

# Chemistry Students' Mathematics Ability as a Correlate of their Performance in Senior Secondary School Examination

## REVIEW ARTICLE

### How to cite this article

Konduon, A.Tartenger, T.T., Agbidye, A. and Enemariae, V. (2019), Chemistry Students' Mathematics Ability as a Correlate of their Performance in Senior Secondary School Examination, *Education Review Letts.* 4 (12), Pp6.

**Received:** December 12, 2019

**Accepted:** December 15, 2019

**Published:** December 20, 2019

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## ABSTRACT

*This study investigated Chemistry students' Mathematics ability as a correlate of their performance in Senior School Certificate Examination in Makurdi L.G.E.A of Benue State. The study aimed at re-emphasizing the importance of Mathematics to Chemistry and other science Subjects. Two research questions and two hypotheses guided the study. The ex-post factor research design was employed in carrying out the study. This involved the use of already existing data of 500 students in secondary schools in Makurdi Local Government Area of Benue State. Using spearman correlation and t-test statistics, it was found that there existed a significant relationship between Mathematics and Chemistry at 0.05 level of significance. The study therefore recommended that the necessity of Mathematics for Chemistry students in secondary schools to be sustained and resources required for effective teaching and learning of both Chemistry and Mathematics should be made available.*

**Keywords:** Chemistry, Mathematics, Students, Ability, Correlate and Performance School.

## INTRODUCTION

Science education is a tool for developing critical thinking ability in learners to solve scientific tasks. Mathematics and Chemistry are science related subjects for developing critical thinking ability in students.

Chemistry is a branch of science that deals with the study of matter, its structure, composition, properties and the changes it undergoes. It includes the study of material substances that occur on earth and in the universe (Ojokuku, 2012). The study of Chemistry help us to understand the way matter behaves and reacts under different conditions, and to device ways in which it can be used to improve our lives.

Mathematics is used widely in Chemistry as well as all other science subjects. Mathematical calculations are absolutely necessary to explore important concepts in Chemistry (D'Ambrosio,

2007). Without some basic mathematical skills, these calculations and Chemistry itself, will be extremely difficult. However, with a basic knowledge of some of the Mathematical skills, one could be well prepared to deal with the concepts and theories of Chemistry effectively.

The position of Mathematics is indeed glaring. That is why the secondary school curriculum makes it mandatory for students to take Mathematics at the secondary school certificate level. The knowledge of students in Mathematics is indeed necessary for effective performance in Chemistry. This is based on the fact that Chemistry is the science that deals with numbers and calculations. Mathematics as a subject which dwells reasonably on the manipulation of numbers and indeed positively influence the students' performance in Chemistry.

Maduabum (2007) posits that a student needs basic knowledge of Mathematics like change of subject formula to understand topics like density, mole concept, theory of gases, chemical equilibrium, heat and energy changes, diffusion and electrolysis. These are taught in Chemistry. Consequently, the relationships between variables such as volume, pressure, temperature, are revealed through the use of mathematical concepts. Different Mathematical topics such as vectors, calculus, logarithms and arithmetic are applied to solve Chemistry problems.

Aba (1991) describes mathematics as a communication system of those concepts of shape, equality, size and others used in describing various phenomena both in physical, biological and economic situation. Through the application of science, man ensures the convexity of his existence, also the prestige and political power of any nation resides in its level of scientific activities. Emaikwu (2010) states that Mathematics is the queen of science and no nation can hope to achieve any measure of scientific and technological advancement without proper foundation in school Mathematics.

Abah (1991) also regards Mathematics as the art of science of dealing with numbers, quantities and their internal, external and space relationship. Abah further noted that science and technology depend heavily on the collection, analysis and interpretation of qualified information or data. Hence whenever scientist engage in their investigation, which always involves data gathering, analysis and interpretation of such data, they must make use of various forms of mathematical skills, principles, theories, table etc. to give meaning to their result in a precise form. Mathematics and science provide a base for the country's socio-economic emancipation and they cannot be totally separated from the space of development in any nation. Also no home can function effectively today in the absence of modern day technological breakthrough. Many members of the mathematics and Chemistry community believes that the integration of mathematics and Chemistry enhances students understanding of both subjects and this has brought about the integration of mathematics and science in all levels of the school curriculum by National Science and Mathematics Standard (Federal Government of Nigeria (2014).

In the recent times, Chemistry remains one of the subjects whose result has continued to be of very low grade or passes in certificate examinations like WAEC and NECO. This has been attributed to the deficiency in Mathematics which is very fundamental to the excellence in Chemistry. Most researches undertake seem to consider the failure in Chemistry as the inability of the students to perform well in Mathematics (WAEC, 2016). This research therefore considers it necessary to determine whether chemistry students' mathematical ability affects their performance in senior school certificate examination.

## MATERIALS AND METHODS

### Research Questions

The following research questions were raised to guide this study.

- (i) What is the relationship between students' Mathematical ability and their performance in Chemistry?
- (ii) To what extent does gender affects students' performance in Mathematics and Chemistry?

### Hypotheses

The following hypotheses are formulated and tested at 0.05 level of significance.

- i. There is no significant relationship between students' mathematical ability and their performance in chemistry.
- ii. Gender does not affect students' mathematical ability and their performance in Chemistry significantly.

This study employed ex-post facto design because its nature does not warrant a control and manipulation of variables (Emaikwu, 2010). It rather is involved the inspection, collection and analysis of data that had already occurred and made available to the researcher in the form of students' achievement scores in the WASSCE in selected secondary schools in chemistry.

### Data collection

Six schools out of the 63. SSCE approved secondary schools in Makurdi local government area of Benue State, Nigeria were sampled. The area which is the centre of learning and supervision of academic programmes in the state was used to give credence to the research. Multi-staged method of sampling was used, in that the six (6) schools were purposefully selected for the study while bearing in mind the nature of each school. This was done in this manner in order to vary the types of school to cover single, mixed, and science oriented.

A total of 500 students were sampled by means of proportionate sampling from each of the schools, that is, the more the number of students, the more the sample. This made up 50 boys and 50 girls, that is 100 students from each of the years from 2010 – 2014. In mixed schools however, gender balance was ensured by sampling the same number of male and female students depending on the number of students in the school.

### Data analysis

The method of data analysis used in this research is spearman correlation, since the achievement of students in Mathematics is to be correlated with the achievements of students in Chemistry. t-test statistics was employed to test the significance of hypotheses. This was done by converting the  $\rho$  (rho) values accordingly to t-test at a test significance level of  $p < 0.05$  (two tailed).

## RESULTS AND DISCUSSION

### Research Question 1

What is the relationship between students' mathematical ability and their performance in chemistry?

**Table 1: t-test for the correlation between Chemistry and Mathematics for the years 2010, 2011, 2012, 2013 and 2014.**

Year	Pair	N	Corr.	t.Cal	df	t-Crit
2010	Chm/Math	100	0.89	29.84	98	1.98
2011	Chm/Math	100	0.93	37.41	98	1.98
2012	Chm/Math	100	0.93	37.41	98	1.98
2013	Chm/Math	100	0.86	26.50	98	1.8
2014	Chm/Math	100	0.92	35.00	98	1.98

Referring to Table 1, it can be seen that the relation between Chemistry and Mathematics is positive and strong. This is indicated by the correlation values of 0.89, 0.93, 0.86 and 0.92 for the years 2010, 2011, 2012, 2013 and 2014 respectively. Thus, answering research question one that, there is a positive and strong relationship between students' achievement in Mathematics and Chemistry.

To what extent does gender affects the relationship between students' performance in Mathematics and Chemistry?

To answer this research question, the scores of male and female students in mathematics and chemistry were computed separately and then examined on the basis of sex as shown in Table 2.

**Table 2: Correlation Coefficient Obtained on the basis of Sex in Mathematics and Chemistry**

Year	School	Pair	N	Corr.	t-Cal	df	t-Cri
2010	A (Boys)	Chm/Math	25	0.81	11.00	23	2.069
	D (Girls)		15	0.79	7.87	13	2.160
2011	A (Boys)	Chm/Math	25	0.86	12.81	23	2.069
	D (Girls)		15	0.93	13.62	13	2.160
2012	A (Boys)	Chm/Math	25	0.93	18.12	23	2.069
	D (Girls)		15	0.96	23.98	13	2.160
2013	A (Boys)	Chm/Math	25	0.95	21.45	23	2.069
	D (Girls)		15	0.89	10.87	13	2.160
2014	A (Boys)	Chm/Math	25	0.85	12.38	23	2.069
	D (Girls)		15	0.89	10.87	13	2.160

From the results obtained in Table 2, it shows that for the male students (school) the correlation coefficient obtained was 0.81, 0.86, 0.93, 0.95 and 0.85 for the years 2010, 2011, 2012, 2013 and 2014 respectively. While for the female students (school) the correlation coefficient obtained was 0.79, 0.93, 0.96, 0.89, and 0.89 for the years 2010, 2011, 2012, 2013 and 2014 respectively.

In essence, both correlation coefficient are positive and both fall in the same magnitude of correlation coefficient of best fit. It therefore shows that the level of relationship between

students' performance in mathematics and chemistry is the same and very high. Therefore students' performance in Mathematics and Chemistry is not affected by gender.

#### **Hypothesis 1**

There is no significant relationship between students' Mathematical ability and their performance in Chemistry. Referring to Table 1, the t-calculated are indicative of the fact that there is a significant relationship between mathematics and chemistry of WASSCE. This is because the calculated t-value of 29.84, 37.41, 37.41, 26.50 and 35.00 for the years 2010, 2011, 2012, 2013 and 2014 respectively, are all well higher than the critical t-value of 1.98 at 0.05 levels. Thus, the null hypothesis is rejected.

#### **Hypotheses 2**

Gender has no significant relationship between students' achievement in Mathematics and Chemistry.

From Table 2, the t-value calculated for male and female school shows 11.00, 12.81, 18.12, 21.45 and 12.386 for the male school for years 2010, 2011, 2013, and 2014 respectively and then 7.87, 13.62, 23.98, 10.87 and 10.87 for the sampled years respectively. In each case it can be seen that the t-calculated in each case is higher than the critical values of 2.069 for male school and 2.160 for the female school at an alpha level of 0.05 with a degree of freedom of 23 and 13 respectively. Therefore the null hypothesis which stated that gender has no significant relationship between students' achievement in Mathematics and Chemistry is accepted and its alternative is rejected. This means that gender has no barrier in the relationship between students' achievement in Mathematics and Chemistry.

Result from analysis of hypothesis one which states that there is no significant relationship between students' performance in Mathematics and Chemistry revealed that there exist a very high and positive relationship between students' mathematical ability and their performance in Chemistry, and this implies that a student who is a high academic achiever in Mathematics will also be a high academic achiever in Chemistry and vice versa.

The study agrees with the studies carried by Kurumeh (2006) which appear to show that mathematical ability or mathematical aptitude or accumulated procedural knowledge is positively correlated to success in traditional introductory Physics and Chemistry courses that emphasize quantitative problem solving. In addition, Kurumeh (2013) asserts that for any science material to be assimilated by students, such a material must be presented in a mathematically understandable form.

This study also agrees with the views expressed by Emaikwu (2010) that Mathematics is the bedrock of all meaningful scientific and technological development of every nation and several mathematical concepts and skills are necessary and required in the understanding of Chemistry, Physics and Biology.

The findings are consistent with the findings of Anyo (2005), and Ekpo and Usoro (2011) who carried out separate researches to ascertain whether a multiple relationship exists involving students' performance in Chemistry, Physics, and Mathematics. It was established that there is a positive relationship between mathematics and science. This study has thus confirmed the inter-connectivity that exists in the content and context between mathematics and other science subjects, particularly chemistry and physics.

It was also found that gender does not significantly affect the relationship between students' performance in mathematics and chemistry. This is due to the fact that the correlation coefficient obtained from male and female students was positive and high.

## CONCLUSION

This research work was aimed at investigating the relationship between the Mathematical ability of students' and their performance in Chemistry among secondary schools in Makurdi local government area of Benue State. It has been discovered that a very high relationship between students' performance in Mathematics and Chemistry existed but gender does not have an effect or influence on students' performance. Based on the findings of this study, it was recommended that mathematics which has been made core and compulsory to secondary school students is to be sustained, especially for science students, resources required to enhance effective teaching and learning of both Chemistry and Mathematics should be made available by the relevant authorities for a positive and better performance in both Mathematics and Chemistry and teachers who directly handle students, especially those involved in research are to be actively involved in policy decisions that bother on academics as well as on the structure of education.

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