

## **Prior Knowledge of Relevant Mathematical Concept as Precursor of Academic Achievement in Chemistry in Oyo Metropolis**

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The study examined if student achievement in chemistry could be enhanced by teaching them selected mathematics concepts prior to chemistry teaching or teaching them selected mathematics concepts simultaneously with chemistry. The sample of the study was three hundred students selected by simple random techniques from 4,853 senior secondary II students in Oyo Educational Zone. The design was quasi-experimental involving three groups. Group A was taught relevant mathematics concepts before chemistry group B was taught mathematics with chemistry simultaneously while group C received no mathematics lesson. The instrument used to harvest data was chemistry Achievement Test (CAT) adapted from West African examinations Council (WAEC) and National Examination Council (NECO) 2011-2020. The groups were pre-tested with the instrument comprising eighty (80) multiple choices question and post-tested with a reshuffled faction of the pre-test after the experiment. The data obtained was analyzed using t-test. The results of the study revealed that group taught relevant mathematics concept before chemistry lessons performed better than the two other groups. It was recommended that curriculum should be designed in a way that relevant mathematics topics essential for chemistry should be taught earlier in senior secondary.

### **INTRODUCTION**

The bedrock on which every nation anchors the foundation of its growth and development is science and technology. Chemistry as an integral part of science and technology is of great significance in our world. It is the “Mitochondrion” of science and technology. The power of chemistry culminates into an enabling infrastructure that delivers the food, medicines, dynes, etc and many more product that are hallmark of modern life.

Akpan (2008) indentified mathematics as one of the problems militating against students achievement in chemistry. The place of mathematical skill in teaching chemistry for sustainable achievement should be emphasized as lack of requisite mathematical skill would make it impossible to produce the type of chemistry graduate of diverse educational programmes that can fit properly into the world of work and real life practice of what was learned (Offiah & Samuel, 2008).

### **Statement of the Problem**

The language of science is mathematics. Some mathematical concept frequently occur in secondary schools chemistry and their knowledge is important for the understanding of some chemistry principles. This study intends to review when it is most suitable to teach the students the mathematical concepts essential for understanding chemistry.

### **Purpose of the Study**

The study seeks to achieve the following:

- I. To investigate if prior teaching of selected mathematical concept before teaching chemistry principles can enhance student academic achievement in chemistry.
- II. To find out whether teaching them mathematical concepts simultaneously with chemistry principles can improve students academic achievement in chemistry.

### **Significant of the Study**

The study will allow curriculum planners to ascertain stages at which relevant mathematical concepts significant for particular topics in chemistry are taught. This will foster team teaching between chemistry and mathematics teachers, most especially while preparing scheme of work.

### **Scope of the Study**

A number of mathematical concepts are required for better understanding of some topics in chemistry. For this study, only the following mathematical concepts are considered;

- Significant figures
- Simple equations
- Logarithms
- Change of subject of formulae
- Statistical treatment of data
- Mensuration

The Chemistry topics covered in this study are Mass-Volume Relationship Reactions, Acid-Base Reactions(Volumetric Analysis) Energy and Chemical Reactions, Chemical Equilibrium.

### **Research Questions**

This study is guided by the following research questions:

1. Do students who were exposed to prior lessons on selected mathematical concepts (SMC) before exposing them to chemistry lessons and those who were simultaneously exposed to lessons on selected mathematical concepts and chemistry differ in their academic achievement in chemistry?

2. Is there any different in the academic achievement in chemistry of students who were simultaneously taught SMC and chemistry and those who received lessons in chemistry alone?
3. To what extent do students who were exposed to lessons on SMC prior to lessons in chemistry differ in academic achievement in chemistry to those who were exposed to lessons in chemistry alone?

### **Hypotheses**

The following hypotheses were designed to guide the study.

**Ho1** There is no significant interaction effects on achievement in chemistry of students who received lessons on SMC before Chemistry lessons and those who simultaneously received lessons on SMC and Chemistry.

**Ho2** There is no significant interaction effect on the achievement in Chemistry of students who received Chemistry lessons on SMC and Chemistry.

**Ho3:** There is no significant interaction effect on the achievement in Chemistry of students who received lessons on SMC prior to Chemistry lessons and those who received lessons Chemistry alone.

### **Research Design**

Quasi-experimental research design was adopted for the study/ there were three groups, two experimental groups and one control group for the study.

**Group A:** These are the students that were taught Selected Mathematical Concepts (SMC) before exposing them to chemistry lessons.

**Group B:** These are the students that were simultaneously taught Selected Mathematical Concepts and Chemistry.

**Group C:** Those students who were exposed to only Chemistry lessons.

### **Population of the Study**

All the four thousand eight hundred and fifty three (4853) SS2 students in the fifty four secondary schools that make up Oyo educational Zone of Oyo State formed the population for this study.

### **Sample and Sampling Techniques**

Out of the 4,853 SS II students in the Educational Zone, 300 SS II students from six Secondary Schools in the zone were used for the study. Simple random techniques was used to select the sample from the population. The selection was done by selecting eighteen schools by tossing from the population and were subjected to a pre-test were subjected to ANOVA to select six schools. The selected schools were found to be equivalent in terms of their class were used.

Table 1: Sampled Schools for the Study

Treatment	Schools	Male	Female	Total
Experimental	1	23	27	50
A	2	21	29	50
Experimental	3	26	24	50
B	4	23	27	50
Control	5	28	22	50
	6	31	19	50
		152	148	300

### Instrument

The instrument used for data collections was Chemistry Achievement Test (CAT). This is an achievement test adapted from West African Examinations Council (WAEC) and National Examination Council (NECO) (2011 -2020).

Topic	Knowledge	Compre hension	Application	Analysis	Synthesis	Evaluation	Total
Mass-Volume Relationship Reactions	1 (1.25%)	2 (2.5%)	2 (2.5%)	2 (2.5%)	2 (2.5%)	1 (1.25%)	12.5%
Acid-Base Reactions (Volumetric Analysis)	4 (5%)	4 (5%)	4 (5%)	2 (2.5%)	3 (3.75%)	3 (3.75%)	20(25%)
Energy and Chemical Reactions	6 (7.5%)	4 (5%)	3 (3.75%)	7 (8.75%)	5 (6.25%)	4 (5%)	29 (36.25% )
Chemical Equilibrium	3 (3.75%)	4 (5%)	3 (3.75%)	4 (5%)	3 (3.75%)	4 (5%)	21 (26.25% )
Total	17.5%	17.5%	15%	18.75%	16.25%	15%	80 (100%)

### **Administration of Treatment**

Two major treatment were carried out on the groups. The first is the Mathematics teaching called Selected Mathematics Concepts (SMC). The Mathematical Concepts (SMC). Mathematical Concepts were significant figures, simple equations, Logarithms, Change of Subject of formula, Statistical treatment of data and mensuration. The second treatment carried out on the group is Chemistry teaching. All the topics covered were part of first term SS 2 Scheme of work in Chemistry. They are Mass-Volume Relationship Reactions, Acid-Base Reactions (Volumetric Analysis), Energy and Chemicals Reactions and Chemical Equilibrium.

**Experimental Groups:** The treatment for the experimental groups was coordinated and supervised by the researcher. The researcher gave explanations to the research assistant (Mathematics and Chemistry teachers of the selected schools) on what to do and how to go about it.

**Group A:** For the first two weeks, this group was taught selected Mathematical Concepts (SMC) by their mathematics teacher for eight periods a week (double period by four times). However Chemistry was taught to the students by their Chemistry teachers from the third week. Two double periods per week was used, totaling sixteen periods from third week to sixth week.

**Group B:** One Mathematics periods was taught per week fro the first four weeks of the study and two periods per week in the last two weeks of the study totaling eight periods of Mathematics teaching. Chemistry was taught from the first week to the last week of the study. It was structured in such a way that Chemistry lesson precede Mathematics lesson each day. This group was exposed to a total of sixteen periods of Chemistry teaching i.e three periods of Chemistry were taught per weeks for the first four weeks and at the last two weeks, two periods of Chemistry were taught per week.

### **Control Group**

**Group C:** This group was not exposed to any selected Mathematical Concepts (SMC). This group was taught Chemistry from the third week at the rate of four periods per week totaling sixteen periods. By the end of Six weeks, all the members of the groups were given four days for revision, after which post-test was then administered to them.

### **Procedure for Data Collections**

Chemistry Achievement Test (CAT) was administered at the beginning of the study as pre-test to determine the entry level of the students. The re-arranged CAT was used to collect data after the administration of treatment as post-test. The scores of the experimental Groups A and B and Control group, C were recorded separately and subjected to data analysis.

### Procedure for Data Analysis

The research questions were answered using descriptive statistic mean and standard deviation scores. Inferential Statistical of t-test was used to test the hypotheses. Data generated were analysed at 0.05 level of significance.

### Data Analysis

Table 3: Pre and Post tests mean scores of students who received SMC before Chemistry lessons (Group A) and those who simultaneously received both lessons.

Group	Pre-test mean	Post-test mean	Mean gain
A	10.24	66.54	56.30
B	11.30	52.38	41.08

Table 4: Pre -test and post test mean scores of students w who received lessons on SMC and Chemistry. Simultaneously (Group B) and those who received lesson inn Chemistry alone.

Group	Pre-test mean	Post-test mean	Mean gain
B	11.30	52.38	41.08
C	11.48	43.49	32.01

Table 5: Pre -test and Post -test mean score of students who were exposed to SMC before chemistry teaching and those who received lessons in chemistry only.

Group	Pre-test mean	Post-test mean	Mean gain
A	10.24	66.54	56.30
C	11.48	43.49	32.01

Table 6: t test comparison on the post-test mean scores of Group A and B

Group	N	X	Sd	Df	Cal.t	Crt.t	p?0.05
A	100	66.54	12.36	198	14.48	1.97	0.05
B	100	52.38	8.45				

Table 6: Showed that the achievement in Chemistry of students who received lessons on SMC prior to Chemistry lessons and those who received SMC and Chemistry simultaneously differ significantly. Hence, the null hypothesis is rejected and the alternative accepted.

Table 7: t test comparison on the post test mean scores of Group B and C

Group	N	X	Sd	Df	Cal.t	Crt.t	p?0.05
B	100	52.38	8.45	198	6.76	1.96	0.05
C	100	43.49	10.04				

Results from table 7 revealed that there is significant difference in achievement in Chemistry of students who simultaneously exposed to lessons in SMC and chemistry and those who only received lessons in chemistry.

Table 8: t test comparison on the post-test mean scores of Group A and C

Group	N	X	Sd	Df	Cal.t	Crt.t	p?0.05
A	100	66.54	12.36	198	14.47	1.96	0.05
B	100	43.49	10.04				

Result from table 8 showed that the students achievement in chemistry after receiving SMC prior to chemistry lessons significantly differ to those who were exposed to chemistry alone.

### Discussion of Results

From the two experimental groups (A and B) achievement scores, it was revealed that the group who were taught SMC prior to chemistry lessons performed better than the group who were taught SMC and chemistry simultaneously. This finding is in agreement with Offiah and Samuel (2008) who reported that prior knowledge of some mathematical principles enhance academic achievement in chemistry.

The findings of this study also showed that having relevant skills in mathematics before receiving chemistry lessons promote students achievement than when essential mathematics and chemistry are being taught at the same time or when needed mathematics principles are not taught at all before chemistry lessons. This is in conformity with the submission of Etukudo and Nnaobi (2010) who emphasized that lack of prior requisite mathematics training would make it impossible for students to adequately perform well in chemistry.

### Recommendations

1. Curriculum should be arranged in such a way that relevant mathematics topics essential for chemistry are taught earlier in senior secondary.
2. Chemistry and mathematics teachers should be working as a team.

### ***References***

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