

CORRELATION OF STUDENTS' PERFORMANCE IN MATHEMATICS AND CHEMISTRY AMONG SENIOR SECONDARY SCHOOL STUDENTS IN OYO EAST LOCAL GOVERNMENT AREA, OYO STATE

AYENI Adeniyi Abimbola, ADEJARE Akeem, OLADIPUPO Damilola, ADERINKOLA David A., ADEOTI Oluwatimileyin O., and AJAO Love

Department of Mathematics Federal College of Education Special Oyo

Abstract

The study investigated the correlation between students' performance in Mathematics and Chemistry among senior secondary school students in Oyo East Local Government Area, Oyo State. In specific terms, the study examined the relationship between Mathematics and Chemistry; and determining the effect of the knowledge of Mathematics on Chemistry. Data were collected from 80 respondents – science students purposively selected from randomly selected secondary schools in Oyo East Local Government. Simple percentages were used to analyze data; PPMCC and OLSR were employed to test hypotheses formulated. Findings revealed that there was a significant relationship between Mathematics and Chemistry. This finding was confirmed by $PPMCC = r = 0.6965$ which is greater than 0.5. the result indicated that both Mathematics and Chemistry are interrelated in the sense that mathematics as a subject underpinned Chemistry. Also, it was found that Mathematics knowledge positively has significant effect on the performance in chemistry. The finding was confirmed by regression analysis as F -calculated $F(4, 75) = 219.23$ greater than F -critical of 2.5 at 5% level of significant. Therefore, achievement in Chemistry depended upon Mathematics knowledge. The study concluded that there is significant and positive relationship between the performance of students in Mathematics and Chemistry. Knowing Mathematics positively affects performance in Chemistry. The study recommended among others that Mathematics teachers should be encouraged to impart quality knowledge to their students as this will help Chemistry understanding. Chemistry training teachers should be made to offer courses in Mathematics at college for better understanding. Government should include the aspects of Mathematics that contribute to the learning of Chemistry in the curriculum as this will help the students in performing well in Chemistry.

Keywords: Correlation, Students Performance, Mathematics, Chemistry

Introduction

Mathematics as a subject express itself everywhere, in almost every facet of life in nature all around us, and the technologies in our hands. According to Osofechinti in Odili (2006), the importance of mathematics to individuals in their daily undertaking is so enormous that the knowledge of mathematics is an indispensable tool for a successful and balanced human existence on earth. Mathematics is seen as a science of structure, order and relation that evolves from counting, measuring, and describing the shapes of an object (Mooney, 2015). It deals with logical reasoning and quantitative calculations. Mathematics nurtures the power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability, and even effective communication skills. It is a tool in which its knowledge and skills are the bedrock of all societal transformation and transfer of ideas into reality (Otunu-ogbisi, 2009). It is a creation of human mind concerned mostly with ideas, processes, and reasoning.

Unfortunately, this important subject has suffered a lot of neglect and hatred which has resulted in deficient performance and given rise to poor quality of students. Poor academic achievement in Mathematics could also be attributed to many factors such as students' negative attitude to Mathematics, inadequate motivation from the teacher, inadequate supply of instructional material, lack of qualified teachers, use of teacher-centered instructional strategies, non-challant attitude to the use of available ICT resources for the teaching of Mathematics (Akinoso, 2011, Olafare, Akinoso, Omotunde, & Eguatu, 2017). According to Aliyu and Akinoso (2017), several research efforts have been made to solve the problem of poor performance in Mathematics. Many of such efforts followed the observations of Adamu (2007) and Akinoso (2015). Some of these efforts are in the improvement of the method of teaching, quality of instructional technique employed by teachers and method of presentation before the students to improve Mathematics results.

Klobal and Musek (2001) described academic achievement as self-perception and self-evaluation of one's objective academic success. Dambudzo (2009) stated that education has become concerned with the physical, social and emotional development of the individual, with much attention being given to factors contributing to the academic achievement of learners, other than intellectual ability.

Chemistry is a subject in which adequate knowledge of Mathematics is required. Without sound knowledge of some skills in Mathematics, it might be difficult for a student to perform well in chemistry. The relationship between Mathematics and chemistry was considered in this study. Mathematics can be linked to any field of study and can be applied to every area of life. In short, society and Mathematics are both better off because of the application of mathematical theories to societal development. Mathematics has its influence in chemistry. There are some tools produced in mathematics useful for chemistry. Zambrini (2006) also states that chemistry is an exact science that relies on quantitative models that can be described and applied by using the mathematical language.

Mathematical knowledge plays a crucial role in understanding the contents of other school subjects such as science like chemistry, social studies, and even music and art. It is the language, as well as tools of science and engineering - describing our understanding of all that we observe. It is applied in various fields and disciplines like mathematical concepts and procedures are used to solve problems in science, engineering, medicine, economics, chemistry and so on. Salau (2000) points out that there exists an impregnable link between mathematics and other science subjects. For example, the teaching of the practical aspect of chemistry can hardly be achieved without the knowledge of mathematics. Science applies both simple and complex mathematical concepts, such as measuring a number of chemicals to use in a solution.

Akinoso, Olafare, Aliyu, and Agoro (2016) found out that knowledge of Mathematics relates with chemistry and knowledge of Mathematics influence the students' performance in chemistry. Goodhart (2013), emphasized that, the Mathematics knowledge students had prior to the general chemistry may have allowed them to understand certain chemistry topics more quickly and easily. The knowledge of mathematics and chemistry affects student as well as the nation at large. According to United Nations (2012), Mathematics and Science Education are pillars for economic growth and national development. Mathematics, Science (Chemistry) and technology enhance the prosperity of any society and without them the resources of our nation cannot be structured for industrial growth and development.

Research evidence has proved that Mathematics and Chemistry contribute to quality of life and national buildings in all aspects (Festus and Ekpete (2012). They are among the Science

subjects that technological breakthrough is built on as well as the hub where the wheel of science rotates. Ejidike and Oyelena (2015) posited that Chemistry and Mathematics equip the learner with the ability, experience and confidence to venture into different fields of human endeavors such as medicine, agriculture, transportation, housing, industries and so on. Furthermore, the knowledge of Mathematics and Chemistry facilitates knowledge in other fields which fuel national development. They are among the most important disciplines in the school curriculum as well as in the development of a nation, the mind and in underpinning the study of other subject, their importance in the general education have gained worldwide recognition.

Statement of the Problem

Students in science education especially in Chemistry program in Nigeria are always required to do Mathematics in their respective courses. Numbers of factors have been identified as related to studying Chemistry. Such factors include; teaching methods, teacher attitude, the influence of parents, gender, age, cognitive styles of pupil, career interest, social view of science and sacrifice and scientific, social implicating of Chemistry and achievement. Experience has shown that some students run away from the Chemistry courses because of their poor performance in Mathematics.

It is on this premises that this study is designed to investigate the correlation of students' performance in Mathematics and Chemistry among senior secondary school students in Oyo East Local Government Area, Oyo State.

Objectives of the Study

The main objective of the study is to investigate the correlation of students' performance in Mathematics and Chemistry among senior secondary school students in Oyo East Local Government Area, Oyo State. The specific objectives are to:

1. Examine the relationship between Mathematics and Chemistry; and
2. Determine if there is any effect of the knowledge of Mathematics on Chemistry.

Research Hypotheses

H₀₁: There is no significant relationship between Mathematics and Chemistry.

H₀₂: There is no significant effect of the knowledge of Mathematics on chemistry.

Methodology

Research Design

The descriptive research design was used for this research work.

Population of the Study.

The population for this study consisted of the Senior Secondary School (SSS) students in Oyo State, Nigeria.

Sample and Sampling Technique.

The purposive sampling technique was adopted to select 20 science students from the four randomly selected Secondary Schools to make a sample size of 80.

Research Instrument

In carrying out the study, the researcher employed the use of a questionnaire to collect necessary data for the study. The questionnaire contained close-ended items that held the response format of Strongly Agree (SA), Agree (A), Strongly Disagree (SD), and Disagree (D). The questionnaires were for the secondary schools' science students that were randomly selected. The questionnaire used for this study was self-constructed. The instrument was divided into sections. Section A contained the biodata of the students while Section B consists of questions.

Validity of the instruments

The drafted questionnaire was scrutinized by expert in the field and content validation to ascertain the content's face and construct validity. Therefore, it was typed and administered on the respondents.

Reliability of the instruments

A pilot study was carried out among 20 secondary school students in Oyo East Local Government within an interval of two weeks.

Data collected from the field of study was analyzed using simple percentages and Pearson Product Moment Correlation Coefficient (PPMCC) and Ordinary Least Square Regression (OLSR).

Methods of Data Analysis

Data collected from the field of study was analyzed using simple percentages and Pearson Product Moment Correlation Coefficient (PPMCC) and Ordinary Least Square Regression (OLSR).

Result

Demographic Characteristics of Respondents

From table 1 below, it was revealed that 43.74% of the respondents were males while 56.25% were female. This implies that there are more female students in Oyo East Local Government. Also, the table showed that 31.25% of respondents fell within the age of 10-14 years, 50% fell between 15-19 years, 18.75% of respondents were between 20-24. This implies that most of the students fall within the school age. It was also revealed that 35% of the students were Christians, 47.5% were Muslims, and however, 17.5% practiced other faiths. This implies that the majority of the students in Oyo East Local were Muslims and Christian.

Table 1: Distribution of Respondents by Demographic factors

Demographic Factors	Frequency	Percentage (100%)
Gender		
Male	35	43.75
Female	45	56.25
Total	80	100
Age Range		
10-14years	25	31.25
15-19 years	40	50.00
20-24 years	15	18.75
25 years & above	0	0
Total	80	100
Class		
Islam	38	47.50
Christianity	28	35.00
Others	14	17.50
Total	200	100

TESTING OF RESEARCH HYPOTHESIS

In testing research hypotheses inferential statistics Ordinary Least Square Regression (OLSR) and Pearson Product Moment Correlation Coefficient (PPMCC) were used. The hypotheses were tested at 5% level of significance.

Hypothesis I

H₀: There is no significant relationship between Mathematics and Chemistry.

H1: There is significant relationship between Mathematics and Chemistry.

DECISION RULE

If the PPMCC is greater than 0.5 at 5% level of significant, the null hypothesis (Ho) will be rejected while alternative hypothesis (Hi) will be accepted. If otherwise, alternative hypothesis will be rejected and null hypothesis (Ho) will be accepted.

In table 2, PPMCC between Mathematics and Chemistry is 0.6965 greater than 0.5. therefore, null hypothesis which stated that there is no significant relationship between Mathematics and Chemistry is rejected. However, the alternative hypothesis stated that there is significant relationship between Mathematics and Chemistry is accepted.

Table 2: Correlation Analysis Showing the Relationship between Mathematics and Chemistry

	Mathematics	Chemistry
Mathematics	1.0000	0.6965*
Chemistry	0.6965*	1.0000

Hypothesis II

Ho: There is no significant effect of the knowledge of Mathematics on chemistry.

Hi: There is significant effect of the knowledge of Mathematics on chemistry.

DECISION RULE

Showed regression analysis of the effect of knowledge of Mathematics on Chemistry. If F-calculated is greater than F-critical at 5% level of significant, the null hypothesis (Ho) will be rejected while alternative hypothesis (Hi) will be accepted. If otherwise, alternative hypothesis will be rejected and null hypothesis (Ho) will be accepted.

In table 2, F-calculated is $F(4, 75) = 219.23$ greater than F-critical of 2.5 at 5% level of significant. Therefore, null hypothesis which stated that there is no significant effect of the knowledge of Mathematics on chemistry is rejected. Meanwhile, the alternative hypothesis stated that there is significant effect of the knowledge of Mathematics on chemistry is accepted.

Table 3: Table showing the summary of Ordinary Least Square Regression (OLSR)

Source	Sum of Squares	Df	Mean Square	F	Significant
Model	74.4338028	4	18.6084507	219.23	.000 ^b
Residual	6.36619718	75	0.084882629		
Total	80.8	79			
R Square = 0.9212 Adjusted R Square = 0.9170 Root MSE = 0.29135 No of Obs. = 80					

Discussion of Findings

The study investigated the correlation of students' performance in Mathematics and Chemistry among senior secondary school students in Oyo East Local Government Area, Oyo State.

It was found that female students were more than male in senior secondary schools in Oyo East Local Government. It was also found that most of the students falls within the school age. Religiously, it was discovered that majority of the students in Oyo East Local Government are Muslims and Christian. Furthermore, it was discovered that there is significant relationship between Mathematics and Chemistry. The result is in line with that of Salau (2000) where he pointed out that there exists in impregnable link between mathematics and other science subjects it is also in line with that of Odidi (2006) who posited that achievement in sciences is often contingent upon mathematics knowledge and the ability to perform mathematics operations concepts and procedures are used to solve problems in various fields and disciplines including chemistry.

Hypothesis One revealed that Mathematical concepts are used to teach relationships between variables such as volumes, pressure, temperature e.t.c; Mathematics is used to find the relationship between some Chemistry concepts like hypothesis and data, electrons and energy, chemical reactants and reactions; Mathematical calculations are necessary to explore important concepts in Chemistry; Mathematics concepts are pre- requisite to some topics in Chemistry; and every concept in Chemistry has numerical interpretation. The result was confirmed by PPMCC = $r = 0.6965$. The result indicated that both Mathematics and chemistry are interrelated in the sense that mathematics as a subject underpinned Chemistry. The result corroborates Hemkin et al (2017) where they posited that knowledge and skills in the area of basic mathematics calculus and 3 dimensional geometry can be useful as a prerequisite or co-requisite to general chemistry.

Moreover, Etukodo and Nnaobi (2002) found that the place of mathematical skill in teaching for sustainable development should be emphasized as the lack of requisite mathematical skill makes it impossible to produce chemistry graduates from diverse educational programs that can fit effectively apply what they have learned to real-life problems.

Also, from hypothesis II, it was revealed that having Mathematics knowledge positively has significant effect on the performance in chemistry. The finding was confirmed by regression analysis as F-calculated $F(4, 75) = 219.23$ greater than F-critical of 2.5 at 5% level of significant. Also, regression analysis result obtained in the evaluation of mathematics knowledge that influenced performance in Chemistry was found to be more adequate because the results obtained indicates that the R^2 had values of 0.9212 (92.12%). This indicated that the contribution of Mathematics knowledge to students' performance in Chemistry accounted for 92.12% while the remaining 7.88% was left for others factors that influence students' performance in Chemistry.

Therefore, achievement in Chemistry is contingent upon Mathematics knowledge because calculations, concept and theories in Chemistry are made extremely easy with some basic mathematical skills. Not only that, creativity in Mathematics influence students' performance in Chemistry as Mathematics is used to find relationship between some Chemistry concepts like hypothesis and data, electrons and energy, chemical reactants and reactions; and the practical aspect of Chemistry can be achieved with the knowledge of Mathematics. The result is in line with that of Akinoso et al (2016) where they found out that knowledge of mathematics relates with chemistry and knowledge of mathematics influence the students' performance in chemistry the result also supports that of good hart (2012) who emphasized that the mathematics knowledge students had prior to the general chemistry may have allowed them to understand certain chemistry

topics more quickly and easily. Based on this finding, knowing mathematics positively affects performance in Chemistry.

Conclusion

Based on this finding, the study concluded that there is significant and positive relationship between performance of students in Mathematics and Chemistry. Having knowledge of mathematics positively affects performance in Chemistry. If a student is good in Mathematics, he/she would be very good in Chemistry as well. An increase in mathematics knowledge facilitates an increase in performance in Chemistry.

Recommendations

According to the findings of the study, it was revealed that Mathematics is the bedrock of the sciences not even only Chemistry. For secondary school students to perform very well and to be academically sound in Chemistry and other related sciences subjects, knowledge of Mathematics is indispensable. Therefore. The study recommends the following:

1. Mathematics teachers should be encouraged to impart quality knowledge to their students as this will help Chemistry understanding.
2. Chemistry training teachers should be made to offer courses in Mathematics at college for better understanding.
3. Chemistry and mathematics instructors should be advised of those Mathematics items which relate significantly to chemistry success, and of those items which showed student deficiencies upon entry to chemistry.
4. Additional research should be conducted to determine if the relationship between Mathematics growth and success in Chemistry is one of cause, or effect.
5. Guidance counselors should be made aware of the relationship of mathematics prowess to chemistry success, and urged to carefully consider individual students' mathematics backgrounds when planning schedules that include introductory chemistry.
6. Government should include the aspects of Mathematics that contributes to the learning of Chemistry in the curriculum as this will help the students in performing well in Chemistry.
7. In teaching Chemistry, the tutor should try as much as possible to explain using teaching aid as Chemistry should not be taught in abstraction.

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