

## **Enhanced Mastery Learning Strategy on the Achievement and Self Concept in Senior Secondary School Chemistry**

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**Abstract:** The present study examined the effect of enhanced mastery learning strategy on achievement and self-concept in senior secondary school chemistry. The widespread poor performance and the negative attitudes towards chemistry of secondary school pupils have been largely ascribed to teaching problems. Self-concept is vital in the field of psychology and education which is greatly valued as a desirable educational goal. The purpose of this paper is to examine the effects of enhanced mastery learning strategy as an intervention programme to enhance chemistry achievement and self-concept. One hundred and twenty seven senior secondary schools year two (SSS II) students' from three secondary schools in Bauchi state of Nigeria participated in the study. They were taught for six weeks with conventional teaching, mastery-learning strategy combined with co-operative learning strategy and were administered the chemistry self-concept scale and chemistry achievement test before and after teaching. Results showed that there was significant difference in mastery achievement among the groups. It was found that enhanced mastery-learning strategy with co-operative learning strategy helped in improving chemistry achievement and self-concept by the students. It is therefore, important that teachers in general and chemistry teachers in particular provide students with experiences in which they have opportunity to monitor their progress, ask questions, elaborate and qualify their ideas.

**Key words:** Mastery learning • Self-concept • Chemistry • Cooperative-learning • Educational development • Nigeria

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### **INTRODUCTION**

The role of chemistry in the development of the scientific base of a country cannot be overemphasized and Nigeria is not an exception. Yet with the increasing importance of chemistry to the unfolding world, the performance of nigerian students in the subject at the secondary school remains a dismal failure. Several factors have been advanced to affect students' achievement. Oloyede [1] and Demide [2] reported that such include the student factor, teacher factor, societal factor, the governmental infrastructural problem, language problem and instructional strategy employed by the teacher among others. Of all these factors, the instructional strategy employed by the teacher appeared overbearing because of its manipulability. Zayum [3] noted that instructional format provided by the teacher seems to be the medium of effective learning and that good teaching makes learning more meaningful. He argued that while good teaching helps the learner more quantitatively, poor teaching would lead to poor learning and poor performance. Mathematics teachers in Turkey have been advised and encouraged to use visualization in their teaching practices [4]. According to Arcavi [5] visual representation

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in mathematics provides not only a fulfillment of our desire but also to stimulate student's mathematical thinking. Infact, the cause of the widespread poor performance and negative attitudes towards chemistry by secondary pupils in Nigeria have largely been attributed to teaching problems [6].

However, in recent years one method of teaching that has gained attention and greatly acclaimed as having a positive outcome in chemistry is the mastery learning teaching strategy Bloom [7] Johnstone [8], Oloyede and Demide [6]. The study of self concept is vital in the fields of psychology, education and for society in general, whilst self concept is widely valued as a desirable educational goal and is frequently posited as a mediating variable that facilitate the attainment of other desired outcome such as academic achievement [9]. Consequently many intervention studies have been designed to enhance self concept by Bryne [10], Whyhe, [11] and Oloyede and Demide [6]. But few studies have produced positive results while intervention studies are plagued with series of problems like methodological flaws, the use of weak intervention, the failure to incorporate a logical match between intended outcomes and outcomes measurement, weak experimental designs and so on. Therefore, this study was designed to examine the effects of enhanced mastery learning strategy as an intervention programme to enhance chemistry achievement and self concept by senior secondary school students.

### **Hypotheses**

The following null hypotheses were tested.

**H<sub>01</sub>:** There is no significant difference in the mean post test scores among the three groups (Control, (CM) Mastery learning (ML) and Enhanced Mastery Learning (EML) with respect to achievement in chemistry.

**H<sub>02</sub>:** There is no significant difference in the mean post test scores among the three groups (CM, ML and EML) with respect to self concept in chemistry.

### **MATERIALS AND METHODS**

**Research Design:** This study employed a quasi-experimental pre-test, post test control group design with three experimental groups namely; Enhanced Mastery Learning Strategy (EMLS) , Mastery Learning Strategy (MLS) and one control group (CM).

The sample consisted of one hundred and twenty seven SSII students (86 males, 41 females) from three co-educational secondary schools in Bauchi, Bauchi State, Nigeria. One class was randomly selected from streams in each of the three co-educational schools and the three classes selected were randomly assigned to experimental groups.

Instruments - Two instruments were used to collect data for the study.

- Chemistry Self Concept Questionnaire (CSCQ)

This is a 34-item self-report inventory designed to measure self-concept of students towards chemistry. Students responded to the scale by indicating how the item applies to them within the 5-points Likert format ranging from least like me (1) to most like me (5). The reliability of the whole scale was determined to be 0.89.

- Chemistry Achievement Test (CAT)

This is a 40 items multiple-choice test that covered the learning units treated during the study. The reliability of the test was found to be 0.82 using the Kuder Richardson formula 21 (KR 21)

**Procedure:** Students in the experimental group one (EMLS) received mastery learning strategy combined with cooperative learning method, while the experimental group two (MLS) students had mastery learning strategy only. The students in the control group (CM) received the conventional method of teaching chemistry. The experiment lasted six weeks. All the three groups were administered the CSCQ and CAT before and after the exercise, respectively.

**The Teaching Phase:** Three learning units based on the scheme of work of SS II chemistry being used in the three schools were covered during the teaching phase. Three teaching approaches were employed namely: Enhanced Mastery Learning Strategy and conventional method of teaching.

### **Enhanced Mastery Learning Strategy**

#### **This Method Incorporates the Following Steps:**

- Brief review of the previous lesson (or group discussion where applicable at the end of a diagnostic test).
- Stating objectives of the new lesson.
- Teaching of the topic.
- Class exercises.
- Diagnostic progress tests at the end of a specific lesson or two or more correlated lessons.
- Corrected test returned to the students to serve as a feedback before the next topic.
- Students (in groups) discussed the tasks among themselves i.e. areas of group weakness.
- Review of major ideas or test items by the teacher where the students are not sure of by referring to specific pages of instructional materials.
- Students helping each other over aspects of specific learning tasks which appear difficult or test items which they have missed.
- Provision of parallel formative test until students reached the mastery standard set.
- Students' individual scores were pooled and averaged. The averaged score represent the score of each student in a group.

### **Mastery Learning Strategy**

#### **The Following Steps Were Followed:**

- Brief review of previous lesson or re-teaching of previous lesson via other methods.
- Stating objectives of new lesson.
- Teaching a new topic.
- Class exercises.
- Diagnostic progress tests at the end of a specific lesson or more correlated lessons.
- Corrected test returned to the students to serve as feedback before the next topic.
- Re-teaching was done on the diagnostic test before the new lesson.
- Parallel formative test was given until mastery standard set was reached
- Individual score in the diagnostic test represent the score of each student.

### **Conventional Method**

#### **The Following Steps Were Followed**

- Brief review of the previous lesson
- Introduction of new lesson
- Class exercise
- Marking exercise
- Correction and Summary

**RESULTS**

**H0<sub>1</sub>:** There is no significant difference in the mean post-test score among the three groups (CM, ML and EML) with respect to achievement in chemistry.

The student's post test scores were analyzed using analysis of covariance at 0.05 level of significance and the results are presented in Table 1.

The results showed a significant difference in the mean scores of students exposed to the three methods of teaching with regards to achievement in chemistry. Therefore H0<sub>1</sub> is rejected.

Table 2 shows the Scheffe Multiple Range Test for post achievement scores of experimental and control groups at P= 0.05 level of significance. The three groups are divided into three subsets. The results showed that the mean scores of the three groups are significantly different from one another in the direction of EML > ML > CM which finally refutes hypothesis one that there is no significant difference between the three methods with respect to chemistry achievement.

**H0<sub>2</sub>:** There is no significant difference in the mean post test scores among the three groups (CM, ML and EML) with respect to self concept in chemistry.

The student's post test scores were analyzed using analysis of covariance at 0.05 level of significance and the results are presented in Table 3.

The results indicated a significant difference between three groups with respect to self concept in chemistry and hence H0<sub>2</sub> is rejected.

Table 1: Analysis of Covariance of post achievement test scores of CM, ML and EML Groups

Source	Sum of squares	Df	Mean squares	F ratio	P
Covariates	671.265	1	671.265	43.671	0.001***
Pre-Cat	671.265	1	671.265	43.671	0.001***
Main Effect	1288.897	2	644.449	41.926	0.001***
Method	1288.897	2	644.449	41.926	0.001***
Explained	1960.162	3	354.387	42.508	0.001***
Residual	1890.641	123	15.571		
Total	3850.803	126	30.562		

\*\*\* Highly significant at p<0.001

Table 2: Multiple range test for post achievement scores of CM, ML and EML Groups

Mean	Group	1	2	3
21.95	1			
28.14	2	*		
30.59	3	*	*	

\* Denotes pairs of groups significantly different at p <0.05

Table 3: Analysis of Covariance of post chemistry self concept scores of experimental and control groups

Source	Sum of squares	Df	Mean squares	F ratio	P
Covariates	6610.518	1	6610.518	41.650	0.001***
Pre-Cat	6610.518	1	6610.518	41.650	0.001***
Main Effect	12217.558	2	6108.779	38.489	0.001***
Method	12217.558	2	6108.779	38.489	0.001***
Explained	18828.076	3	6276.025	39.543	0.001***
Residual	19521.972	123	15.571		
Total	38350.047	126	30.562		

\*\*\* Highly significant at p<0.001

## **DISCUSSION**

Results of the analysis of covariance indicated significant differences between the three groups (CM, ML and EML) with respect to achievement in chemistry and do not provide support for  $H_{01}$ . The enhanced mastery learning strategies produced the highest means score of 30.59 while the mean scores of ML and CM were 28.4 and 21.95 respectively. This confirms that EML is the most effective technique or strategy of the three employed and could therefore be argued that classroom teaching based on mastery learning and enhanced mastery learning (as defined in this study) are more facilitative to the learning of chemistry than the conventional method. This result suggested that the declining performance of students in chemistry may well be due to the chemistry teacher's conventional method that is widely employed in our secondary school classroom.

The findings on whether or not students in chemistry class based on CM, ML and EML strategies will differ on their chemistry self concept showed that significant differences existed among the groups with respect to chemistry self concept. This implied that there is significant difference in chemistry achievement of both control and experimental groups and this probably helps to improve chemistry self concept. The results of this study confirm an earlier finding in this area [12].

This study have clearly shown that teaching strategies enhance chemistry self concept and that students in both mastery learning and enhanced mastery learning condition performed significantly better than their counterparts in the conventional method. Thus, better teaching approach would correspondingly increase the chemistry self concept of students.

## **CONCLUSION**

The inadequacies of the traditional method of teaching chemistry led to the focusing of attention on other alternative strategies for communicating chemistry concepts more meaningfully to the learners. This study indicated that:

- Mastery learning strategy can facilitate both cognitive and affective outcomes.
- Enhancing mastery learning strategy with cooperative activities have been shown to be more facilitative in improving chemistry achievement and chemistry self concept.

It is therefore, important that teachers in general and chemistry teachers in particular provide students with experiences in which they have opportunity to monitor their progress, to ask questions, elaborate and qualify their ideas.

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