Effect of Mastery Learning Approach (MLA) on the Performance of Boys and Girls in Public Primary Schools in Basic Science and Technology in Jos Metropolis Nigeria

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Abstract - *The study examined the effect of Mastery Learning Approach (MLA) on the performance of boys and girls in public primary schools in basic science and technology in Jos Metropolis Nigeria. Four research questions and four hypotheses were asked and formulated respectively. Non-equivalent pretest and posttest control group of quasi-experimental design was used. A sample of 175 primary six pupils (92 boys and 83 girls), from two pilot science primary schools out of the population of 1,049 pupils from six pilot science primary schools in Jos Metropolis. Validated instrument for data collection was the Basic Science and Technology Performance Test (BSTPT), with a reliability value of 0.84 using Cronbach Alpha Coefficient. Research questions were answered with mean and percentages, while t-test was used in analyzing the hypotheses at 0.05 level of significance. Results showed that gender had no influence on the performance of pupils in basic science and technology and also showed that Mastery Learning Approach improved the performance of boys and girls in basic science and technology in the experimental group than those of the control group. The findings further revealed that MLA narrowed the gap between boys and girls with high, moderate and low performance level. This implies boys and girls performance improved equally in BSTPT. The results showed that teaching method has great influence on the performance of pupils than gender influence, since the performance of both boys and girls in the experimental and control groups did not show any remarkable differences. It was recommended that teachers should integrate MLA in their classroom day to day teaching and learning process.*

Keywords:*Mastery Learning Approach, Science and Technology*

INTRODUCTION

For any nation to develop technologically, it should be able to effectively apply scientific knowledge and principles in areas like, health, agriculture, transportation, material and energy production, industry and communication to improve the quality of life of its people [1]. This can be achieved only by ensuring that the young ones are properly taught the basic skills in science and technology that will enable them learn effectively within the global community [2]. Further, Okwor [3] states that basic skills in science and technology will help in grooming pupils that will develop interest in learning science in the secondary school and beyond, thereby producing scientists and technologist for the nation. In view of this, the science teacher must play a great role of encouraging and inspiring boys and girls to study science.

At the basic level of education, public schools are co-educational and as such Nigerian Government has made basic science and technology a compulsory subject for boys and girls. It is structured around core activities and events like observation, manipulation, experimentation, classification, prediction and communication designed to assist boys and girls acquire, retain and apply basic and functional intellectual and operations needed to cope with the rapid global changes in a science dominated society. Science consists of sequence of meaningful experiences which provide for boys and girls the unique opportunities to develop the learning

strategies, attitudes and values for sustained acquisition and processing of scientific information.

Gender has also continued to be an issue of concern to educators and researchers. This is also evident from the reports of Okebukola [4], Adedeji and Longe [5] and a host of others. They note that gender has impact on science education. Male supremacy and gender stereotyping are factors among others that were identified to influence occupational choice. Hence, Adedeji and Longe [5] are of the opinion that: science and technology is a male-dominated subject and that females tend to shy away from scientific and technological fields. Boys, therefore, appear to have a natural positive attitude to technical and science subjects, while girls show negative attitude (p. 69).

This negative attitude appears to be due to the acceptance of the myth that boys are better in science subjects than girls. Okebukola [4] proposed some instructional strategies to promote gender equity. The American Physical Society suggested that one of the ways of addressing women under-representation in physics is by improving strategy and the environment in which women learn physics.

Some researchers found out that performance in science, mathematics and other science related fields is below expectation. The problems are attributed to poor instructional method Gender has continued to be an issue of concern to educators and researchers. This is also evident from the reports of Okebukola [4], Longe and Adedeji [5], and a host of others, who identified male supremacy and gender stereotyping as factors among others that influence the performance of boys and girls in basic science and technology. They suggested more studies to be carried out which should be gender inclusive.

Performance is a characteristic of learners in the classroom. There are high moderate and low performance levels. Thus, there is need for more studies on instructional strategies that can enhance performance among boys and girls at the basic level of education, especially that which relates to the teaching and learning of science and technology at the primary school. It is against this backdrop that this study investigated the effects of Mastery Learning Approach on performance of boys and girls in public primary schools in basic science and technology in Jos Metropolis, Nigeria.

Mastery Learning Approach (MLA) is an instructional method, where pupils are allowed unlimited opportunities to demonstrate mastery of the content taught. In Mastery Learning Approach classes, boys and girls are expected to master the learning objectives in a unit before proceeding to the next unit. All boys and girls who could not obtain marks up to the criteria set are subjected to further remedial lessons and parallel tests until 75% of them master at least 75% of the objectives of a unit before proceeding to the next unit. By this approach, it is believed that individual differences between boys and girls will be minimized at the end of the instruction. Teaching for mastery entails the formation of a set of objectives or tasks that all boys and girls will be expected to achieve a particular mastery or performance standard, then breaking the course into a sequence of smaller learning elements or unit. In this study mastery learning approach involved providing quality instruction, immediate feedback to boys and girls, corrective lessons for remediation, and re-testing until the set criteria for mastery is achieved. Formative test was designed to determine the performance and proficiency exhibited by an individual pupil in a specific area or set of area during the teaching and learning process.

OBJECTIVES OF THE STUDY

The main objective of the study was to determine the effect of mastery learning approach on the performance of boys and girls in public primary school in basic science and technology in Jos Metropolis, Nigeria. It also aimed to determine the performance levels of boys and girls in the experimental group and in the control group; the performance levels of boys in the experimental and control groups after exposure to mastery learning approach and conventional teaching approach; the performance levels of girls in the experimental and control groups after exposure to mastery learning approach and conventional teaching approach. It also aimed to test the difference between the BSTPT posttest performance mean scores of boys and girls in the experimental group as well as in the in the control group;

METHODS

The study employed the quasi experimental design of non-equivalent pretest-protest control group design. Intact classes were used to avoid disrupting the school arrangement for experimental purpose. A sample of 175(92 boys and 83 girls) primary six

pupils from two schools was used out of the population of 1,049 (547 boys and 502 girls) from the six pilot science primary schools in Jos Metropolis, of Plateau State, Nigeria. Science teachers that have five years and above teaching experiences and the least qualification was an NCE were used as research assistants.

Simple random sampling technique was used to select two schools from the population of six schools and the hat and draw method was used. Two streams from each school were selected using the same method since each class had more than two streams. Since intact classes were used, the entire boys and girls of each selected stream were used for the study. The first intact class in each school was used as experimental while the second intact class was used for control. This was merely for the convenience of the researcher. Both boys and girls in experimental and control groups were taught the same topics using the same instructional materials to minimize Hawthorn effect. Also the same formative test items administered to boys and girls in the experimental group were given to those in control group as assignments in order to avoid intergroup competition. Finally, to reduce pupils interaction effects, the basic science and technology formative test (BSTFT) exercise books in the experimental group were retained by the researcher after every lesson for each day.

The research instrument was the basic science and technology performance test (BSTPT) which comprised 25 multiple choice items. Section A solicited pupils' background, section B made up of 11 multiple choice questions with options A-E, section C has 4 true or false questions and section D has 10 filling in the blank spaces questions making 25 items.

The items were trial tested on 60 pupils in two schools different from those used for the study. Cronbach alpha coefficient method was used to estimate the internal consistency of the instrument. The analysis of the results was done using Statistical Package for Social Science (SPSS). The reliability coefficient of BSTPT was 0.84. Four teachers were engaged to teach for four weeks and one week for excursion using the prepared lesson plans, a week after the pretest. One teacher taught the experimental group and one the control group in their respective schools. BSTPT was administered as posttest at the end of the seventh week of the exercise. The scripts of the pretest and posttest were marked by the researcher to minimize differences in scoring while using marking scheme.

METHODS

Results of this study are presented according to questions asked and their corresponding hypotheses.

Research Question 1: What are the performance levels of boys and girls in the experimental group?

The analysis in Table 1 showed that boys recorded an average performance mean score of 69.75 while girls recorded an average performance mean score of 72.50 in the experimental group. In this group also 26 boys fell within the high performance level with 55.32%, 18 boys fell within moderate level by 38.30% and 3 fell within the low level of performance with 6.38%, while 26 girls fell within the high performance level with 63.41%, 12 girls fell within the moderate level with 29.72% and 3 fell within the low performance level with 7.32%.

The result indicated that the performance level of boys and girls is similar in the experimental group though girls performed slightly above boys with 3.20%. This indicates that both boys and girls improved upon their performance in post BSPFT. This also shows that pupils' performance could be improved upon using MLA irrespective of gender difference. Both boys and girls performed well when taught using the MLA.

Table 1: BSTPT Performance Levels of Boys and Girls in Experimental Group.

Group	Gender	Number	Mean	Performance Levels					
				High (70%-100%)		Moderate (50%-69%)		Low (0%-49%)	
				n	%	n	%	n	%
Experimental	Boys	47	69.75	26	55.32	18	38.30	3	6.38
	Girls	41	72.50	26	63.41	12	29.27	3	7,32

Table 2: Posttest Analysis of Scores of Boys and Girls in the Experimental Group.

Gender	n	Mean	SD	df	t-Cal.	t-Crit.	P
Boys	47	69.75	16.41	86	0.74	1.99	0.46
Girls	41	72.50	18.43				

**Not Significant at p > 0.05*

The analysis in Table 2 showed that the t-calculated value of 0.74 is less than the critical t-value of 1.99. This result is further strengthened with the 2-tailed significance value (p) of 0.46 > 0.05 level of significance resulting in the decision to accept the null hypothesis at p > 0.05. The t-test failed to reveal a statistical reliable difference between the post-test mean scores of boys (X = 69.75, SD = 16.41) and girls exposed to MLA (X = 72.50, SD = 18.43) $t_{(86)} = 0.74$, p = 0.46, α = 0.05. Therefore, there is no significant difference between the BSTPT posttest performance mean scores of boys and girls exposed to MLA.

Table 3: BSTPT Performance Level of Boys and Girls in Control Group.

Group	Gender	N	Mean	Performance Level: High (70%-100%) n	%	Moderate (50%-69%) N	%	Low (0%-49%) n	%
Control	Boys	45	46.04	0	0.00	14	31.11	31	68.89
	Girls	42	44.05	0	0.00	8	19.05	34	80.95

The analysis in Table 3 showed that boys recorded an average performance mean score of 46.04 while the girls recorded an average performance mean score of 44.05. In the control group 14 boys fell within the moderate performance level with 31.11%, 31 boys at low performance level of with 68.89% while 8 girls fell at the moderate performance level of 19.05% and 34 girls fell at the low performance level of 80.95%. The boys are a little bit higher than girls with just 1.99%. The result indicated that the performance levels of boys and girls is similar in the control group. This shows that teaching method has great influence on performance of pupils than gender since the performance of both boys and girls in the experimental and control groups are similar.

Hypothesis Two

There is no significant difference between the BSTPT posttest, performance mean scores of boys and girls in the control group.

The result of the t-test analysis for independent samples as regards the above hypothesis is presented in Table 4.

Table 4: Posttest Analysis of Scores of Boys and Girls in the Control Group.

Gender	N	Mean	SD	df	t-Cal.	t-Crit.	P
Boys	45	46.04	10.03	85	1.00	1.99	0.31
Girls	42	44.05	8.32				

**Not Significant at p > 0.05*

The analysis in Table 4 showed that the t-calculated value of 1.00 (Appendix B_6) is less than the critical t-value of 1.99. This result is further strengthened with the 2-tailed significance value (p) of 0.31 > 0.05 level of significance resulting in the decision to accept the null hypothesis at p > 0.05. The t-test failed to reveal a statistical reliable difference between the post-test mean scores of boys (X = 46.04, SD = 10.03) and girls exposed to CTA (X = 44.05, SD = 8.32) $t_{(85)} = 1.00$, p = 0.31, α = 0.05. Therefore, there is no significant difference between the BSTPT posttest performance mean scores of boys and girls pupils exposed to CTA.

The analysis in table 5 showed that boys in the experimental group recorded an average performance mean score of 69.75 while those in the control group recorded an average performance mean score of 46.04. The analysis in Table 3 showed that boys recorded an average performance mean score of 46.04 while the girls recorded an average performance mean score of 44.05. In the control group 14 boys fell within the moderate performance level with 31.11%, 31 boys at low performance level of with 68.89% while 8 girls fell at the moderate performance level of 19.05% and 34 girls fell at the low performance level of 80.95%. The boys are a little bit higher than girls with just 1.99%. The result indicated that the performance levels of boys and girls is similar in the control group.

Table 5: BSTPT Performance Levels of Boys in the Experimental and Control Groups

Group	Gender	N	Mean	High 70%-100% n	%	Moderate 50%-69% n	%	Low 0%-49% n	%
Experimental	Boys	47	69.75	26	55.32	18	38.30	3	6.38
Control	Boys	45	46.04	0	0.00	14	31.11	31	68.89

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Table 6: Posttest Analysis of Performance Scores of Boys in the Experimental and Control Groups.

Group	n	Mean	D	Df	t-Cal.	t-Crit.	P-value
Experimental	47	69.75	16.41	170	12.21	1.97	0.00
Control	45	46.04	10.03				

** Significant at p < 0.05*

The analysis in table 6 showed that the t-value of 12.21 was greater than the critical value of 1.97. The result is further strengthened with the 2-tailed significance value (p) of 0.00<0.05 level of significance. The null hypothesis was rejected at P<0.05. The t-test revealed a statistical reliability difference between the posttest performance means score of boys in the experimental group (X=69.75, SD= 16.75) and those of the control group (X=46.04, SD=10.03), t(170)=12.21,P=0.00, a = 0.05. The performance means scores of boys in the experimental group was higher than those of the control group by 23.71. This means that there is a significant difference between the performance mean scores of boys in the experimental group exposed to MLA and those of the control group not exposed to MLA as a result of intervention.

The analysis in table 7 showed that girls in the experimental group recorded an average performance mean score of 72.50, while those of the control group recorded an average performance mean score of 44.05. In the experimental group 26 girls fell within the high performance level with 63.41, 12 girls fell within the moderate performance level of 29.27% and 3 girls fell within the low performance level with 7.32%. In the control group none of the girls fell within the high performance level, 8 girls fell within the moderate performance level with 19.05% and 34 girls fell within the low performance level with 80.95%. The result indicated that the performance levels of girls in the experimental group were higher than those of the control group with mean performance score of 28.45.

Table 7: BSTPT Performance Levels of Girls in the Experimental and Control Groups

Group	Gender	N	Mean	High 70%-100%		Moderate 50%-69%		Low 0%-49%	
				n	%	n	%	n	%
Experimental	Girls	41	72.50	26	63.41	12	29.27	3	7.32
Control	Girls	42	44.05	0	0.00	8	19.05	34	80.95

HYPOTHESIS 4: There is no significant difference between the BSTPT posttest performance mean scores of girls in the experimental group and those of the control group.

Table 8: Posttest Analysis of Performance Scores of Girls in the Experimental and Control Groups.

Group	n	Mean	SD	Df	t-Cal.	t-Crit.	p-value
Experimental	41	72.50	18.43		12.36	1.97	0.00
Control	42	44.05	8.32	170			

** Significant at p < 0.05*

The analysis in table 8 showed that the t-value of 12.36 was greater than the critical value of 1.97. The result is further strengthened with the 2-tailed significance value (p) of 0.00<0.05. The null hypothesis was rejected at P < 0.05 The t-test revealed a statistical reliability difference between the posttest performance mean scores of girls in the experimental group (X=72.50, SD=18.43) and those of the control group (X=44.05, S.D = 8.32), t(170) = 12.36, P=0.00,a= 0.05. The performance mean scores of girls in the experimental group was higher than those in the control group by 28.45. This shows that there is a significant difference between the performance mean scores of girls in the experimental group exposed to MLA and those of the control group not exposed to MLA as a result of intervention.

DISCUSSION

The finding of this research revealed that gender had no effect on the performance of boys and girls in basic science and technology. Hence, there was no statistically significant effect of gender on their performances in basic science and technology. This finding is in line with the findings of Akinbobola [6], Abakpa and Iji [7], that there is no significant effect of gender on pupils' performance in science and technology. The finding also is not in agreement with the findings of Abiam and Odok [8] and Vale [9] where they concluded that gender differences do exist

in students' performance in science, technology and mathematics. Researchers' differing views on gender effect on pupils' performance in basic science and technology suggest that if care is taken to make the classroom environment conducive for learning through the use of appropriate teaching strategy, both boys and girls will perform equally well in any given task [10], [11]. This suggests that MLA has been structured in such a way that it does not give one group an edge over the other. To give credence to this, Akinbobola and Afolabi [12] observed that any good teaching approach adopted in teaching science and technology should not discriminate between sexes.

The result also revealed that boys taught basic science and technology using the MLA improved in their performance mean scores than those of the control group taught using CTA. Also girls of the experimental group performed higher than their counterpart in the control group as a result of adopting MLA as an instructional strategy. This also confirms the reports of Iji [13]. Uloko and Usman (2008) who found that an effective teaching method improves the performance levels of pupils in mathematics science and other science related subjects. Thus, MLA is effective in influencing pupils' performance.

Again, the finding of this study showed that MLA influenced high, moderate and low performance levels of boys and girls since there are improvements in their scores. This is further confirmed in their posttest performance means scores. This also confirms the reports of Iji [13], Uloko and Usman [14], Abakpa and Iji [7] who found that an effective teaching approach bridges the gap between high, moderate and low performance levels of pupils. Thus, MLA is effective in influencing pupils of different performance levels to equally perform high in a learning task.

EDUCATION IMPLICATION

The importance of the findings of the study to education and indeed to science education is that it will enable science teachers to utilize the use of Mastery Learning Approach (MLA) which is gender inclusive in the teaching and learning of Basic Science and Technology in our primary schools. It will also help them to be able to use the formative test in the teaching and learning process as the study revealed the effectiveness of the test in reordering the learning process for boys' and girls' understanding and performance in science taught concepts. This is important because of the situation of gender stereotyping in primary schools. The findings will furnish policy makers, teachers and curriculum planners and developers with information on innovative and effective methods that can assist teachers to be gender sensitive during the teaching and learning of science. It will also generate in boys and girls the desired motivation in learning basic science and technology thereby increasing their performance in the subject.

CONCLUSION AND RECOMMENDATIONS

It is recommended that the Primary school teachers especially basic science and technology teachers should be encouraged to explore the application of MLA in their classroom instruction which is gender inclusive. Primary school basic science and technology teachers should break the concept to be taught into small discrete units and make sure each child masters each unit before moving to the next. Basic science and technology formative test (BSTFT) should be administered at each unit of teaching to know pupils performance levels and also to identify and address learning difficulties for further teaching and activities. Teacher trainers should integrate MLA among instructional strategies being inculcated into the pupils. Seminars and workshops should be organized for serving teachers to keep abreast with principles and implementation process of MLA. More teachers should be recruited to reduce class size for effective implementation of the MLA as an instructional strategy.

Teaching strategy from reviews has the potential to make or mar pupils' performance. Mastery learning approach has shown that the era of boys' dominance and supremacy over girls in basic science and technology learning is fast winding up. The trend of boys having grater natural performance than girls has been proved not to be a truism by the finding of this study. MLA is found to improve performance of boys and girls in basic science and technology than CTA. Furthermore, MLA helped to bridge gaps between boys and girls as well as those with low, moderate and high performance level.

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