant relationship between students' performance in Mathematics and Physics in SS2 mock examination 2017.

Hypothesis 4

There is no significant relationship between students’ academic performance in Mathematics and Physics in Senior Secondary Two (SS2) 2015-2017 mock examinations.

Table 8: Pearson’s Product Moment Correlation (*r*) between Students’ Performance in Mathematics and physics in SS2 Mock examinations 2015-2017.

Variables	N	$\sum X \sum Y$	$\sum X^2 \sum Y^2$	$\sum XY$	r-cal	r-cri	Decision
Mathematics (X)	723	2538	10128				
				6658	.22	.09	Rejected
Physics(Y)	723	1799	6327				

As shown in Table the calculated r-value is greater that the corresponding critical value. Therefore, the null hypothesis is rejected. This means that there is significant relationship between students’ performance in Mathematics and Physics in SS2 mock examinations 2015-2017.

Discussion of Findings

From the results, it was found that there was significant relationship between students’ performance in Mathematics and their performance in physics in mock examinations for 2015, 2016, 2017 and 2015-2017. This is as a result of the identical concepts in both mathematics and physics, such as vector, geometry, graphs, statistics and calculus. It is also as a result of the mathematical symbols used in physics such as phi (ϕ), theta (θ), alpha (α), pi (π), plus and minus (\pm), delta (Δ), infinity (∞). The findings could also be attributed to the calculation which is common in both mathematics and physics. Hence, Bassey (2003) stated that calculations are very important in expressing physics contents and students with less ability in calculation will struggle in physics because of the relationship between mathematical calculations and physics.

The findings of the study agreed with the findings of Awodun and Ojo (2013), who investigated the predictive influence of mathematics skills (computation skills, geometry skills, algebra skills, probability, statistical skills, measurement skills, interpretation of graphs and table skills) on physics students’ performance in senior secondary schools and found that mathematics skills have strong positive influence and strong predictive value on physics students’ performance in senior secondary schools. The study is also in agreement with that of Wenno (2014) who studied the relationship between physics and knowledge of mathematics basic concepts with the ability to solve physics problems and found that there is positive relationship between physics and knowledge of mathematics basic concepts with students’ ability to solve physics problems. However, the findings of this study contradict the findings of Abdurrahman and Madugu (2014), who related the performance of students in mathematics and physics in senior secondary school and found no significant correction between students’ performance in mathematics and their performance in physics.

Conclusion

It can be concluded from the findings that mathematical knowledge has a relationship with physics. Thus, lack of mathematical knowledge could block some students from venturing into physics as subject.

Recommendations

The result obtained from this study has creates an avenue for the researcher to make the following recommendations:

1. Guidance should be provided to students on significance of mathematics as an instrument of communication in physics. This will lead to appreciation of mathematical calculations in physics and thus raise the performance of students in physics.
2. Physics teachers should constantly consult and work closely with mathematics teachers. This will help to identify and solve mathematics calculations involved in physics.
3. Science Teachers Association of Nigeria should organize seminars, conferences and workshops to enlighten physics teachers on the important of collaborating with mathematics teachers.

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