Effects of Mastery Learning Strategy on Secondary School Students Performance in Mathematics

O. I. Oginni, A. S. Akinola, A. E. Fadiji and P.A. Amole

ABSTRACT

The paper examined the effects of Mastery Learning Strategy (MLS) on secondary school students' performance in Mathematics. It investigated differences in the performance of Mathematics students in conventional and MLS groups. The study adopted a pretest, posttest and control group quasi-experimental research design. The population for the study comprises all secondary school students in Ekiti State. 60 students were the sample selected using the stratified sampling technique. Achievement Test in Mathematics (ATM) was the instrument used for the study. The validity of the instrument was ensured by experts in Mathematics education while the reliability coefficient of 0.83 was obtained, which adjudged the instrument suitable for the study. The findings of the study revealed that there is a significant difference in post-test mean scores of students taught using MLS and the Conventional method. Also, there is no significant difference in the post-test and retention mean scores of students taught using the MLS and Conventional method. There is no significant difference in the post-test mean scores of male and female students taught using MLS and Conventional method. Based on the findings of this study, it was recommended that the use of MLS should be encouraged in Mathematics teaching.

Keywords: Mastery learning strategy, mathematics ability, performance, retention.

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I. INTRODUCTION

Teaching strategy is also known as an instructional strategy, is the method or pedagogy that teacher uses to foster constructive students' engagement on a particular subject matter, through demonstration of different skills acquired over time. Teaching strategies play an important role in impacting mathematics knowledge unto the learners. Methodologies are teachers centered which will aid in achieving results. The methods, techniques, and strategies that teachers adopted could be at times influence the students, levels of mathematics understanding.

Every mathematics teacher has a mandate to teach their students how to master mathematical concepts and internalizing contextual understanding that would prepare them for its future applicability. The assignment of mathematics teacher is hanging in the balance if he/she personally master relevant mathematics concepts but fail to adopt suitable teaching technique that could lead students to the mastering of relevant mathematical knowledge and facts during classroom activities. Mathematics teachers need to incorporate learning strategies that can encourage students to develop a special interest and better performance in the subject. [1] explained that if students view mathematics ability that they either possess as a fixed ability (i.e., innate tendency) or otherwise, there is the likelihood that the

students lose interest when they encounter difficulty with the subject. However, if students perceive mathematics ability as ideas that can be developed through self-study or seeking assistance with ease, when necessary, they may eventually maintain their interest in mathematics despite difficulties or challenges experienced. Therefore, better learning approaches could as well motivate students in developing interest in mathematics teaching and make students acquire standard mathematics ability by playing important role in teaching and learning mathematics.

Mathematics is one of the core crossing bridge subjects into a tertiary institution in Nigeria education system and turns to determine students career choice in science and technology-related worldview. It is expedient for a mathematics teacher to incorporate a method that can enhance students mathematical conceptual understanding. According to [2], conceptual understanding exposes Mathematics teachers' expertise in the area of mathematics mnemonics, language and signs. He stressed that any teacher with this understanding can sharpen students' mathematical maturity and as well aid their reflective index in the subject. Mathematics teaching involves the creation of opportunities for students to learn by providing a supportive learning environment that can withstand any challenges faced by them.

II. Basic Concepts of Mastery Learning

[3] MLS was developed by B.S. Bloom, and it made up of different steps which include distribution of content into parts, formulation of objectives related to each subdivision, organization of teaching for realizing objectives of each division, administering the formative test to evaluate the mastery level and diagnose the knotty areas, remedial instructions are given to remove the ambiguities and attain mastery level by every student. This strategy plays an important role in learning basics e.g., operations in different number systems – Natural numbers, Integers, Rational numbers, Real numbers.

Mastery learning is termed organized learning through ordered steps, in which students have to master the first step before advancing to the next. [4] explained that mathematics mastery is teaching and learning approach that enable learners to develop a deep understanding of mathematics rather than being able to memorize key procedure or resort to note learning. Teaching from simple to complex, concrete to abstract, real to imaginary, has been advocated in the mathematics teaching approach as the way to go [5]. Teachers in most cases use students' mental ability as one of the strong indexes for categorizing them into high, middle and low mental resourcefulness over time. The teacher would ensure that all students in a group are subjected to the same working condition. A mastery learning approach provides the framework of sustainability where to apply their learning a range of contents.

III. Importance of MLS in Mathematics

MLS allows the student to move forward at their own pace as they master mathematics knowledge and skills and position them for effective implementation that will completely change how students learn, how a teacher teaches and how school works. According to [6], mastery learning strategies help students remember mathematics content and procedure and practice their computation skills. Students are especially engaging to master Mathematics content to learn practical information and set procedures.

The pedagogue of MLS encompasses keeping the students working together by supporting mastery of the in-depth knowledge, through questioning, appropriating variations in concepts, intelligent practices and transformation of concrete concept to representational to abstract in solving mathematics problems [7] Advancing mathematics understanding and students ability for critical thinking and reasoning through all-encompassing transferring of new learning to students is not unconnected with mastery learning of mathematics. Richardson listed some effective mathematics learning strategies that will help to raise students understanding aid mathematics scores by; Providing explicit instruction: encourage student discourse: building mathematics vocabulary and offering differentiated learning opportunities.

IV. MLS and Mathematics Teacher

Teachers contribute in no small measure to students' achievements in schools. Teachers who have mastered the subject teaches with dexterity and help to expand student mathematics knowledge. MLS is one of the strategies to be popularized by teachers for students to master mathematics content. Mathematics teacher enables his students to perceive learning difficulties in mathematics as an existing challenge that peers, and adults can help to overcome. MLS exposes the importance of assessment in teaching and learning mathematics [8], perceived that mastery learning approach assessment is not a one – short do – or – write experienced instead, it is an initiative that is ongoing to help students learn Mathematics. [8] further explained that the teacher delivers the unit to students over a few days or weeks, set a formative assessment to measure student's comprehension and move on once a satisfactory pinnacle is reached.

Mathematics formula requested learning strategy which can allow the learners to grasp and master how the formula came into existence and its application in solving a mathematics problem. MLS focuses on ensuring a student grasp any given concept regardless of the time and resource needed for the achievement and mastery of the subject [9]. The incorporation and implementation of MLS enable the students to solve the problem of academic weakness in mathematics. Mastery learning can boost achievement levels, improve students towards learning and give students more confidence when students relearning new concepts.

The application of MLS played an important role in secondary school students' mathematics conceptual understanding, most especially the concepts that are abstract; mastering is deeper, and it occurred as a result of learning repetition skilled. [10] [11]opined that one of the best ways to teach is through concept repetitiveness, which in turns improve mathematics skill.

V. Methodology

The research design adopted was a pretest, posttest, control group, quasi-experimental design. The population for the study consists of all the secondary school students in Ekiti State. The sample for the study consisted of 60 students, selected by using a stratified sampling technique. The instrument used for the study was Achievement Test in Mathematics (ATM). The face and content validity of the instrument was ensured by a consortium of experts in Mathematics education while the reliability coefficient of 0.83 was obtained, which adjudged the instrument suitable for the study.

VI. Results and Discussion

Question 1: What is the effect of MLS on the performance of students in Mathematics?

TABLE I: Mean Scores of Students Taught Using MLS and Conventional Method of Teaching

Group	Pre-test		Post-test		Mean Difference
	N	$\bar{x}$	SD	$\bar{x}$	SD	
MLS	30	6.77	1.79	31.10	8.16	24.33
Conv.	30	7.27	1.66	14.40	6.06	7.13

Table I showed that students exposed to MLS and Conventional groups had mean scores of 6.77 and 7.27, respectively before treatment. On exposure to treatment, the mean scores of students taught with MLS increased by 24.33

and had higher mean scores of 31.10. Also, the mean scores of students taught using the Conventional method increased by 7.13 and had higher mean scores of 14.40. The result is graphically represented in Fig. 1.
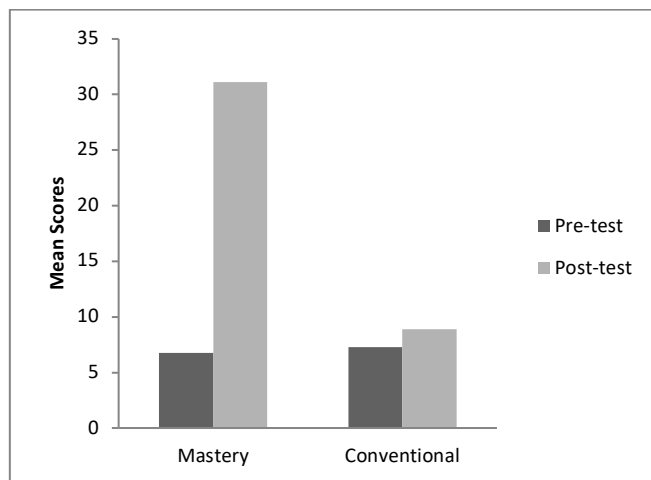

Fig.1. Bar chart representation of the performance scores of students taught using MLS and Conventional Method.

Question 2: What is the retention effect of MLS on performance in Mathematics?

TABLE II: RETENTION SCORES OF STUDENTS TAUGHT USING MLS AND CONVENTIONAL METHOD OF TEACHING

Group		Post-test		Retention test		Mean Diff
	N	$\bar{x}$	SD	$\bar{x}$	SD	
MLS	30	31.10	8.16	32.93	6.50	1.83
Conv	30	14.40	6.06	19.37	6.01	4.97

Table II showed that students exposed to MLS and Conventional methods had mean scores of 31.10 and 14.40 respectively after treatment. After two weeks, the mean scores of students taught with MLS increased by 1.83 and had retention scores of 32.93. Also, the mean scores of students taught using the Conventional method increased by 4.97 and had retention scores of 19.37. The result is graphically represented in Fig. 2.
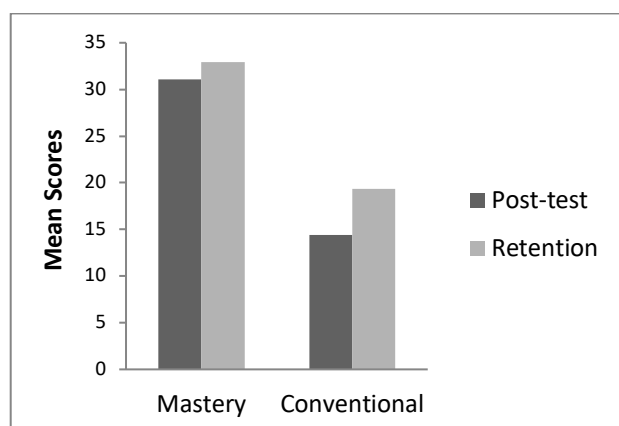

Fig. 2. Bar Chart representation of the Post-test and Retention scores of students taught using MLS and Conventional Method.

Table III reveals that t_{cal} = 1.121, p-value (0.267) > 0.05. Hence, the null hypothesis is not rejected. Therefore, there is no significant difference in the pre-test performance of students taught using MLS and the Conventional method.

This implies that there is homogeneity in the performance of students' prior treatment.

Hypotheses 2: There is no significant difference in the post-test mean score of the experimental and control group after treatment.

TABLE IV: T-TEST SUMMARY OF THE POST-TEST MEAN SCORES OF STUDENTS IN THE EXPERIMENTAL AND CONTROL GROUP

Group	N	$\bar{x}$	SD	Df	t_{cal}	P
MLS	30	31.10	8.16			
Conv.	30	14.40	6.06	58	-9.002	.000

p < 0.05 (Significant).

Table IV reveals that tcal = -9.002, p value 0.000 < 0.05. Hence, the null hypothesis is rejected. Therefore, there is a significant difference in the post-test performance of students taught using MLS and the Conventional method.

Hypotheses 3: There is no significant difference in the post-test and retention mean scores of the experimental and control group.

TABLE V: ANCOVA SUMMARY OF POST-TEST AND RETENTION SCORES PERFORMANCE SCORES OF STUDENTS BY TREATMENT

Source	Sum of Squares	Df	Mean Square	F	P
Corrected Model	2770.675ª	2	1385.338	34.925	0.000
Intercept	3256.589	1	3256.589	82.100	0.000
Post test	9.858	1	9.858	.249	0.620
GROUP	994.691	1	994.691	25.077	0.000
Error	2260.975	57	39.666		
Total	46061.000	60			
Corrected Total	5031.650	59			

* R. Squared = 0.886 (Adjusted R. Squared = 0.883)

Table V revealed that F = 0.249, and p value of 0.620 > 0.05. Therefore, there is no significant difference in the post-test and retention mean scores of students taught using the MLS and Conventional method.

Hypotheses 4: There is no significant gender difference in the post-test mean scores of the experimental and control group.

TABLE VI: TWO-WAY ANOVA SUMMARY OF POST-TEST PERFORMANCE SCORES OF MALE AND FEMALE STUDENTS IN THE TWO EXPERIMENTAL GROUPS

Source	Sum of Squares	Df	Mean Square	F	P
Corrected Model	4199.383ª	3	1399.794	26.324	0.000
Intercept	31053.750	1	31053.750	583.978	0.000
Group	4183.350	1	4183.350	78.670	0.000
Gender	0.017	1	0.017	0.000	0.986
Group* Gender	16.017	1	16.017	0.301	0.585
Error	2977.867	56	53.176		
Total	38231.000	60			
Corrected Total	7177.250	59			

* R. Squared = 0.585 (Adjusted R. Squared = 0.583).

Table VI revealed that F = 0.301, and p value of 0.585 > 0.05. Hence, the null hypothesis is rejected. Therefore, there is no significant difference in the post-test mean scores of male and female students taught using the MLS and Conventional method.

Hypotheses 5: There is no significant school location difference in the post-test mean scores of the experimental and control group.

TABLE VI: TWO-WAY ANOVA SUMMARY OF POST-TEST PERFORMANCE
SCORES STUDENTS TAUGHT USING MASTERY LEARNING AND
CONVENTIONAL METHOD BASED ON SCHOOL LOCATION

Source	Sum of Squares	Df	Mean Square	F	P
Corrected Model	4466.317*	3	1488.772	30.754	0.000
Intercept	31053.750	1	31053.750	641.480	0.000
Group	4183.350	1	4183.350	86.416	0.000
Location	156.817	1	156.817	3.239	0.077
Group * Location	126.150	1	126.150	2.606	0.112
Error	2710.933	56	48.410		
Total	38231.000	60			
Corrected Total	7177.250	59			

* R. Squared = 0.622 (Adjusted R. Squared = 0.602).

VII. DISCUSSION AND CONCLUSION

The study showed that there is no significant difference in the pre-test performance of students taught using mastery leaning strategy and the conventional method. This is in contrast to the finding of [2] that says that there is a significant difference between students taught Mathematics using the MLS and expository teaching method. He explained further by saying that students taught using the MLS performed better than students taught with the conventional expository method. This difference could be attributed to the fact that students in the MLS class were allowed to collaborate amongst themselves to share knowledge and ideas, actively participating in the lessons.

The study also showed that there is a significant difference in the post-test performance of students taught using mastery leaning strategy and the conventional method. The result of this study is in agreement with earlier findings by [2],[3] that the MLS helps to improve students' performance in the class and that students taught using mastery learning easily assimilate what has been taught by their teachers. The result conforms with the two notable studies of [4] that found that the average students in a mastery learning classroom achieve much better than the same levels of 150 students in another classroom not using mastery learning while 850 of mastery learning studies have shown positive results than others that are not in the group. This could be explained by the fact that MLS allows students input and full participation in the learning process unlike the expository where leaner participation might be restricted. The MLS ensures that students can collaborate among themselves and as such improve their achievement.

The study revealed that there is no significant difference in the post-test and retention mean scores of students taught using MLS and the conventional method. This is in contrast with [5][6] finding that showed that there was a significant difference in students' retention ability in the English language when taught with Mastery Learning Strategy. Students taught using MLS demonstrated higher retention ability than students taught using the expository strategies in Mathematics. This could be attributed to the teachers' disposition in approach concerning both strategies. While mastery learning gives more experiences that make it easy to recall, the expository method is in most teaching sessions abstract. The result of this study disagrees with the earlier findings by [7],[8],[9] who observed that mastery learning

increases retention ability. It could be said that retention is dependent upon achievement and whatever is recalled is determined by what the individual has learnt.

The study also found out that there is no significant difference in the post-test mean scores of male and female students taught using MLS and the conventional method. The study is in contrast with the finding of [1] that revealed that there was a significant difference in students' achievement in Mathematics when taught with MLS based on gender. The female student performed better than the male student. in the mastery learning class. But the result of the study is in agreement with the findings of [7] which showed that MLS enhances students' attributes and gender roles may not be a strong predictor of students' performance in school subjects. Furthermore, [10],[11] found that gender has no impact on the abilities of students to learn in a mastery learning class and also that mastery strategy enhances the abilities of students to learn. It could be suggested that some male students do not take their studies as seriously as their female counterparts when they are being taught by female teachers. This may account for the superiority of the performance of the female student in the study. Given the discrepancies in the findings, there is a need for further studies on the mastery learning strategy. There could be some features peculiar to the males and or females in the experimental subjects which further studies would have to unveil.

Finally, the study finds out there is no significant difference in the post-test mean scores of students taught using MLS and the conventional method. This is in agreement with the findings of [9] that showed that there was no significant school location difference in the performance of students exposed to mastery learning.

The incorporation of MLS into mathematics will bring rapid improvement for students in learning and teaching mathematics in secondary schools. MLS involve simplifying larger and complex learning goals into concise and more easy steps.

Teachers should note that there is a difference between knowing and what? In the year past, mathematics teachers as believed to have all knowledge and at the same time a master of all concepts ready to impact his student s. therefore mathematics teachers should be encouraged in engaging MLS to enable them to master their subject matter.

VIII. ACKNOWLEDGEMENT

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