
MASTERY LEARNING APPROACH ON SECONDARY STUDENTS' INTEGRATED SCIENCE ACHIEVEMENT**Dr. Tim. E. Agboghroma FRHD, FIPMD.**The Faculty of Education Complex, Department of Curriculum and Integrated Science
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ABSTRACT: *This study is aimed at finding the effects of Mastery Learning Approach (MLA) on students' Achievement in Integrated Science. The study was Quasi-experimental Non-randomized Pretest-Posttest Control Group Design. The target population comprised of Junior Secondary School Students (JSS) in Delta Central Senatorial District of Delta State, Nigeria. The accessible population was JSS III Students drawn from the district co-educational schools in the Senatorial District. Purposive sampling technique was used to obtain a sample of four co-educational secondary schools. Each school provided one JS III class for the study, hence a total of 120 students were involved. The students were taught the same Integrated Science topic of Drug Abuse and Metabolism in the Human body. In the experimental group MLA teaching method was used while the conventional method was used in the control group. The experimental group was exposed to MLA for a period of four weeks. The researcher trained the teachers in the experimental group on the technique of MLA before the treatment. Pretest was administered before treatment and a posttest after four weeks of treatment. The instrument used in the study was Integrated Science Achievement Test (ISAT) to measure students' achievement. The instrument was pilot tested to ascertain the reliability. The reliability co-efficient alpha was 0.74. Data was analyzed using ANCOVA statistics. Hypothesis was accepted or rejected at 0.05 significant level. The result of the study show that MLA teaching method resulted in higher achievement. The researcher concluded that MLA is an effective teaching method, which Integrated Science teachers should be encouraged to use and should be implemented in all teachers' education programmes in Nigeria and other African nations.*

KEYWORDS: Mastery Learning Approach, Junior Secondary School Students, Integrated Science Achievement, Conventional Teaching Method, Experimental and Control Groups

INTRODUCTION

The introduction of Integrated Science in Nigerian school system dates back in 1968. Hence, its introduction is relatively new in the Nigerian school system. Integrated Science as a subject teaches the fundamental principles of science and help to unify the sciences for a better understanding by the students at the Junior Secondary School level. But presently as a result of the reform agenda in recent years in Nigeria, Integrated Science has been renamed Basic Science in the school system. This is as a result of the goals of the National Economic Empowerment and Development Strategy (NEEDS) and the Millennium Development Goals (MDGs) established by the Federal Government as one of its reform agenda in helping to improve its educational policy.

Science is recognized widely as being of great importance internationally both for economic well being of nations and because of the need for scientifically literate citizenry. The knowledge of science and technology is therefore a requirement in all countries and all people globally due to the many challenges that are facing them (Wambugu and Changeiywo, 2007). These challenges according to them include emergences of new drugs resistant diseases, effects of genetic experimentation and engineering, ecological impact of modern technology, dangers of nuclear

war and explosion and global warming among others. As a result, there are rapid changes taking place in industry, communication, agriculture and medicine. This science as an instrument of development plays a dominant role in bringing about these changes of advancing technological development, promoting national wealth, improving health and industrialization. Arising from all these important gains of science, there is therefore the need for effective science teaching and learning in our schools as sure means of achieving the much needed technological breakthrough in Nigeria. This can only be achieved by a meaningful means of impartation of knowledge through good teaching technique. It is only when knowledge is imparted through good technique and one makes sure that the learner has gained something useful which can make his/her experience relatively permanent that one can say that learning has taken place. In time past, the regular teaching method (Conventional teaching method) has remained the only teaching method in teaching the sciences. This method has not achieved the much needed scientific literacy among the Nigerian youths because of its theoretical nature. Most of the time, students are exposed to the sciences without practical involvement. The relevance of this Conventional method and its attendant criticism has not offered the much needed scientific and technological advancement (Agboghoroma, 2005). This has led to the development of new teaching approaches for the impartation of knowledge in the sciences and among these techniques is mastery learning approach.

Mastery Learning Approach (MLA) is an instructional method where students are allowed unlimited opportunities to demonstrate mastery of content taught, Kibler, Cegala, Watson, Barther and Miler (1981) in Wambugu and Changeiywo (2008). MLA involves breaking down the subject matter to be learned into units of learning, each with its own objectives. Adepoju (2002) refers to mastery learning as an innovation which in its various forms is designed towards making learners to perform beautifully well in an academic task. Also Adeyemi (2007) described mastery learning as a teaching strategy that involves a pre-specified criterion level of performance which students must master in order to complete the instruction and move on. According to him, mastery learning involves frequent assessment of students' progress, it provides corrective instruction and emphasizes on all participation, feedback and reinforcement. In the same vein, Wibler et al (1981) in Wambugu and Changeiywo (2007) opined that MLA helps the students to acquire prerequisite skills to move to the next unit. Mastery of each unit is shown when the students acquire the set pass mark of a diagnostic test. The teacher is also required to do task analysis and state the objectives before designating the activities. Mastery Learning Approach (MLA) can help the teacher to know students area of weakness and correct it thus breaking the cycle of failure. Results from research studies carried out on Mastery Learning Approach (MLA) suggest that Mastery Learning Approach (MLA) yields better retention and transfer of material, yield greater interest and more positive attitude in various subjects than Non-Mastery Learning Approaches (Ngesa, 2002; Wachanga and Gamba, 2004 and Wambugu and Changeigwo, 2007).

The researcher is not aware if this method of teaching had been tried out in Integrated Science teaching and learning in Delta Central Senatorial District where performance in the subject has continued to decline. This study was aimed at finding out the effects of Mastery Learning Approach (MLA) teaching method in the teaching of Integrated Science in the Senatorial District. The study was meant to contribute in the understanding of effects of Mastery Learning Approach (MLA) on academic achievement in Integrated Science in Delta Central Senatorial District of Nigeria. And also bearing in mind that, the available research literatures does not indicate any research on the effectiveness of Mastery Learning Approach (MLA) in secondary school Integrated Science. This research study was therefore intended to fill this gap in the body

of knowledge, as well as contribute to existing body of knowledge on the efficiency of MLA as an instructional means of improving the academic achievement of students in Integrated Science.

Purpose of the Study

The purpose of the study was designed to investigate the effect of using Mastery Learning Approach (MLA) on students achievement in secondary school Integrated Science.

Objective of the Study

The specific objective of the study was to compare the achievement of students taught Integrated Science through Mastery Learning Approach (MLA) with that of students taught through conventional teaching methods.

Hypothesis of the Study

The following null hypothesis was tested in this study at 0.05 significant level

H₀₁: There is no statistically significant difference in achievement in Integrated Science between students who are exposed to Mastery Learning Approach (MLA) and those who are not exposed to it.

THE CONCEPTUAL FRAMEWORK

The conceptual framework to guide the study was based on the System Approach (Joyce and Weil, 1980) which propounds that the teaching and learning process has inputs and outputs. It is obvious that a good result anchors on input that has suitable teaching materials. The study was based on the assumption that the blame for a students failure rests with the quality of instruction and not lack of students' ability to learn (Bloom, 1981; Levine, 1985). As it is with the framework, learning outcomes are influenced by various factors and these include learners' characteristics, classroom environment and teacher characteristics. These according to them are extraneous variables which are capable of jeopardizing a study and hence need control. Teacher training determine the teaching approach a teacher uses and how effective the teacher will use the approach. The learners' age and hence their class determine what they are taught. The type of school as a teaching environment affects the learning outcomes. The study involved trained Integrated Science teachers to control the teacher variable. The type of school used was co-educational to control the effect of classroom environment. JSS III students who are approximately of the same age were involved in the study. In this study, therefore, the teaching method used influenced the learning outcomes. The framework is represented diagrammatically in figure 1 below:

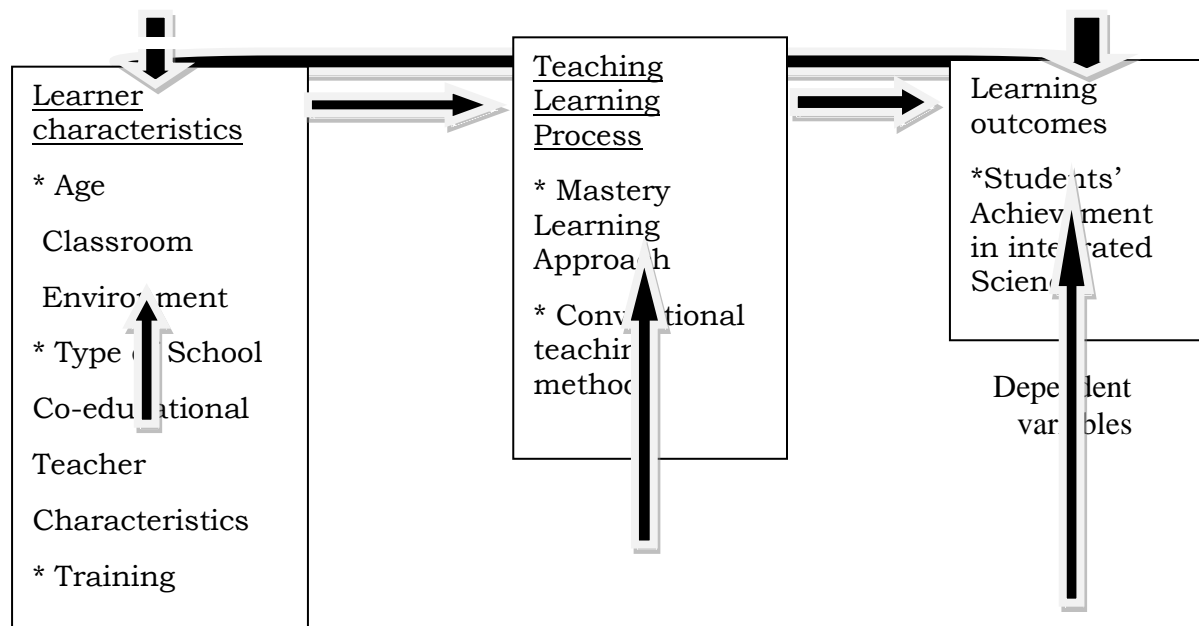


Figure 1: The conceptual framework adopted from Wambugu and Changeiywo (2008)

METHODOLOGY

A quasi-experimental non-randomized pretest-posttest control group design with one experimental group namely Mastery Learning Approach (MLA) and one control group, the conventional method of teaching Integrated Science was employed in the study. The Mastery Learning Approach constituted the independent variables while the dependent variable was achievement in Integrated Science. In a non-randomized study like this, secondary school classes exist as intact groups, as school authorities will not allow the classes to be dismantled for experimental purposes. This design has advantage over others since it controls the major threats to internal validity except those associated with interaction and history, maturity and instrumentation (Cook and Campbell, 1979, in Wambugu and Changeiywo, 2008). In this study, no major event observed in the sample schools to introduce the threat of history and interaction. The conditions under which the instruments were administered were kept as similar as possible across the schools in order to control instrumentation and selection. The schools were randomly assigned to the control and treatment groups to control for selection, maturation and interaction (Ary, Jacobs and Razavien, 1979, in Wambugu and Changeiywo, 2008).

The design is as represented with the symbol as follows:

Group I	(Experiment)	=	$O_1 \times O_2$
Group II	(Control)	=	$O_3 \quad O_4$

Where O_1 and O_3 were pretest; O_2 and O_4 were the posttest; X was the treatment where students were taught using Mastery Learning Approach (MLA). The control had no treatment and the group were taught with the conventional teaching method which is the predominant teaching method in schools in the Senatorial District.

The population of the study is made up of students drawn from public Basic Junior Secondary Schools in Delta Central Senatorial District. The target population of students was 18,176 drawn

from 167 Basic Junior Secondary Schools and with a total of 197 teachers from the Senatorial District.

The sample of the study was made up of 120 Basic Junior Secondary School Three (JSS III) students selected from four local government areas by use of purposive sampling technique. 30 students each were drawn from the four (4) local government areas totaling 120 students. In each school, an intact class was used as either the experimental or control group. In this study, no school had more than one treatment group. The decision was taken in order to avoid the problem of contamination which might occur as a result of having more than one treatment group per school. All the students had an average mean age of 13 years.

Research Instrument

The instrument used in this study was the Integrated Science Achievement Test (ISAT) containing past JSS III questions of the Delta State Ministry of Education. This contained 50 multiple questions. These multiple choice questions were developed by the Test and Statistics section of the state Ministry of Education, Asaba. For the purpose of revalidation, the questions were given to experts in science education for validation. The test was pilot tested using a school in the Senatorial District that was not included in the study but had similar characteristics as the sample schools. This ascertained the test reliability of the instrument. The reliability coefficient was calculated using Kuder Richardson formula 21 and this yielded an estimate of 0.74 alpha which was considered high enough for the study.

The content of the instrument was developed based on Basic Education syllabus of the Delta State Ministry of Education. The area where the instrument was drawn was the second term scheme that contained Drug Abuse and Metabolism of the Human Body. In constructing the test items, a table of specification was worked out. This table was two-dimensional, that showed the test objectives and the content to be tested. This table was required to show the topics selected and the intellectual (cognitive domain) of the content covered in the study. A guiding manual was constructed for the teachers involved in administering Mastery Learning Approach (MLA) that was used throughout the treatment period.

Treatment

The teachers of the experimental group were trained by the researcher on how to use the manual. These teachers were taught using Mastery Learning Approach (MLA) on a different topic other than Drug Abuse and Metabolism of Human Body for one week to enable them master the skills. After this, the pretest were administered to Group I and Group II. The treatment period was four weeks. At the end of the treatment period, a posttest was administered to all the groups. While the group I on mastery learning approach received treatment, those in group II, the control did not receive treatment but taught with the conventional method. The researcher scored the pretest and posttests and generated quantitative data, which were analyzed with the use of Analysis of Covariance (ANCOVA) statistics and use of Multiple Classification Analysis (MCA) to ensure ultimate equivalence of the groups in the posttest.

RESULTS

The non-randomized pretest-posttest control group design used in this study enabled the researcher to have two groups sit for pretests as recommended by Borg and Gall (1989). This enables the researcher to assess the effects of the pretest relative to no pretest and assess, if there was an interaction between the pretest and the treatment conditions. Hence, to test for effect of

Mastery Learning Approach (MLA) on students' achievement in Integrated Science, the test of stated hypothesis comes to play.

Hypothesis Ho₁ of the study sought to find out whether there was any statistically significant difference in achievement in Integrated Science scores between students exposed to Mastery Learning Approach (MLA) teaching method and those who were not exposed to it. To test this hypothesis, analysis of covariance was carried out and result presented in Table 1 below

Table 1: Analysis of Covariance (ANCOVA) summary table of students taught with Mastery Learning Approach (MLA) and those who were not exposed to it

Source of variation	Sum of square	Df	Mean square	P	Sig. of f(p)
Covariates	1211.242	1	1211.242	60.185	.000
Pretest	1211.242	1	1211.242	60.185	.000
Main effect	1603.676	1	1603.676	79.684	.000
Group	1603.676	1	1603.676	*79.684	.000
Explained	2814.918	2	1407.459	69.934	.000
Residual	2354.673	117	20.125		
Total	5169.592	119	43.442		

*Significant at P< 0.05, F critical ratio = 3.92

From the table above F ratio was 79.684 while the F critical value was 3.92. Since the F calculated value was greater than the F critical value, the null hypothesis was rejected. Therefore, there was a significant difference in the mean posttest scores of students taught with the MLA and those who were not exposed to it. And these were those taught with the conventional teaching method. This was an indication that MLA has a role to play in students achievement in

Integrated Science.

The Multiple Classification Analysis of students taught with MLA and Conventional method in posttest scores in Integrated Science revealed relevant results as regards the significant difference in the mean posttest scores in Integrated Science achievement. See Table II below

Table II: Multiple Classification Analysis (MCA) of students taught with MLA and Conventional Method in posttest scores in Integrated Science

VARIABLE + CATEGORY	N	UNADJUSTED DEVIATION ETA	ADJUSTED FOR INDEPENDENTS + COVARIANCE BETA
GROUP			
1. Experimental	60	4.74	4.19
2. Control	60	-4.74	-4.19
		.72	.64 (40.96%)
Multiple R Squared			.545
Multiple R			.738

From the table above, the adjusted mean score for students taught with MLA was 73.83 (i.e. Grand mean of 69.64 + 4.19) as against the conventional method with adjusted mean score of 65.45 (i.e. Grand mean of 69.64-4.19). The table also revealed that MLA accounted for 40.96%, that is $(0.64)^2$ of the variation in the posttest scores. The result indicates that students taught with the MLA out performed their counterparts taught with the conventional method. This confirms the results of the ANCOVA with ISAT as covariate, therefore H_{01} was rejected.

DISCUSSION

The research found out that the students who were taught through the MLA teaching method achieved statistically significant higher scores in the ISAT compared to those that were taught through the conventional teaching method. This implied that MLA teaching method is more effective in enhancing students achievement. Block (1971) showed that students with minimal prior knowledge of materials had higher achievement when taught MLA teaching method than those taught through conventional teaching method. The findings of the current study at 0.05 alpha, showed a statistically significant difference in scores even when the students had no prior knowledge on the topic to be taught when MLA was used as compared to conventional teaching method. This therefore corroborates with the finding of previous researches.

The findings of the current study show that MLA covers small units of study which students show mastery as they proceed to the next. In this study there was improved performance for the students who were taught using MLA. In a related study carried out by Wambugu and Changeiywo (2007) using Kenya National Examination Council past examination papers which were modified to measure the students' achievement in physics, showed similar result. Using ANCOVA statistics, the posttest Physics Achievement Test (PAT) scores as covariate and tested at 0.05 significant level, the groups taught with MLA had higher achievement than the groups taught with RTM. This confirms the results of the ANCOVA with KCPE as covariate in the study. Also, that the difference between the means was as a result of the treatment effect. This implied that the treatment condition affected the MLA groups. In this study also, the groups taught MLA had a similar better performance. The result of data analyzed in this study also showed a statistically significant difference between students taught with MLA and those taught with the conventional method in Integrated Science. The F-ratio calculated was 79.684 and this was significant at 0.05 alpha level. This finding therefore corroborates with studies by Adepoju (2002), Wambugu and Changeiywo (2007) and Akinsola (2013).

An explanation that can be advanced from this better performance by those taught with MLA over those taught with the conventional method could be that of breaking down of learning materials into learnable units for the groups to comprehend. The package also offer re-teaching and re-testing, it motivates students through verbal and written praises and also made sure that students master a unit before advancing to the next unit. This type of learning packages does not only enhance performance but also stimulate students to be more actively involved in the learning process. This is unlike the conventional method where learners are passive learners in the teaching-learning process.

CONCLUSION

Based on the results of this study, it can be concluded that MLA enhances students learning in Integrated Science better as compared to the conventional teaching method

RECOMMENDATIONS

The following are recommendations for the study:

1. Integrated Science teachers should be encouraged to use MLA in the teaching of Integrated Science in the secondary school level especially at the Basic secondary school level
2. Integrated Science teachers should be exposed to workshops and seminars on the use of MLA as a means of enhancing students' achievement in Integrated Science.
3. Curriculum developers will find this study helpful in designing appropriate instructional strategies involving Mastery Learning, which would enhance the learning of Integrated Science.
4. Integrated Science teachers and education inspectors will identify this as an effective teaching method that would be suitable, to provide favourable learning conditions for all students rather than just for the top fraction of the class
5. All teachers' educators will find the study useful in developing programmes aimed at producing teachers capable of structuring learning environment that can equalize their interaction with learners enabling greater learner participation, satisfaction and further academic aspirations.

CONTRIBUTIONS TO KNOWLEDGE

This paper no doubt has contributed to knowledge in the following ways:

1. That the use of mastery learning approach (MLA) in teaching Integrated Science enhances students understanding of Integrated Science since they work in heterogenous groups; and
2. The frontiers of activity-based learning approaches have been expanded with the inclusion of Mastery Learning Approach (MLA) to teaching integrated Science.

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