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STUDENTS ATTITUDE TO MATHEMATICS AS CORRELATES TO ATTITUDE AND PERFORMANCE IN CHEMISTRY

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Abstract: Requirement for basic knowledge of some subjects has been considered as prerequisite for students in depth knowledge in other subjects and subsequent performance in the examinations among secondary school students. Mathematics is being considered as the bedrock of art and science subjects. However, there is need to establish the extent to which this claim is true especially between Mathematics and Chemistry hence this investigation. This study investigated the attitude of students to Mathematics in correlation to its relationship and influence in Chemistry, using multiple regressions. The study is a descriptive research of survey type. The instruments for data collection include, Student Attitude Questionnaire (SAQ), Mathematics and Chemistry Relationship (MCR) and Student Influence Questionnaire (SIQ). 475 students were randomly selected from 10 Secondary Schools in Oyo State, while one intact class was selected randomly from each school. The test items (SAQ), (MCR) and SIQ were administered to thirty SS II students that were not involved in the main study to determine the reliability and internal consistency of the scores using Cronbach alpha formula. The standardized alpha value of 0.79, 0.81 and 0.67 were obtained. It was discovered that attitude of students to Mathematics has influence and relationship to attitude and performance in Chemistry. Since the relationship exist among attitude, relationship and influence, it was concluded that, students attitude to Mathematics has relationship that influenced the performance in Chemistry. Hence, students must possess positive attitude to Mathematics in order to have positive attitude to learning and perform better in Chemistry.

Keywords: Influence, attitude, relationship, mathematics

Introduction

Mathematics as a subject is very important to the daily life of every individual as it aids the development of knowledge and the required skills in problem solving situations. Mathematics is seen as science of structure, order and relation that evolves from counting, measuring and describing the shapes of object. 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 the bedrock of scientific and technological development of any society. Teaching and learning of mathematics was established in schools in order to produce competent persons who are skillful in applying mathematical knowledge in solving everyday life problem. Mathematics cannot be completely separated from sciences because of its applications to physical sciences. All applicants for the best employment opportunities will need a good grasp of science, Mathematics, and computer technology. Unfortunately, this important subject has suffered a lot of neglect and hatred which has resulted in poor 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 teacher, inadequate supply of instructional material, lack of qualified teachers, use of teacher centered instructional strategies, non - challan attitude to the use of available ICT resources for 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 method of teaching, quality of instructional technique employed by teachers and method of presentation before the students in order to improve Mathematics result.

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Mathematics is the bedrock of scientific and technological development of any society. Mathematics as a subject is very important to the daily life of every individual as it aids the development of knowledge and the required skills in problem solving situations. Mathematics is seen as science of structure, order and relation that evolves from counting, measuring and Omoniyi (2015) notes that the study of Mathematics was established in schools in order to produce competent persons who are skillful in applying mathematical knowledge in solving everyday life problem. Problems are of different categories in life, some need little dialog, while others need critical and rigorous intervention before getting the solution, so also mathematical problems. Learning Mathematics is not a just, but the application to real life situation is very important. By considering the following, one will discover that learning Mathematics is very essential, Mathematics for life, for scientific and technology development, for workplace, part of culture and heritage, practical values, disciplinary values, cultural values, moral values, aesthetic values, recreational values, national development, measurement in every area of life. The measuring skill in Mathematics is very useful for chemist especially for mixture and solution of chemicals. As important as the subject is, in terms of its widely use in virtually everything in life, attitude of the students to Mathematics is not encouraging (Akinoso, 2016). This might also affect the attitude and performance of students in chemistry.

Attitude is defined as positive or negative emotional dispositions (Aiken, 2002). Students' attitude towards a subject determines their success in that subject (Akinsola & Olowojaye, 2008). The attitude towards Mathematics could therefore be described as either a positive or negative emotional disposition towards Mathematics (Zan & Martino, 2007). Positive attitude to Mathematics lead to good performance in Mathematics as well as Mathematics related subjects, since it forms the basis of every other subjects being sciences, arts, or commercial. Attitude of students constitute major aspect of learning, it is important to consider the fact that learners can mainly contribute to the learning outcomes as a result of the attitude possessed, positive attitude leads to good performance and negative attitude leads to poor performance. Attitudes are seen as more or less positive and encompass emotions, beliefs, values and behavior and hence affect individual way of thinking, acting and behaving which has a lot of implications to teaching and learning.

Attitude to any subject plays a significant role in performance of such student. If students are emotionally balance, having positive attitude, and have the believe in learning and understanding of that particular subject, all these possessions when put together will help a lot in performance in such subject. In this case, there must be a way of improving the attitude of students to Mathematics so as to improve the attitude and performance in chemistry. This can be done in different ways such as:

- Using the strategies that are activity based
- Integrating Information and Communication Technology to the teaching and learning of Mathematics`
- Using resources in teaching such as interactive whiteboard, iPad, and other real-life materials.
- Teaching Mathematics with the use of students mathematical thinking and error committed in Mathematics class
- Effective management of teachable moments when occur in Mathematics class

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. Relationship between Mathematics and chemistry was also considered in this study. Though chemistry is about learning the names of atoms, how atoms are constructed through electrons, protons, and neutrons and some trends on the periodic table but, Hayes (2015) emphasized that the behavior and properties of atoms and molecules, rely on a mathematical explanation. Hayes (2015) explains further that for general chemistry, one can get by with a solid algebra and pre-calculus training. But, calculus is needed for upper division chemistry classes. Invariably, chemistry is applied Mathematics. Also, Akinoso, Olafare, Aliyu, and Agoro (2016) shed more light on the relationship that exist between Mathematics and chemistry, that, chemistry is concerns with measurement issues concerning the particles protons, neutrons' and elections which have mass and electrical charge that can be measured. Then, numbers have been used to understand the structure of the 92 naturally occurring elements and to classify them into families with similar kinds of chemical properties, which lead to the formation of periodic table. This helps in organizing the elements into cheaters which have similar properties and then was the information to understand the properties of these elements. In this case, there is an element of Mathematics in chemistry and the importance of it in science and technology as a viable tools for the development of any nation is incontestable. It has become necessary to test mathematical skills of any student that wish to register for chemistry as a course and find a way of tutoring the students who have interest in chemistry but low mathematical skill.

The Federal Government of Nigeria made Mathematics as one of the requirements for admission to Higher institution to study chemistry and other science subjects. Mathematical confidence and problem-solving ability are probably the most important factors in predicting the success of students in chemistry. However, according to Hemkin, Jorgensen, Robinson, Schrier, Seeman and Simon (2017) knowledge and skills in the areas of basic mathematics, calculus, and 3 - dimensional geometry (as described below) can be useful as a prerequisite or co-requisite to general chemistry. Without the knowledge of basic skills in Mathematics like unit conversion,

significant figures, proportions and concentrations, expressions involving exponents and logarithms, summation notation, basic probability and statistics, it is unlikely for chemistry students to cope with the calculation in chemistry. There are some other aspects of Mathematics that contributes to the learning of chemistry, but this depends on the level of the chemistry students.

Differential calculus and integrals have applications to the study of functions and graphs. The students of chemistry must know how to use derivatives to find the maxima and minima of a function. The 3-dimensional geometry is another part of Mathematics that is important in learning chemistry especially for organic chemistry. Also, mathematical software like MATLAB is also useful for chemistry students. With this relationship between Mathematics and chemistry, ways of improving chemistry students attitude should be the concern of the teachers and all other education stakeholders.

Students run away from chemistry as a result of calculation and Mathematics which is a viable tool for national development is incontestable and forms the basis of chemistry. Then, since researches on Mathematics and chemistry has not been widely reported, this study therefore, investigated the students attitude to Mathematics as correlate to attitude and performance in chemistry.

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. Soleymani and Rekabdar (2016) on the relation between Mathematics self-efficacy and Mathematics achievement with control of Mathematics attitude, the results show that there is a significant relationship between self-efficacy and Mathematics achievement.

Purpose of the Study

The purpose of this study is to find out:

1. Whether Mathematics has any relationship with chemistry
2. Whether there is any relationship between attitude of students to Mathematics, relationship between Mathematics and chemistry.
3. Also, to find out if there is any relationship between attitude of students to Mathematics and influence of the knowledge of Mathematics to chemistry.
4. Whether students attitude to Mathematics has any influence on performance in chemistry
5. Whether the relationship between Mathematics and chemistry and influence of the knowledge of Mathematics to chemistry account for attitude of students which aids the performance in chemistry.

Research Questions

Three research questions were answered in this study:

1. Is there any relationship between students' attitude to Mathematics and performance in chemistry?
2. (i). Is there any relationship between attitude of students to Mathematics and relationship between Mathematics and chemistry?

(ii). Is there any relationship between attitude of students to Mathematics and influence of the knowledge of Mathematics to chemistry?
3. What is the joint contributions of independent variables to the dependent measure?

Methodology

The study is a descriptive survey type of research design. The sample consist of 475 chemistry students randomly selected from 10 Secondary Schools in Oyo State from five Local Government areas randomly selected from the list of Local Government areas in Oyo state. Two secondary schools were selected randomly from each of the Local Government and one intact class also selected was selected randomly from each school. The instruments for data collection include, Student Attitude Questionnaire (SAQ), Section A for the background information of the students, section B consists of three sub-sections with 15 questions for SAQ adapted from Modified Fennema-Sherman (1976) attitude scale. Other sub-sections were Mathematics and Chemistry Relationship (MCR) which consists of 10 questions and Student Influence Questionnaire (SIQ) also consists of 10 questions. The test items (SAQ), (MCR) and SIQ were administered to thirty SS II students that were not involved in the main study to determine the reliability and internal consistency of the scores using

Cronbach alpha formula. The standardized alpha value of 0.79, 0.81 and 0.67 were obtained, all instruments were validated. The instruments were then taken to the sampled schools and were administered to the students. Students responses were scored, data obtained were collated and were imputed into the computer using SPSS Package. Descriptive statistics of mean and standard deviation, and inferential statistics Pearson moment correlation and regression analysis were used to provide answer to research questions.

Results

Relationship between Mathematics Students Attitude to Mathematics and attitude and performance in chemistry

Research Question 1. Is there any relationship between students' attitude to Mathematics and performance in chemistry?

Table 1 below provided answer to research question 1 above.

Table 1. Descriptive statistics and inter – correlational matrix of students

Variables	Mean	SD	N	Attitude	Relationship	Influence
Attitude	15.470	2.140	475	1.000		
Relationship	15.940	2.100	475	0.300	1.000	
Influence	14.470	2.310	475	0.220	0.450	1.000

Table 1 reveals the description of the relationship that exists between the students' attitude, relationship and influence with scores of ($r = 0.300$) for relationship and attitude, score of ($r = 0.220$) for the relationship between influence and attitude. Relationship also exist between relationship and influence with a score of ($r = 0.450$).

Between relationship of Mathematics to chemistry is shown on table 2 below.

Table 2. Adjusted R square value for the model summary on attitude

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.320	.099	.095	2.043

Predictors, (constant), influence, relationship

As shown in the Table 2, the adjusted R Square (.320) has a fit. The constructed multiple regression model indicated that the independent variables (relationship and influence) account for 0.99% variance in the dependent variable (attitude). Further analysis on the analysis of variance (ANOVA) for the model is as shown in Table 3.

Research Question 2. (i) Is there any relationship between attitude of students to Mathematics and relationship between Mathematics and chemistry?

(ii) Is there any relationship between attitude of students to Mathematics and influence of the knowledge of Mathematics to chemistry?

Table 1 and 3 provided answer to research questions 2(i) and 2 (ii).

Table 3. ANOVA for independent variables on attitude

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	216.782	2	108.391	25.977	.000
	Residual	1969.462	472	4.173		
	Total	2186.244	474			

a. Dependent Variable: attitude

b. Predictors: (Constant), influence, relationship

Results from the analysis of variance (ANOVA) show that, $F(df\ 2,472 = 25.980, p < 0.000)$, indicated a statistically significant relationship (less than 0.05) by the independent variables (relationship and influence) on the dependent variable (attitude). This indicates that, overall, the model applied is significantly good

enough in predicting the outcome variable. Further analysis was done on this significant relationship, as the coefficient for the Beta weight for the amount of standard deviation unit of change in the dependent variable for each standard deviation unit of change in the dependent variable was done. The results are as shown in Table 4.

Research Question 3. What is the joint contributions of independent variables to the dependent measure? The solution to this question can be found on table 4.

Table 4. Coefficients for Independent Variables on Attitude

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.92	.78		12.75	.00
	Relationship	.26	.05	.25	5.15	.00
	Influence	.09	.05	.11	2.18	.03

a. Dependent Variable: attitude

The standardized coefficients Beta weight which reveals the amount of standard deviation unit of change in the dependent variable for each standard deviation change unit change in the dependent variable in table 4 reveals that:

- The independent variable, influence has the strongest positive effect on the attitude because the Beta ($\beta = .11, .030$) shows statistically significant relationship because the significance value was less than 0.05 alpha value.
- The independent variable, relationship has the next stronger positive effect on the credibility because the Beta ($\beta = .25, .000$) shows statistically significant relationship because the significance value was less than 0.05 alpha value.

Discussion

The results of the study indicated that relationship exist among attitude, relationship between Mathematics and chemistry and influence of the knowledge of Mathematics to chemistry. That is, for all the three variables (Attitude of students to mathematics, Relationship between Mathematics and chemistry and Influence of Mathematics knowledge to chemistry), there exist a relationship. It was also discovered that, the constructed multiple regression model indicated that the independent variables (relationship and influence) account for 0.99% variance in the dependent variable (attitude). Results from the analysis of variance (ANOVA) show that, $F(df\ 2,472 = 25.98, p < 0.00)$, indicated a statistically significant relationship less than 0.05 by the independent variables (relationship and influence) on the dependent variable (attitude). This indicates that, overall, the model applied is significantly good enough in predicting the outcome variable.

The further analysis was done on this significant relationship, as the coefficient for the Beta weight for the amount of standard deviation unit of change in the dependent variable for each standard deviation unit of change in the dependent variable. The standardized coefficients Beta weight which reveals the amount of standard deviation unit of change in the dependent variable for each standard deviation change unit change in the dependent variable. It was discovered that, (a) the independent variable, influence has the strongest positive effect on the attitude because the Beta ($\beta = .11, .03$) shows statistically significant relationship because the significance value was less than 0.05 alpha value. (b) The independent variable, relationship has the next stronger positive effect on the credibility because the Beta ($\beta = .25, .00$) shows statistically significant relationship and the significance value was less than 0.05 alpha value. In this case, students that want to study chemistry must take more Mathematics classes since a general chemistry student's mathematical preparation is directly related to their performance (Akinoso, Olafare, Aliyu, Agoro, 2016). Also, 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 result of this study was in line with the findings of Akinoso, Olafare, Aliyu, Agoro, (2016) on Mathematics and chemistry an inseparable companion in Science and Technology Education that, the knowledge of Mathematics relates with chemistry and knowledge of Mathematics influence the students' performance in chemistry. The results also corroborate with the findings of Soleymani and Rekabdar (2016) on the relation between Mathematics self-efficacy and Mathematics achievement with control of Mathematics attitude, the results show that there is a significant relationship between self-efficacy and Mathematics achievement.

Conclusion

Based on the findings of this study, it could be concluded that, there was a relationship between the variables considered in this study, that is, Mathematics and chemistry relationship, influence of the knowledge of Mathematics to chemistry and students attitude to Mathematics and its effect on attitude and performance in chemistry. It was also concluded that, influence of the knowledge of Mathematics to chemistry has the strongest positive effect on the attitude of students to Mathematics on attitude and performance in chemistry. In this case, any student that wish to study chemistry must possess adequate knowledge of Mathematics and for the reason of relevance of Mathematics in chemistry, students that want to study chemistry and come out with good grade, must attend more Mathematics class to increasing the learning of Mathematics while attending normal or regular chemistry class.

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