

MATHEMATICAL ABILITY AS PREDICTOR OF ACADEMIC PERFORMANCE IN CHEMISTRY AMONG UNDERGRADUATE STUDENTS OF SULE LAMIDO UNIVERSITY KAFIN HAUSA JIGAWA STATE, NIGERIA

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Abstract

The study aimed to find out the relationship between the mathematical ability of chemistry students and their academic performance. Two research questions and one null hypothesis were stated to guide the study. The study employed correlation design. The population of the study consists of sixty (60) four hundred (400) level undergraduate chemistry education students for the 2021/2022 session of Sule Lamido University Kafin Hausa. Since the population is not much all the 60 level 400 students were used as the participants for the study. The instruments used for data collection were the examinations of the students in two (2) mathematic courses to elicit mathematical ability and five (5) chemistry courses to elicit academic performance. The data collected were analysed using Pearson Product Moment Correlation and the results showed that there is positive relationship between mathematical ability and academic performance of chemistry students. The study recommends that students should pass mathematical ability test before given admission into chemistry and chemistry education programmes.

Keywords: Academic Performance, Chemistry, Mathematics, Mathematical Ability

Introduction

Chemistry is a branch of science that deals with the study of nature, composition and structure of matter. Mastery of chemistry is associated with excellent analytical and mathematical skills that are useful in any job as these skills are required in critical thinking and problem solving. Other skills acquired through a formal training in chemistry include curiosity, careful observation, conducting research, record keeping, analyzing numeric data, working well independently, decision making and operation of scientific equipment. It is a branch of science that enhances every aspect of our lives example, pharmaceuticals contributes to our physical well being; synthetic fibers dress us in style; frozen food serve up a convenience; and the automobiles we drive are safer, lighter and energy efficient (Abubakar, 2019). These applications utilize knowledge gained through chemistry education.

Chemistry education is the study of the teaching and learning of chemistry in schools which includes understanding how students learn chemistry, how best to teach chemistry and how to improve learning outcomes. Chemistry education is a field of study that relates to both the study of various concepts and the methodology of teaching them in order to produce a chemically literate society (Anaso, 2010). Chemistry education is a vehicle through which chemical knowledge and skills reach the people who are in need of the capacities and potentials for development (Udofia & Ekong, 2017).

Chemistry education is a programme that combines chemistry and education in the department of science education at universities which leads to award of Bachelor of Science Education (B. Sc. (Ed))

Chemistry. Chemistry education has been identified to be one of the major bedrocks for the transformation of our natural economy and hence must be accorded adequate attention (Adejo, 2015). Chemistry teaching is supposed to be result oriented and can only be achieved when students are willing and teachers are favourably disposed, using the appropriate method and research in teaching the students (Adesoji, 2008).

Despite the importance of chemistry as a subject at all level of schooling in Nigeria, most students perform poorly in the subject (Baanu, Oyelekan & Olurundare, 2016). The students' academic performance in Nigerian Universities is measured using Grade Point Average (GPA). This takes into consideration the assignment, test and examination scores for each course. As the students move from the first semester up to the end of the study their academic performance is expressed as Cumulative Grade Point Average (CGPA). The CGPA is the sum of all grade points obtained from all registered courses in all the semesters of the study $\{\Sigma (\text{credit unit} \times \text{grade point}) \text{ divided by the total number of credit units registered}\}$.

Research has revealed that chemistry education students' performance has been unsatisfactory over the years (Umate, Eya & Okebanama, 2019; Ezeudu, Attah & Nwafor, 2019; Akume, 2020). Literature further revealed that most of chemistry education students do not graduate by the stipulated time and even those graduated ended with class of degree that is below second class (Lower Division) (Abdulkadir, & Ogwueleka, 2019). For instance, the statistical analysis of chemistry education final year students of the Federal University, Kashere (FUK), Gombe state, in 2018/2019 showed that out of 24 students only 4 graduated with second class (upper division). 6 students graduated with second class (lower division) and below while 14 students could not graduate (FUK, Science Education Department, Examination officer's Report, 2021). However, in 2018/2019 and 2019/2020 sessions 33.3% and 18% of level 400 students in Sule Lamido University Kafin Hausa graduated with higher than second class lower division, 13.3% and 8% graduated with second class lower division while 53.3% and 74% were not able to graduate respectively (SLUK, Department of Science Education, 2021).

Many studies revealed that the low performance is caused by many factors such as perceiving chemistry concepts as difficult (Agogo & Onda, 2014; Eze-Odurumkwe, 2014), use of traditional method in teaching the subject (Uzezi and Zainab, 2017) and poor mathematical ability of students (Adesoji & Ibraheem, 2009). Among these factors, Adigwe (2012) reported that mathematical ability is the major contributing factor to the consistent low performance among chemistry education students.

Mathematical ability is the ability of an individual to use numbers effectively in clerical administrative, scientific and other areas of application of numbers (Nizoloman, 2013). It is the ability to understand and work with mathematics concepts and ideas. Mathematics is seen by the society as the foundation of the scientific and technological knowledge which is vital in the socio-economic development of a nation. The critical role of mathematics in understanding the relationships between scientific concepts especially in the physical sciences cannot be underestimated (Furner & Kumar, 2007). Most chemistry topics are mathematical skills inclined and there no way someone can cope up with them without mathematical skills. Mathematical skills/Knowledge and thought process are required at all educational levels for studying chemistry (Adigwe, 2012). Mathematics as a discipline provides student with an understanding of solving some important problems in chemistry in terms of concepts, rules and principles (Orimogunje, 2019). For instance, the knowledge learned from the mathematical concepts of fractions, ratio, proportion, percentage, logarithm, indices, quadratic equations could be applied in solving chemistry problems like mole concept, acid-base reactions, PH scale, chemical kinetics, gas laws, stoichiometry, and so on.

Previous studies have shown that competency in mathematics is a good predictor for academic performance in secondary and tertiary institutions (Orimogunje, 2019; Hein, Smerdon, & Sambolt, 2013). A study carried out by Nizoloman (2013) revealed that there is a positive significant relationship between mathematical ability and academic achievement of students in Mathematics. Another study carried out by

Okoronka and Onuaha (2017) and Awodun and Ojo (2015) discovered that the better the mathematical ability of students the better their academic achievement. Another study by Charles-Ogan, Arokoyu, and Amadi (2017) revealed that academic performance of students in chemistry is directly proportional to their mathematical ability.

Most of the reviewed literature showed that the participants in their studies are secondary school students or students of tertiary institutions other than universities. The specific reference to University chemistry students' mathematical ability and how it contributes to their academic performance is not known. On this basis, the study intends to find out whether mathematical ability of chemistry education undergraduate students has relationship with their academic performance in Sule Lamido University Kafin Hausa Jigawa State.

Purpose of the Study

1. To determine the mathematical ability of undergraduate chemistry education students.
2. To determine the mean academic performance of undergraduate chemistry education students base on their mathematical ability.
3. To determine the relationship between the mathematical ability and academic performance of undergraduate chemistry education students.

Research Question

1. What is the mathematical ability of undergraduate chemistry education students?
2. What is the mean academic performance of undergraduate chemistry education students based on their mathematical ability?
3. What is the relationship between mathematical ability and academic performance of undergraduate chemistry education students?

Hypotheses

1. There is no significant difference in the mean academic performance of undergraduate chemistry education students based on their mathematical ability.
2. There is no significant relationship between mathematical ability and academic performance of undergraduate chemistry education students.

Methodology

The research employed correlation design. This design analyses the relationship between variables and some other results in such a way that the underlying pattern of relationships becomes clear (Sidhu, 2013). This design is suitable because the study involves collecting data in order to determine the degree of relationship between the mathematical ability and academic performance of students.

The population of the study comprises sixty (60) four hundred (400) level undergraduate chemistry education students from Sule Lamido University Kafin Hausa for the 2021/2022 session admitted through UTME. Since the population is not much all the 60 level 400 students were used as the participants for the study.

The Instruments used for data collection are; the examinations in the two mathematics courses (MTH121 and MTH132) and five (5) chemistry courses (CHM111, CHM112, CHM121, CHM122 and CHM123) undertaken by the students in their 100 level to elicit mathematical ability and their academic performance in chemistry respectively. The instruments were considered valid because they were moderated by external examiners who are experts in both mathematics and chemistry. The mathematical ability scores were used to categorise the students into three ability levels namely; high (students scoring 70% and above), medium

(students scoring from 50 – 69%) and low (students scoring below 50%) as suggested by Okoronka and Onuoha (2017). The scores of students in chemistry courses were used as their academic performance.

Results

The data collected were analysed using mean, standard deviation and Pearson Product Moment Correlation by utilizing SPSS. The results of the study are presented as follows;

Research Question 1: What is the mathematical ability of undergraduate chemistry education students?

Table 1: Mathematical Ability of Undergraduate Chemistry Education Students

Variable	Number of Students	Mathematical Ability Score
HMAS	-	70% and above
MMAS	6	50-69%
LMAS	54	<50%
Total	60	

HMAS= High Mathematical Ability Students

MMAS=Moderate Mathematical Ability Students

LMAS=Low Mathematical Ability Students

Table 1 shows that none of the students possess high mathematical ability, six (6) students possess moderate mathematical ability while fifty four (54) students possess low mathematical ability. Hence, research question 1 is answered.

Research Question 2: What is the mean academic performance of undergraduate chemistry education students based on their mathematical ability?

Table 2: Mean Academic Performance of Undergraduate Chemistry Education Students based on their Mathematical Ability.

Variable	N	Mean	SD
HMAS	-	-	-
MMAS	6	59.80	3.88
LMAS	54	39.60	12.60

The result presented in Table 2 shows that the mean academic performance scores of medium and low mathematical ability students are 59.80 and 39.60 with standard deviations of 3.88 and 12.60 respectively. Hence, research question 2 is answered.

Research Question 3: What is the relationship between mathematical ability and academic performance of undergraduate chemistry education students?

Hypothesis 1: There is no significant relationship between mathematical ability and academic performance of undergraduate chemistry education students

Table 3: Summary of Pearson Product Moment Correlation between mathematical ability and Academic Performance of

<u>Undergraduate Chemistry Education Students in Chemistry</u>							
Variable	N	Mean	SD	Df	R	p	R ₂
MA	60	29.41	14.81				
				58	0.77	0.000	0.5929

AP

60

41.58

13.50

MA=Mathematical Ability

AP=Academic Performance in Chemistry

The result presented in Table 3 shows a significant positive correlation between the mean scores of mathematical ability and academic performance of chemistry education students ($n=60$, $r= +0.77$; $p< 0.05$). This answers the research Question 3 because it shows there is positive correlation between mathematical ability and academic performance of undergraduate chemistry education students. The result in Table 3 also indicates that, the null hypothesis which says there is no significant relationship between mathematical ability of undergraduate chemistry education students and their academic performance is rejected. This means there is significant relationship between mathematical ability of undergraduate chemistry education students and their academic performance. The correlation coefficient of determination, R^2 , is 0.5929 which indicates that 59.29% of the academic performance in chemistry could be determined by mathematical ability of students.

Discussion of Findings

The analysis of data in Table 2 shows that none of the students has high mathematical ability. The analysis also shows that there is wide gap between students with median mathematical ability and those with low mathematical ability because their mean performances are 59.80 and 39.60 respectively. Since the mean academic performance of 54 students out of 60 is 39.60, it shows that their academic performance in chemistry is low.

The result obtained in Table 3 shows that the null-hypothesis 1 was rejected. Hence, there is significant relationship between mathematical ability of students and their academic performance in chemistry. This means as the mathematical ability of students increases their academic performance increases and viceversa. This agrees with the findings of Okoronka and Omoha (2017), Nizoloman (2013) and Awodun and Ojo (2013) who also found that there is positive correlation between the mathematical ability of students and their academic performance.

Conclusion

Based on the result of the study, it was concluded that the mathematical ability of students is a predictor of their academic performance in chemistry.

Recommendations

1. Government should put more emphasis in teaching of mathematical skills right from primary schools, secondary schools up to tertiary Institutions.
2. Mathematical ability test should be passed by students seeking admission into chemistry and chemistry education programmes in universities and other tertiary institutions.

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