Effect of Mastery Learning Approach on Senior Secondary School Students Achievement in Biology in Imo

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ABSTRACT

This study examined the effect of mastery learning approach on the senior secondary school students' achievement in Biology in Imo state, Nigeria. The study was a pre-test, post-test quasi experimental, non-equivalent control group design. A sample of 150 SSII Biology students was drawn from three (3) secondary schools in Orlu Education Zone of Imo State, Nigeria. Three research questions and two null hypotheses guided the study. Biology Achievement test (BAT) was used to collect data, the data was analyzed using mean, standard deviation and ANCOVA. The result obtained revealed that the experimental group achieved significantly better than the control group, hence mastering learning approach improved students' achievement in biology. Also male and females' students improved equally in Biology Achievement Tests. It was recommended that mastery learning should be encouraged for use by teachers in their classroom.

Keywords: Effects, Mastery learning, Achievement, Biology.

INTRODUCTION

Science subjects constitute a major part of the subjects being offered in secondary schools in Nigeria today. This subjects are so important that the Federal Government National Policy on Education (2008) stated in specific terms that "the secondary schools' education shall provide trained manpower in the applied science and technology. The National Policy on Education (2008) further stated that science subjects constitute part of the core subjects at both junior and secondary school levels. The importance attached to science by the Federal Government could be due to the general belief that science is capable of improving and changing skills, attitudes, knowledge about themselves, their environment and their world. (Nnorom and Obi, 2013)

Biology is one of the subjects that is taken very serious in the school system, irrespective of country or level of education. Biology has been described as a model of thinking which encourages learners, to observe, reflect and reason logically about a problem and in communicating ideas, making it the central intellectual discipline and a vital tool in science (Imoko & Agwagah, 2006; Iji, 2008). In the words of Salman (2005), biology is a precursor of scientific discoveries and inventions. It is the foundation for any meaningful scientific endeavour and any nation that must develop in science and technology must have a strong biology foundation for its youths. In terms of curriculum relevance, biology is compulsory at the secondary school level for science students as required by the Joint Admission and Matriculation Board (JAMB), Despite the recognition accorded biology due to its relevance, Elekwa (2010) remarked that students exhibit non-chalant attitude towards biology, even when they "know that they need it to forge ahead in their studies and in life. Such students who _have already conditioned their mind that biology is a difficult subject are usually not serious in the learning of biology and therefore perform poorly in biology tests and examination. Uwadiae (2010) reported that less than 42% of registered candidates in SSCE obtain Credit pass in science which Biology is one. West African Examination Council Chief Examiners –report 2010, 2013, indicated poor achievement of students in biology in Senior School Certificate Examination.

According to Olunloye (2010), this ugly trend of high failure rate in biology is a national disaster. Many Researchers agree that the Conventional teaching method is deficient in meeting the, needs, of majority of. learners (Abakpa and Iji, 2011; Igboanugo, 2013; Nnorom & Obi, 2013; Nnorom, 2015; Saudat & Umaru, 2015). The Conventional Teaching Approach is described as teacher centred and didactic, with learners simply listening, copying notes, doing class work and doing assignments. Furthermore, with Conventional or lecture teaching method, gap between high and low ability studentsis vary wide.

Research Findings also showed that gender imbalance in science and mathematics Education is not a recent trend but stretches back to Prehistoric culture (Obasi, 2007; Oshun, 2007; Ochu & Atagher, 2010; Nnorom, 2013). Other

reasons identified by Offor (2007) includes marriage among girls, lack of female opportunity cost of Education, early role model, Poor self-concept inherent sex differences and gender stereotyping among students and teachers. Therefore, feasible ways of improving the performance has remained an area of great concern for researchers. One option is mastery learning.

Mastery learning according to (Block & Anderson, 2010), is an approach to learning intended to bring all students to a pre-established level of mastery on a set of instructional objectives. Students are taught well-defined objectives, formatively assessed, given corrective instruction if needed, and then summative assessed. This model provides teachers with timely feedback about the progress and deficiencies of students in meeting specific instructional goals and presents a curriculum that provides extra time and opportunities for all students to attain mastery. This learning approach takes care of individual differences in learning due to individual student's characteristics as well as their aspirations. Mastery learning as an instructional strategy is based on the principle that all the students can learn a set of reasonable objectives with appropriate instruction and sufficient time to learn. In mastery learning, students are not advanced to a subsequent learning objective until they demonstrate proficiency with the current one. Students must demonstrate mastery on unit examinations, typically 80% before moving into new material (Davis & Sorrel, 2011). Students who do not achieve mastery receive remediation through tutoring, peer monitoring, small group discussion, or additional homework. Remediation requires additional time. Mastery Learning is anchored on behavioral learning theory which believes that learning is determined by experiences that learners are exposed to within the environment (Bruce, 1990).

Many researchers, Akinsola (2011); Abakpa and Iji (2011) found that Mastery Learning Approach improved students' achievement in sciences (Biology). Thus, the problem of the study posed in question form: will Mastery Learning Approach (MLA) help to improve students' achievement in Biology? Again, will gap in gender difference in Biology Achievement test be narrowed if Mastery Learning Approach (MLA) is adopted by biology teachers?

Purpose of the Study

The purpose of this study is to determine the effect of mastery learning approaches on senior secondary school students' achievement in biology in Orlu education zone of Imo State, Nigeria. Specifically, the study intends to: -

- **i.** Determine the effect of Mastery Learning Approach (MLA) on students' achievement in biology.
- **ii.** Determine the mean scores of students taught using Mastery Learning Approach (MLA) and those taught using conventional method,
- **iii.** Determine the mean scores of male and female students taught biology using Mastery Learning, (MLA).

Research Questions

The following research questions were formulated to guide the study:

- **i.** What is the effect of mastery learning approach on students' achievements in biology?
- **ii.** What is the effect of mean achievement scores of student taught using Mastery Learning Approach (MLA) and those taught using conventional method in biology?
- **iii.** What is the effect of MLA on mean achievement scores of male and female students in biology?

Research Hypotheses

Two null hypotheses were formulated and tested at 0.05 level of significance:

Ho1: There is no significant difference between the mean achievement scores of students taught biology using Mastery Learning Approach (MLA) and those taught using conventional teaching method

H02: There is no significant difference between the mean achievement scores of male and female students taught biology using Mastery Learning Approach (MLA).

METHODOLOGY

The quasi-experimental pre-test, post-test, non-equivalent control group design was adopted for the study. Randomly selected groups, intact classes were used in order not to disrupt normal school program during the experiment. One experimental group namely mastery learning and one control group were constituted for the study. A sample of 150 senior secondary class two (SS11) students were selected from three co-educational schools chosen from Orlu Education zone of Imo State. The experimental sample is (N = 77) consisted of 38 boys and 39 girls while the control sample (N = 73) consisted of 37 girls and 36 boys. Purposive or judgmental (non-probability sampling)

was used to select the local Government Area and the schools for the experiment. Simple random sampling was used to select the classes for the experiment.

The instrument for the study was Biology Achievement Test (BAT). The researcher constructed 24 multiple choice test items of four options for pre-test, similarly, 24 -multiple choice test items were constructed for post-test. The instrument was Administered to a sample of 30 students who had studied the topics for the experiments on two occasions within 14 days' intervals. These students were drawn from a co-educational school situated in different area from those schools used for experiment. The scores of the 30 students in objective test items were analyzed. A reliability co-efficient of 0.93 was obtained for the objective questions. Pearson product moment correlation co-efficient was used to determine the stability of the instrument in the test re-test and a co-efficient of 0.87 was obtained.

The regular biology teachers were engaged to teach for both experimental and control group using the prepared lesson plans prepared by the researchers. Training was given to biology teachers who took the experimental group on the application of the instructional approach, while the teachers who took the control group used the conventional method. Biology Achievement Test (BAT) was used for both pretest and posttest. The treatment consists of teaching a selected biology concepts nutrition respiration and ecological concepts. The control group was taught the same biology concept using lecture method.

At the end of four weeks of twelve periods, the teacher administered the post test (after reshuffling of the items) to the subject in the two groups using BAT. The scripts from both pre-test and post-test of BAT were analyzed using mean and standard deviation for answering the research questions while ANCOVA was used in testing the hypotheses at 0.05% level of confidence.

Result

Results of the study are presented according to the research questions raised and their corresponding hypotheses.

Research Questions 1

What is the effect of mastery learning approach on students' achievement in Biology?

Table 1: Mean Achievement and Gain scores of experimental and control Groups

Teaching Approach	Pre-test mean	Post-test mean	Main difference scores/Grain
Group 1 Experimental	32.76	64.34	31.38
Group 2 control	33.68	34.26	0.56

From the Table 1 above, the experimental Group 1 had a Gain score of 31.38 while the control group had a gain score of 0.58. This suggests that mastery learning approaches affected the performance of students in Biology positively. A formal test of hypotheses was done to determine weather this differences are statistically significant.

Research Question 2

What is the mean achievement scores of students taught using mastery learning (MLA) and those taught using conventional Learning method in biology?

From Table 1 above the gain scores of 31.38 for mastery learning group 1 is greater than the gain score of conventional method 0.58. This shows that mastery learning affected the biology achievement scores of students' positively more than conventional method of teaching.

Research Question 3

Table 2: Mean score, standard deviation and mean difference of mastery learning approaches in biology achievement test according to gender.

Type of tests	Ability levels			
	Male		Female	
	Mean	SD	Mean	SD
Pre-test	50.63	8.15	21.89	9.36
Post-test	76.29	8.17	57.74	10.84
Mean Difference	25.66		35.85	

For Table 2, the result shows that difference between pre-test and post-test mean achievement score of male and female students in mastery learning are 25.66 and 35,85 respectively, this indicates that both male and female taught using the MLA improved in biology achievement.

Ho_1: There is no significance difference between the mean achievement scores of students taught biology using mastery learning approach and those taught using convention teaching methods.

Table 3: Analysis of covariance (ANCOVA) of performance of students by treatment

Source	Type 111 of Sum of squares	df	Mean square	F	Sig.
Correct	48569.799	3	16189.931	196.005	.000
Model	29919.203	1	29919.203	362.219	.000
Intercept	18628.552	1	18628.552	225.528	.000
Approach	32321.360	2	16160.680	195.650	.000
Method	12059.568	146	82.600		
Sex	2.446	1	2.446	.011	.918
Error	501926.000	150	11.864		
Total	60629.360	149			
Corrected total					

a. R square = 801 (Adjusted R square = .797)

Source: Computed using achievement scores of experimental and control groups**.**

The result of Table 3 indicates an F-ratio value of 195.65 which is statistically significant at the 0.05 level. We reject the null hypotheses and conclude that there is significant difference in the performance of students in the 2 groups. Students in group 1 outperformed their counterparts in group 2. Hence, mastery learning Approaches enhanced the achievement of students in biology.

Ho_2: There is no significance different between the mean achievement score of maleand female students taught biology using Mastery Learning Approach (MLA).

From table 3, F-calculated is .011 at P <0.91. the null hypothesis is therefore accepted. That is there is no significant difference between the mean achievement scores of male and female students taught biology using mastery learning approach.

DISCUSSION

The result of this study revealed that students taught biology with MLA improved in their biology achievement scores than those taught using conventional method. The findings of this study corroborate those of other researchers, Salman (2005); Wambugu and Changeiywo (2008); Olunloye (2010); Akinsola (2011); Abakpa and Iji (2011), who reported that mastery learning if effectively employed would enhance students in academic achievement in various school subjects.

The effectiveness of mastery learning approach could be due to the inherent advantage of the approach on insisting on attainment of mastery of unit objective before proceeding to the next topic. Hence, the pre- requisite to a topic is mastered well before studying the topic. The procedure of obtaining feedback on efficacy of instrument through continuous testing and retesting with other remediation is an added advantage of the approach. Hence students really understood the principles, conceptsand formulae involved the topics.

Furthermore, the result shows that MLA improved the achievement scores of both male and female students in BAT. The result is in line with Abakpa and Iji (2011) who stated that there is no gender difference when good teaching method is used.

CONCLUSION

Research evidence shows that instructional method or strategy influences academic achievement of students. Current results showed that the conventional teaching approach is deficient in meeting the needs of majority of learners, hence the need to refocus attention on other alternative approaches. Mastery learning approach is found to be effective in enhancing the achievement of students in Biology. It also helps to bridge the gap between high and low ability students.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

- Biology teachers should be encouraged to adopt mastery learning approaches during instructions to poster students learning and retention of biology concepts.
- Educational planners should in corporate in the plans period when the slow learners will be given additional instructions to ensure mastery and activities that will be used to keep the fast learners busy during such periods considering the fact that learners learn at different rates.
- Government need to motivate their teachers to encourage them put in their best to ensure that all students attain mastery of concept taught. Also government should recruit more qualified teacher to be able to cope with the increasing population of secondary school students.

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