

THE EFFECT OF PRIOR KNOWLEDGE OF REQUIRED MATHEMATICAL PRINCIPLES ON THE ACHIEVEMENT OF SENIOR SECONDARY SCHOOL STUDENTS IN CHEMISTRY

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Abstract

The effect of mathematics in teaching and learning of Chemistry cannot be overemphasized. The level of students' achievement in Chemistry with the prior knowledge of required mathematical principles amongst 135 Chemistry students from selected Senior Secondary 2 students in Anambra State is the aim of this study. The design is quasi-experimental involving three groups of the selected students. The grouping is as follows: group one was taught required mathematics before Chemistry, group two was taught mathematics and Chemistry concurrently; while group three received only Chemistry lesson. The groups were pre-tested with the instrument comprising of fifteen multiple-choice questions based on the topic- Gas laws. Gas laws require the knowledge of graph and statistics. After the experiment they were post- tested. t-test and ANOVA were used for the analysis. The results show that students taught required mathematics principles before receiving Chemistry lessons performed better than those received chemistry and required Mathematics principles concurrently. And those that received Chemistry and required Mathematics principles concurrently performed better than those that received Chemistry alone.

Introduction

Chemistry is typically an experimental Science and relies primarily on practical work. Studying Chemistry helped us to be trained scientifically. It is essential for technological growth of any nation. It has contributed greatly towards providing the basic needs in the Society. It has wide application in food production, Clothing, Housing, Medicine, Transportation, Industries, Chenrurgy and so on.

Despite the fact that the knowledge of Chemistry cuts across many careers, it is unfortunate that only few students pick interest in this subject and succeed. Several recent studies have revealed a decline in students' interest in science subjects especially Physics and Chemistry (Ezenwa 1985, Akpan 1985, Inikori and Ezenwa 1985). Bernadette (1999) indicated that the students' failure rate in Chemistry is becoming alarming. Among the factors that contribute to the failure of students in Chemistry is the presence of Mathematics in Chemistry. It seems that poor mathematical background influences the students negatively towards the study of Chemistry. Aferniche and Bello (1985), indicated that certain mathematical skills are required for interpretation of quantitative data in Science practical work. They observed that multiplication, division, addition, subtractions, four figure tables, conversion of units, means/Averages, percentages and ratio were used. Oguntimchin and Olaninonye (1999), indicated that a topic like thermodynamics in Chemistry is not interesting to most students. This may be due to the mathematical rigours they have to go through in developing most of the thermodynamic principles and concept. Mathematics is a deductive science while Chemistry is an inductive science (Irikori and Ezenwa U 85). Badru (2004), predicted that performance of students in mathematics affect their performance in other science subjects. Alonge, Ikeobi and Thompson (1986), show that Chemistry is usually studied along with mathematics. For the students to succeed in Chemistry, they must have put in at least little effort of knowledge in mathematical aptitude. This paper therefore, is to study the effect of prior knowledge of required Mathematical principles on the achievement of senior secondary students in chemistry.

Statement of the Problem

There is a problem of effective teaching and learning of chemistry today in schools. This has resulted due to presence of the mathematical aspect of chemistry. The relationship between mathematics and chemistry is the concern of this paper.

Purpose of the Study

I lie researcher intend to find out if students performance in Chemistry can be improved by teaching them Required Mathematical Principles (R M P) before Chemistry is taught, or teaching mathematical principles concurrently with Chemistry.

Significance of the Study

This study will improve the teaching and learning of Chemistry. It will help the students to pick interest and perform better in Chemistry.

The Scope of Study

Chemistry requires a number of mathematical concepts and principles. Some of these mathematical concepts and principles include: Algebra, Graph, Variations, Statistics, Stimulus equation and so on. Graph and statistics will be considered here.

Hypotheses

The following hypotheses were formulated at 0.05 level of significance.

- HO₁. There will be no statistical significant difference between the mean performance scores of students who received prior knowledge of RMP before Chemistry and those taught without RMP.
- HIO₂. There will be no statistical significant difference between the mean performance scores of students who received prior knowledge of RMP before Chemistry and those students who received RMP and Chemistry concurrently.
- HO₃. There will be no statistical significant difference between the mean performance scores of students who received Chemistry and RMP concurrently and those students who received Chemistry alone.
- HO₄. There will be no statistical significant difference in performance scores according to the ability levels of the students exposed to the strategies used in the study.

Research Design

This is quasi-experimental research. It uses intact classes of students involving a control. Pre-test and Post-test were incorporated in the design. See table 1.

Table One: design for experiments

Group	Pre-Testing Treatment Post-Testing		
G₁	Pr₁	c₁	PO₁
G ₂	Pr ₂	C ₂	PO ₂
G ₃	Pr ₃	C ₃	PO ₃

Key

G₁ . represented the group that received RMP before Chemistry lesson.

G₂ . . represented the group that was taught RMP and Chemistry concurrently.

G₃ . represented the group that did not receive RMP at all but was taught only Chemistry.

Pr₁ . - represented pre-testing to group 1

Pr₂ . - represented pre-testing to group 2

Pr₃ . - represented pre-testing to group 3

C₁ . represented control to group 1

C₂ . - represented control to group 2

C₃ . - represented control to group 3

PO₁ .- represented post-testing to group 1

PO₂.. represented post-testing to group 2

PO₃.- represented post-testing to group 3.

Area of the Study

The study was conducted in Awka town.

Population

The population consisted of all S.S.II Students studying Chemistry in all Senior Secondary Schools in Awka town.

Sampling and Sampling Technique

This, study involves classes of 45 best 2 students in chemistry in each class selected from the following Schools.

1. Igwebuikie Grammar School, Awka.
2. Girls' Secondary School, Awka.
3. Capital City Secondary School, Awka.

These schools were randomly selected amongst the secondary schools in Awka town.

Data Analysis and Result Presentation

Hypotheses 1: There will be no statistical significant differences between the mean performance scores of students who received prior knowledge of RMP before Chemistry and those taught without RMP.

Table 2: t-Test Comparison of Pre-Test Scores of Group 1 That Received RMP before Chemistry and Group 3 That Did Not Receive RMP

Group	No	Mean	SD	Df	t-cal	t-crit
1	45	10.05	4.56	89	0.67	1.98
3	45	10.90	4.87			

Significant at $P < 0.05$

Table 3: t-Test Comparison of Post-Test Scores Of Group 1 That Received RMP Before Chemistry and Group 3 That Did Not Receive RMP

Group	No	Mean	SD	Df	t-cal	t-crit
1	45	85.64	15.64	89	6.21	1.98
3	45	41.72	8.03			

Significant at $P < 0.05$

Decision: H_0 is rejected from (he post-test in table 3, since t-cal (6.21) is greater than t-crit(1.98). Hence, accepting alternative hypothesis.

Hypothesis 2: There will be no statistical difference between the mean performance scores of students who received prior knowledge of RMP before Chemistry and those students who received RMP and Chemistry concurrently.

Table 4: t-Test Comparison Of Pre-Test Scores Of Group 1 That Received RMP Before Chemistry Concurrently And Group 2 That Received RMP And Chemistry

Group	No	Mean	SD	Df	t-cal	t-crit
1	45	10.05	4.56	89	1.02	1.98
2	45	11.00	3.17			

Significant at $P < 0.05$

Table 5: t-Test Comparison of Post-Test Scores Of Group 1 That Received RMP Before Chemistry Concurrently And Group 2 That Received RMP And Chemistry

Group	No	Mean	SD	Df	t-cal	t-crit
1	45	85.64	15.84	89	3.37	1.98
2	45	71.88	17.40			

Significant at $P < 0.05$

Decision: H_{02} rejected for the post-test in table 5, since $t\text{-cal}(3.37) > t\text{-crit}(1.98)$. Hence accepting the alternative hypothesis

Hypotheses 3: There will be no statistical significant difference between the mean performance scores of students who received Chemistry and RMP concurrently and those students who received Chemistry alone.

Table 6: t-Test Comparison Of Pre-Test Scores of Group 2 That Received Chemistry And RMP Concurrently Ant Group 3 That Did Not Receive RMP

Group	No	Mean	SD	Df	t-cal	t-crit
2	45	11.00	3.17	89	0.99	1.98
3	45	10.90	4.87			

Significant at $P < 0.05$

Table 7: t-Test Comparison of Post-Test Scores of Group 2 That Received Chemistry And RMP

Group	No	Mean	SD	Df	t-cal	t-crit
2	45	71.88	17.40	89	7.21	1.98
3	45	41.72	18.03			

Significant at $P < 0.05$

Decision: H_{03} is rejected from the post-test in table 7, since $t\text{-cal}(7.21) > t\text{-crit}(1.98)$. Hence alternative hypothesis is accepted.

Hypothesis 4: There will be no statistical difference in performance scores according to the performance of the students exposed to the strategies used in the study.

Table 8: One way ANOVA for post Achievement Test of significance according to Low, Medium and High Ability Levels.

Ability levels	No	Mean	Source of Variation	SS	Df	Ms	f-cal	f-crit
Low	10	20.01	SSB	18.289	2	9.15	74.62	2.71
Medium	10	47.06						
High	10	66.50						

Significant at $P < 0.05$ since $f\text{-cal}$ is greater than $f\text{-crit}$ as shown in table 8.

Decision: H_{04} is rejected in table 8, since $f\text{-cal}(74.62) > f\text{-crit}(2.71)$. Hence accepting alternative hypothesis

Discussion

The study tested four hypotheses on the effect of prior knowledge of required mathematical

principles (RMP) on the students' achievement in Chemistry. The summary of the results show that prior knowledge of required mathematical principles (RMP) is better than having RMP and Chemistry concurrently. Having RMP and Chemistry concurrently was also found to be better than learning Chemistry without the knowledge of required mathematical principles. Furthermore, result in table 4 shows that the high ability group obtained the highest score (66.50), followed by the medium ability group (47.06) and lastly the low ability group (20.01), Inyang and Ekpenyang (2000); Akinsola and Igwe (2002), found similar result.

Conclusion

The result of the study have highlighted the superiority of prior knowledge of required mathematical principles (RMP) before Chemistry lesson is taught over having RMP and Chemistry lesson concurrently. While having RMP and Chemistry lesson concurrently is superior to not having required mathematical principles at all. There were difference in mean scores of the ability groups and they were significant at $P < 0.05$ on ANOVA and t-test analysis. It is therefore, advised that the basic required mathematical principles be taught before the main topics in Chemistry are taught.

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