



The effect of using mastery learning approach on academic achievement of senior secondary school II physics students

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ABSTRACT

The method of teaching students is very important for the students' academic achievement and general performance. This study investigated the effects of mastery learning approach on the academic achievement of Senior Secondary two students in Physics. The study was a pre-test, post-test quasi-experimental study on Physics Achievement in Ogidi Education zone of Anambra State, Nigeria. Physics Achievement Test (PAT) was used to collect data and data was analyzed using mean, standard deviation and Z-test. The result obtained revealed that the experimental group achieved significantly ($P < 0.05$) better than the control group. The female students achieved slightly better than their male counterparts but the difference was not significant at $P = 0.05$. Implication of the findings is that mastery learning is seen to enhance learning greatly and recommendation is that mastery learning should be encouraged for use by teachers in place of the lecture method.

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Introduction

Education in the world has been recognized as a veritable Instrument for nation's growth and development. It is the bed rock on which development of any nation is based. Oriaifo (2002) supported this view by stating that one of the most important goals of education is for it to be functional. One of the aims of Education is to inculcate in the child the spirit of equity, creativity, through exploration of natural and local environment.

Science is recognized widely as being of great importance locally and internationally both for economic well being and need for scientifically literate citizenry (Ntukidem, 2004).

Physics as a science subject has been viewed as difficult by some students who shy away from the concepts. Ivowi (1999) has recorded a lot of misconceptions in physics which made students perform poorly in examinations. Equally, Ivowi (1999) noted among others, inadequate infrastructures and teaching methods as factors affecting students' poor performance in physics.

The teaching method that a teacher adopts is one factor that may affect Students' Achievement (Mills, 1991). Therefore the use of appropriate teaching method is critical to the successful teaching and learning of physics. Regrettably, most science teachers in a bid to cover their syllabus adopt the lecture based method in teaching (Ali and Akubue, 1998). The lecture method is mainly teacher centered and subject content driven (Liddle, 2002). It discourages initiative, curiosity and creativity in learners and does not offer them opportunity to interact effectively with their peers and learning materials. This has resulted in student's loss of interest, reduced participation in class and poor learning achievement. Focusing on this, Nzewi (1993) advocated the use of a more effective method of teaching science; the mastery learning approach (MLA), no doubt can be one of such technique.

Mastery Learning Approach (MLA) is an instructional method where students are allowed unlimited opportunities to demonstrate mastery of content taught (Kibler, 1981). It involves divisions of subject matter into units that have predetermined objectives or unit expectations. The strategy allows students to study materials unit after unit they master it. Mastery of each unit is shown when the students acquire the set pass mark of a diagnostic test. Additional time learning is prescribed for those requiring remediation and students continue to cycle until mastery is met. Mastery learning is committed to criterion referenced evaluation and to a strong emphasis on feedback and corrections throughout the learning experience. The major components of the strategy are: specifying objectives, division of course content, formative diagnostic evaluation, remedial instruction, and summative evaluation.

Mastery learning approach is implemented in a group based and teacher-placed format (Liddle, 2002). Four optional steps are (a) Defining mastery (b) Planning for mastery (c) Teaching for mastery (d) Grading for mastery.

Normal specification of cognitive objectives, division of course content into units, formative diagnostic, remedial instruction and criterion referenced summative evaluation. Essential for mastery learning is the development of a learning unit that takes between one and many hours for students to learn. The students work to master the learning unit rather than an entire course of curriculum. Gusky and Gates (1986) conduct a meta-analysis which contained 27 studies addressing five areas: student achievement, student retention, time variable, students and teacher variables. They found that achievement results were positive. Students in mastery learning program at all levels showed increased gains in achievements over those in lecture. Students retained what they had learned longer under mastery learning both in short-term and long-term studies. Student

developed more positive attitude towards learning, also recorded are higher expectations for students and greater personal responsibilities for learning outcomes.

Guskey and Piggott (1988) conducted a meta-analysis in an attempt to answer several questions about group-based mastery learning program, what types of education outcome are affected by the use of mastery learning? Do programs or age affect mastery?

They found that students' achievement was the primary variable of interest in the majority of these studies in regards to student achievement. A positive effect was obtained as a result of the application of group-based mastery strategies.

Kulik (1990) conducted a meta analysis involving 108 evaluation of mastery learning programs. The outcome measures used were performance on extermination at end of instruction and showed positive effects on students' achievements although these effects were higher on locally prepared examination than on nationally standardized test. Majority of studies showed a positive correlation in student attitude towards instruction and content of mastery learning program.

Inputs by contributors show that mastery learning stands as one of the ways of improving students' achievement.

Significance of Study: The findings of this study will benefit the teachers to give them better understanding of the method that will be suitable to provide favourable learning condition. Equally, it will help the educators and curriculum planners in designing appropriate strategies involving mastery learning.

Scope of study: The study was restricted to S. S. 2 students of physics and concepts of Electricity and Circuits were taught.

1. *Research questions: what is the difference between the mean achievement scores of students taught using mastery learning and those taught using lecture method?*

2. *What is the difference between the achievement scores of male and female students taught using mastery learning approach?*

Hypothesis: H_{01} : There is no significant difference in achievement of physics students taught with mastering learning and those taught with lecture method.

H_{02} : There is no significant difference in achievement of physics between male and female students taught with mastery learning.

Methodology

Design: The design for this study is a pretest-posttest quasi-experimental study involving non randomization of the subjects. The Secondary school classes existed as intact group and school authorities does not normally allow the classes to be dismantled for research purposes.

Area of the Study: The study was conducted in Idemili North Local Government Area in Ogidi Education Zone of Anambra State, Nigeria.

Population of the Study: The population of this study consisted of 513 males and females physics students of senior secondary schools II in the zone.

Sample and Sampling Techniques: Two out of ten schools in the area were randomly selected using purposive random sampling. The sampling consisted of 20 males and 20 females of S S 2 physics students. The two groups were randomly assigned to experimental and control groups.

Instrument for Data Collection: This consisted of PAT developed by the researcher. It consisted of 20 multiple choice items used for both pretest and post test.

Validation of the Instrument: Both the face and content validation of the instrument were done by three physics teachers. Reliability of instrument was done with 15 students who were

not part of the study target, using Kuder Richardson yielded 0.71.

Results and Discussions

The pre-tests were administered to all students and scores collated. Then the 20 students in the experimental group were subjected to treatment. They were allowed opportunity to achieve a mastery of the concepts taught while the other 20 students in the control group were taught using the lesson plan and lecture method as a normal class setting. After the treatment, both groups were now given the post tests i.e. the instrument. Then the results were later collated and analyzed.

Research question 1

1. *What is the difference between the mean achievement scores of students taught using mastery learning and those taught using lecture method?*

Table 1: Means of Pre-Test and Post Test scores of students in both experimental and control groups.

	Group A (Experimental)			Group B (Control)		
	X ₁	Y ₁	Gain	X ₂	Y ₂	Gain
Mean	42.6	79.65	37.15	42.9	65.78	22.88
Total	1704	3190	1486	1716	2631	915

From table 1, the mean gain on achievement for experimental group is 37.15 and 22.88 for control group. The mean gain of students taught with mastery learning is higher than those taught using lecture method which showed that mastery enhanced achievement.

Research question 2:

what is the difference between the achievement of male and female students taught using learning Approach?

This is shown in table 2.

Table 2: Mean and standard deviation scores for male and females exposed to mastery learning.

	Male	Female
Total	1575	1525
Mean, \bar{X}	78.75	81.25
Standard Deviation, SD	10.40	8.98
Number	20	20

The mean of male students exposed to mastery learning is 78.75 while that of female students is 81.25. This showed that the means of female in experimental group is 81.25 which that of male is 78.75 with a difference of 2.5 which show that both sex maintain unequal level of achievement even though females scored better than males.

Hypothesis I: There is no significant difference in achievement of physics between students taught with mastery learning and those taught with lecture method. This is answered with a Z-test analysis shown in table 3.

Table 3: Z-test for difference between mean achievement score for students in experimental and control for Hypothesis 1

Group	Number of Students	Mean	SD	Z-Cal	Z critical
Experimental (A)	20	79.75	8.96	5.03	1.96
Control (B)	20	65.78	15.13		

Significant at $P < 0.05$

df = 38

The Z test showed there is a significant difference because the Z calculated of 5.03 is greater than Z critical of 1.96. Thus, the hypothesis is rejected.

Hypothesis 2: There is no significant difference in achievement of physics between male and female students taught with mastery learning. This hypothesis is answered in table 4 which

showed a Z-test analysis of the scores between male and female students in both groups.

Table 4: Z-test for difference between mean achievement score for students in experimental and control for hypothesis 2.

Sex	Number of Students	Mean, \bar{x}	SD	Z-Cal	Z critical	Result
Male	20	81.75	8.96	0.81	1.96	Not significant
Female	20	78.75	10.40			

Significant at $P = 0.05$

Df = 38

The hypothesis was tested using Z test to ascertain whether there is significant difference between the achievements of students taught using mastery learning based on sex. Results on table – shows that Z cal of 0.81 is lower than Z critical which shows that there is no significant difference; therefore the Null hypothesis is accepted.

Results show that the students who were taught using mastery learning achieved statistically higher scores as compared with those taught with lecture method. This implies that mastery learning approach is more effective in enhancing student's achievement. This agrees with Block (1990) and Bloom (1992) who through studies on mastery learning suggested that the learning procedures enhanced achievement mainly in mathematics and science since learning in these subject areas are ordered and sequential. It equally agreed with Gamba (2004) who found that mastery learning facilities students learning of chemistry better than the lecture method.

The result showed that there was no significant difference between the mean achievement scores of male and female in the experimental group. This agrees with the findings of Kulik (1990) who discovered that males and females do not differ significantly in academic achievement.

Conclusions

Based on the results of study, it can be concluded that MLA facilitates students learning of Physics better than lecture method. The result also showed that there are no significant differences between achievement scores of male and female students exposed to mastery learning Approach.

➤ **Implications:** This study offers evidence that MLA can enhance achievement. Since achievement is necessary in a student's learning process, physics teachers are encouraged to use ML. the features of MLA suggests that it can be implemented in the existing school setting.

➤ **Recommendations:** This study has provided data on effectiveness of MLA in enhancing academic achievement.

Curriculum develops will find the study helpful in designing appropriate last strategies involving M.L which would enhance learning of physics.

References

1. Ali, A. and Akubue A. (1998) Discovery and Expansional Text. Presentation Among Anambra, Benue, Imo, Bendel State of Nigeria Sec Sch Mathematics Journal of Research in Learning and Teaching 1 (1), 78-93.
2. Bloom, B.S (1992). The Two Sigma Problem. The Method of Group Instruction as Effective One-on-One-Tutoring. Education Research 13(6). 4-16.
3. Block, J.H (1990). Mastery Learning: Theory and Practice. New York. Hot Rinebat and Winnson.
4. Gamba, L. O. (2004), effect of mastery learning on achievement in Chemistry, Journal of Research in Teaching and Learning, 1(1).
5. Guskey, T., and Gates, S. (1986). Synthesis of Research on the Effects of Mastery Learning in Elementary Secondary Classroom. Educational Research, 60(2), 265-306.
6. Guskey T. and Piggot T. (1998), Research group based mastery learning programs: A meta-analysis. Journal of Educational Research, 81(4) 197-216.
7. Iwovi U.M (1999). Misconception of Students in Physics in Perspectives of Education. Ibadan: Macimillian Publishers. Pp. 110-123.
8. Kulik, C., and Kulik, J. (1990). Effectiveness of Mastery Learning Programs: A Meta-Analysis. Review of Research, 60 (2), 265-306.
9. Liddle, M., (2000). Student Attitude towards Problem-Based Learning. Journal of Excellence in College Teaching, 11(2) 163-190.
10. Mills, T. (1991). Mastery versus Non-Mastery Instruction with Varying Test Item Feedback Treatment. Journal of Education Psychology 65(1), 50-58.
11. Ntukidem, N. O. (2004). Constraint to Effective Instructional Standard in Programmes of Business Education in Tertiary Institution, Business Edu. Journal, 4(2).
12. Nzewi, U.M. (1993). Effect of Prior Knowledge Behavioural Objectives and Study Question on Attitude to Biology, International Journal of Education and Research, 539.
13. Oriafior, S.O. (2002). Refocusing Tertiary Education in Nigeria: in Refocusing Education in Nigeria. Benin City: Da-Sylva Influence