IMPACT OF COOPERATIVE AND MASTERY LEARNING STRATEGIES ON MATHEMATICS ACHIEVEMENT AND RETENTIONS OF SENIOR SECONDARY SCHOOL STUDENTS IN MINNA METROPOLIS, NIGER STATE, NIGERIA

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Abstract
The study investigated the impact of cooperative and mastery learning strategies on Mathematics Achievement and Retentions of Senior Secondary School students in Minna metropolis Niger State. The study employed a quasi-experimental design using non-equivalent pre-test, post-test and post-post-test control group design. Two research questions and two hypotheses were formulated for the study. A sample of 180 SSII Students from three senior secondary schools in Minna metropolis, Niger State were randomly sample for the study. Instrument of data collection was Mathematics Achievement Test (MAT). The instrument was validated by an expert from Science Education Department, Federal University of Technology, Minna and two Mathematics teachers from secondary schools. The instrument has a reliability index of 0.84 using Kuder- Richardson K_{21}. The research questions were answered using means and standard deviation and the null hypotheses were tested at 0·05 level of significance using ANOVA. Results shows that cooperative and mastery learning strategies improved students' achievement and retentions in Mathematics. It was recommended among others that teachers should be encouraged to integrate cooperative learning strategy and mastery learning strategies in the classroom.

Keywords: Cooperative Learning, Mastery Learning Strategy, Mathematics, Achievement, Retention

Introduction

Mathematics is said to be study of patterns and relationship which can be expressed in symbols. It is an intellectually stimulating subject that have effects on every facet of human society such as politics, economy, science and technology. Maursund, (2010) defined Mathematics as working conjectures, seeking relationship, validating theories, searching for solution, verifying result, communicating findings in words, and problem solving. The learning of Mathematics has become imperative in every society if the citizens are to cope with the fast changing development in science and technology. Mathematics is for life and we do Mathematics in one way or the other in our daily activities. The knowledge of Mathematics is required now than ever especially with the current advancement of development in science and technological advancement and attainment of the millennium development goals (MDGS). It is on this background that the federal government of Nigeria accorded prominence to the teaching and learning of Mathematics in both primary and secondary schools as contained in the National Policy on Education (FRN, 2014). Every career a child may choose to pursue in life are full of things that requires application of Mathematical knowledge and skills. However, evidence shows that students cognitive and effective domains in Mathematics fall below expectation (WAEC chief examiner, 2012-2016). Stake holder have been making concerted efforts to ensure that these problems which are attributed to poor achievement and retention are detected through critical examination of students' selection of questions at terminal examinations (SSCE/NECO) and their general achievement in the question they attempted.

Research reports indicated that many reasons account for students' poor achievement and retention in Mathematics. Among the reasons identified by the chief examiner for the poor performance as cited by (Lawa, Chidimma & Ahmad, 2017) are:-

(i) Failure to apply correctly source Mathematical principles
(ii) Inability to work to the required degree of accuracy
(iii) Lack of basic manipulative skills
(iv) Inability to visualize the component part of 3-dimensional objects.
(v) Lack of required skills in geometrical construction among others.

The poor performance may also be linked to the effects of negative attitudes towards the subject and poor methods of teaching some topics that students perceived difficult. It is sad to note that most students dislike and fail mathematics due to poor methods of teaching the subject. However, concerted efforts have been made to remedy this ugly situation (Akanni, 2015) but up till now the situation has not been resolved. In a heterogeneous class where students of different abilities are taught together, only few of the students achieve and retain high scores in achievement and retention of Mathematics concepts. According to Olunloye (2010), this ugly trend of high failure rate in Mathematics is a national disaster. Therefore, there is a need for Mathematics teachers to intensify efforts in searching to appropriate instructional materials. Insufficient time for learning, unsuitable type of assessment, delayed feedback, ignoring individual differences, and disregard for their previous knowledge. So there is a need for adopting an instructional strategy that could accommodate all those factors which are necessary for enhancing learning achievement and retention.

Statement of the Problem

The decision to research on cooperative and mastery learning strategies in Minna metropolis is based on reality that most of schools embrace traditional learning strategy. According to Aronson (2014), students' performances excel when cooperative learning strategies, including Jigsaw, are implemented. The traditional place of Mathematics in our educational system is in great danger. This is as a result of poor attitudes and performance by both students and teachers. It should be frankly admitted that the present day teaching of Mathematics is far from being satisfactory.

There are many reasons for the low achievement in Mathematics but experts suggest that the main reason is that the Mathematics is taught with the autocratic strategies (conventional instruction) and new methods of teaching are totally rejected. Achievement and retention can only be enhanced by adopting the best method of teaching (Roig, 2008). Mathematics is the most important subject in school curricula and its importance cannot be ignored at secondary school level but the poor achievement and retention of Mathematics knowledge at this level lead to the poor performance at annual examinations. This really disappointing. Therefore, the researcher designed a study to explore the impact of cooperative and mastery learning strategy on learning achievement and retention of secondary school students in mathematics at Minna metropolis, Niger State.

Research Questions

In order to achieve the objectives of the study, the following questions are formulated:

(i) What is the difference in the mean achievement scores of the students taught Mathematics compared to those taught using conventional teaching strategy?
(ii) What is the difference in the mean retention score of the students taught Mathematics using cooperative and mastery strategies compared to those taught using the conventional teaching strategy?

Research Hypotheses

The following research hypotheses were formulated:

Ho_1: There is no significant difference in the mean achievement scores of the students taught Mathematics using cooperative and mastery learning strategy compared to those taught using conventional teaching strategy.

Ho_2: There is no significant difference in the mean retention of students taught Mathematics using cooperative and mastery learning strategy compared to those taught using conventional teaching strategy.

Methodology

The study employed a quasi-experimental design using pre-test, post-test and post-post-test nonequivalent control group design. Intact classes were used to avoid disrupting school programmes for experimental purpose. A sample of 180 SSII students from three senior secondary schools in Minna metropolis, Niger State was used for the study. The three randomly selected schools were further subjected to simple random sampling by balloting and two schools were assigned to experimental groups and the remaining one to control group. The students in both experimental and control groups were taught the same topics using the same instructional materials to minimize Hawthorne effect.

The research instrument was Mathematics achievement Test (MAT) consist of forty (40) multiple choice questions. The test items were given to expert in Science Education Department, Federal University of Technology, Minna and two (2) Mathematics teachers in secondary schools for validation. Their corrections and suggestions resulted in the 30 items used for the study. To determine the reliability coefficient of Mathematics Achievement Test (MAT), a pilot test was conducted in a school within the target population but outside the schools sampled for the study. The instrument was subjected to reliability test using Kuder-Richardson K21 method and yielded a correlation coefficient of 0·84 which implies that the instrument is reliable. Pre-test was administered to both the experimental and control group to ascertain if the two groups were comparable and have the same entry characteristics before treatment and two weeks after the post-test was administered and collected, the post-post-test was also administered and collected for final analysis. Data collected were analyzed using mean, standard deviation and analysis of variance (ANOVA).

Results

Research Question One: What is the difference in the mean achievement scores of the students taught Mathematics compared to those taught using conventional teaching strategy?

Table 1: Mean and standard deviation of pretest and posttest scores of experimental and control groups

Group	N	Prettest		Posttest		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Cooperative Strategy	57	25.99	7.91	75.34	13.24	49.35
Mastery Strategy	63	24.60	8.43	66.55	11.82	41.95
Conventional Method	60	22.44	7.15	50.22	9.41	27.78

Table 1 shows the mean and standard deviation of the mean achievement score of experimental group one, two and control group. The result revealed the mean and standard

deviation scores of post-test of experimental group one are $\bar{X}$ = 75.34, SD = 13.24 respectively. Similarly, the mean and standard deviation of achievement score of experimental group two are $\bar{X}$ = 66.55, SD = 11.82 respectively on the other hand mean and standard deviation of control group are $\bar{X}$ = 50.22, SD = 9.41 respectively. The results also revealed that experimental group one and two had the highest mean gain of 49.35 and 41.95 respectively compare to control.

Ho_1: There is no significant difference in the mean achievement scores of the students taught mathematics using cooperative and mastery learning strategy compared to those taught using conventional teaching strategy.

Table 2: Summary of ANOVA comparison of the post-test mean achievement scores of the experimental groups and control group taught Mathematics using (CLS, MLS and CTS)

Groups	Sum of Squares	df	Mean Square	F-value	p-value
Between Groups	19134.338	2	9567.169	71.35	0.00*
Within Groups	23733.169	177	134.086		
Total	42867.507	179			

*: *: Significance at p < .05

The table two shows the results of the analysis of variance on achievement of students who were taught mathematics using cooperative learning strategy, mastery strategy and conventional method. As shown in (Table 2) revealed. F (2, 177) = 71.35 p=0.00. With P<0.05, the null hypothesis (H_{01}) was rejected. Therefore, there was significant difference in the mean achievement scores of students taught Mathematics using cooperative learning strategy and mastery learning strategy compared to those taught using conventional learning strategy. The mean and standard deviation for each of the groups are (CLS) M=75.34, SD=13.24 (MLS) M=66.55, SD=11.82. (CTS) M=50.22, SD=9.41 with this finding, the students who used cooperative learning strategy and mastery learning strategy have the highest mean.

Research Question Two: What is the difference in the mean retention score of the students taught Mathematics using cooperative and mastery strategy compared to those taught using the conventional teaching strategy?

Table 3: Mean and standard deviation of posttest scores and retention scores of experimental and control groups

Group	N	Post test		Retention test		Mean Gain
		X	SD	X	SD	
Cooperative	57	75.34	13.24	80.49	10.03	5.15
Mastery Strategy	63	65.55	11.82	71.83	9.43	6.28
Conventional Method	60	50.22	9.41	51.23	10.81	-1.01

Table 3 shows the mean and standard deviation of the mean retention score of experimental group one, two and control group. The result revealed the mean and standard deviation scores of retention of experimental group one are $\bar{X}$ = 80.49, SD = 10.03 respectively. Similarly, the mean and standard deviation of achievement score of experimental group two are $\bar{X}$ = 71.83, SD = 9.43 respectively on the other hand mean and standard deviation of

control group are $\bar{X}$ = 51.23, SD = 10.81 respectively. The results also revealed that experimental group two and one had the highest mean gain of 6.28 and 5.15 compare to control group.

HO_2: There is no significant difference in the mean retention scores of students taught Mathematics using cooperative and mastery learning strategy compared to those taught using conventional teaching strategy.

Table 4: Summary of Analysis of Variance (ANOVA) comparison of the retention scores of the experimental groups and control group

Groups	Sum of Squares	df	Mean Square	F	p-value
Between Groups	26679.809	2	13339.904	130.74	0.00*
Within Groups	18059.373	177	102.030		
Total	44739.180	179			

*: Significance at p < .05

The table four shows the results of the analysis of variance on retention of students who taught mathematics using cooperative learning strategy, mastery learning strategy and conventional learning strategy. As shown in (Table 4) revealed F(2, 177) = 130.74 p=0.00. With P<0.05, the null hypothesis (H_{02}) was rejected. Therefore, there was significance difference in the mean retention scores of students taught Mathematics using cooperative learning strategy and mastery learning strategy compared to those taught using conventional learning strategy. The mean and standard deviation for each of the groups are (CLS) M=80.49, SD=10.03 (MS) M=71.83, SD=9.43. (CTM) M=51.23, SD=10.81. With this finding, the students who used cooperative learning strategy and mastery learning have the highest mean.

Discussion

The results obtained in table 1 to 4 indicated an improvement in the experimental groups which is obtained in the control group. Cooperative learning strategy supports peer learning. All individuals have to be successful in order for the group success. Therefore, students corrected other team member's deficiencies. The relevant studies support this finding (Hail, 1988, Slavin, 2010, Ahmad & Mahmud, 2010, Parveen & Batool, 2012). This implies that cooperative learning enhances higher score in mathematics test than conventional learning strategy which deficient in meeting learners needs. Also, the result is in agreement with the finding of mastery learning strategy in schools having shown positive cognitive learning outcomes in students (Patricia & Johnson, 2008), Ogan (2012)). Again, the result in table three and four shows that cooperative and mastery learning strategy improved the retention scores of the students which was online with the finding of Ezinwanyi (2013), Hussaini (2016), and Filgona, Filgona and Sababa (2017) who found positive effect of MLS on learning retention of the students in different subjects.

Conclusion

The following conclusions were made in the light of data analysis and findings of the study:

(i) Both the experimental and control groups were the same on mathematics achievement and retention before starting the experiment.

(ii) The cooperative learning strategy was better than the conventional learning strategy in the enhancement of mathematics achievement and retention of the students.

(iii) The mastery learning strategy was better than the conventional learning strategy in the enhancement of Mathematics achievement and retention of the students.

Recommendations

This study shows that cooperative and mastery learning are better for Mathematics subjects than conventional learning. Therefore:

(i) The Mathematics teachers must apply cooperative and mastery learning in their classroom.

(ii) The Mathematics teachers must apply cooperative and mastery learning strategy to enhance the achievement and retention of students.

(iii) Mathematics teachers should be encouraged to undergo training in cooperative and mastery learning strategies for improvement of their teaching.

(iv) The result of this research should be conveyed to the teachers teaching Mathematics at the secondary school level so that they could implement the cooperative and mastery learning strategies in teaching to improve the achievement and retention of their student.

(v) Government should organize in-service training for serving teachers on how to use cooperative and mastery learning strategy

(vi) Cooperative and mastery learning strategy should be made a compulsory part of the curriculum for Universities and Colleges of Education so as to help in equipping the teachers adequately.

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