IMPACT OF COOPERATIVE LEARNING STRATEGY ON PERFORMANCE AND RETENTION IN GEOMETRY AMONG JUNIOR SECONDARY SCHOOL STUDENTS IN SOKOTO STATE, NIGERIA

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Abstract

The study investigated the impact of cooperative leaning strategy on performance and retention in geometry among junior secondary school students in Sokoto state, Nigeria. The design of the study was quasi experimental control group design such as: pretest, posttest, and post posttest design. 10,103 students formed the population of the study; purposive sampling procedure was used to select 354 students from the study area. Geometry Construction Performance Test (GCPT) was administered before and after the treatment. Four research questions were asked from which four null hypotheses were developed and tested at 0.05 level of confidence. Independent t-test was used to analyze each hypothesis appropriately. CLS was used to teach experimental group in geometry construction of JSS III while CLM was used to teach control group the same topics. The analysis of the data indicated that students taught with CLS performed and retained significantly higher than students taught with CLM. Male students taught with CLS performed better than the male students taught with CLM. The study found no significant deference between male and female students taught with CLS. Female exposed to CLS did not perform better than the Female exposed to CLM. Female students exposed to CLS did not perform better than female taught with CLM. Based on these findings, the study concluded that CLS improved students' performance and retention in geometry construction of JSS III. The study, therefore, recommends that CLS should be adopted in the teaching and learning of mathematics in general and geometry construction.

***Keywords: Cooperative Learning, Geometry, Performance, and Retention*.**

Introduction

Despite the relative importance of Mathematics in Science and information-based courses, as well as in Medicine and Social Sciences, students' [attitude, retention and] performance in Mathematics in both internal and external examinations have remained consistently poor (Isah, 2015). Most students cannot comprehend Geometrical problems couple with students' low retention ability in learning Geometry. These cause tremendous consequences on the students understanding and performance. Thus, it has become necessary to search for a teaching method which can improve the students' retention and academic performance in Geometry. Cooperative learning is a type of cooperative learning which is regarded as a small group of 4 heterogamous learners working together to achieve

common educational objectives within 5 weeks. Consequently, some researchers have tested the impact of STAD and Inquiry methods on students' attitude, retention, and performance in Geometry in the world, specifically in Sokoto state the researcher have not yet come across any study that have been done in this area. Percentages of students' performance for ten yes have been calculated in this study, and the results indicated that yes there is still poor performance of students in mathematics in Sokoto State. The main problem which the study investigated, was which of these learning strategies produce probably good attitude, retention, and performance of students in Geometry and to what extent do these learning strategies affect gender in learning outcomes?

Hence there is the need to develop a strategy or approach that might enhance students' active participation, positive attitude, high retention ability and academic performance in Geometry such as the STAD and Inquiry methods at JSS levels. This is the problem that prompted the researcher to conduct this study Effects of STAD and Inquiry methods on attitude, retention, and performance, among junior secondary school students in Geometry in Sokoto State. Iqbal (2004) investigated the effect of cooperative learning on academic achievement of secondary school student in mathematics. He found that, on the whole cooperative learning has more effect as a teaching learning technique for mathematics as compared to traditional method of teaching. He also found that low achiever taught mathematics using cooperative learning retain more material compared to low achievers taught by traditional method of teaching for low achievers. Ksar (2003) investigated the effects of cooperative learning on social studies achievement among seven class students, the sample comprised forty students of class seven equally phased on experimental group and control groups on the basis of scores obtained in the social studies annual examination. In this experiment of two weeks cooperative learning resulted in higher achievement as compared to routine method of teaching social studies. Parveren (2003) conducted an experimental study on the effect of cooperative learning on social study achievement among eight grade students. The study sample consisted of 35 students who were distributed among experimental group (N-18) and control group (N 17), matched on the basis of their annual examination social studies score. After a treatment of fifteen days duration on the basis of pretest and posttest scores, cooperative learning was found to be a better instructional strategy than routine method of instruction. There were very few studies that were conducted in Nigeria using cooperative learning strategy with respect to geometry at the time of this study, in fact it was only found during this study, that only one study was conducted at central Nigeria in Benue state. The study is titled Effect of cooperative learning strategy on students' retention in circle geometry in secondary schools at Benue state of Nigeria, conducted by (Chianson, Kurumeh, &Obida, 2011). They found out that cooperative learning is more effective in the teaching of circle geometry in terms of retention; this implies that students in the cooperative learning group performed well then those in tradition method of teaching. Chianson, Kurumeh, and Obida(2011) investigated the effects of cooperative learning strategy on student's retention in circle geometry in secondary school in Benue State Nigeria. They found that cooperative learning was found to be more effective in the learning of circle geometry in terms of retention; this

implies that the students in the cooperative learning group maximized the rules binding on the successful implementation of cooperative learning. Furthermore, no study of which the researcher is aware during this study has investigated the impact of cooperative learning strategy on academic performance and retention in geometry in government owns junior secondary schools in Sokoto State. This is all what aroused the researcher's attention to examine the effectiveness of cooperative learning in mathematics. Therefore, the aim of this study is to investigate the impact of cooperative learning strategy in performance and retention in mathematics among junior public secondary schools' students". To see which of the two strategies is more effective.

Statement of the Problem

Despite the relative importance of mathematics in science and information-based courses as well as in medicine and social sciences, students' performance in the subject in both internal and external examinations has remained consistently poor (Adolphus, 2011). According to Adolphus (2011) mathematics educators are trying to identify the major problems associated with the teaching and learning of mathematics in the nation's schools. Despite all these noble efforts, the problem of poor performance in mathematics has continued to surface in nation's public examinations. Even though scholars viewed geometry as the most difficult aspect of mathematics among them are (Nguuma, 2010; Adolphus, 2011). Researchers also conducted studies in geometry, some of them include Chainson, Krumeh and Obida (2011) who worked in circle geometry in Benue State with cooperative learning as the strategy of teaching and found the strategy very effective. Therefore, students have very poor performances and retention in terminal and promotional examinations. To corroborate the above statement West African Examinations Council (WAEC) Zonal coordinator reported that 80% of candidates that sat for the WAEC examination in the year 2012/2013 failed mathematics. This agrees with the report of registrar and chief executive of National Examinations Council (NECO) who said that 71.92% of candidates who registered for further (additional) mathematics in the examination failed the subject. The following table concretized all the above reports about poor performance of students in mathematics in Nigeria.

Years	Total	Credit Percentage(A1-C6)	Percentage with pass and bellow (%) (D7-F9)
2007	**422,681**	**45.96**	**54.04**
2008	**418,423**	**44.42**	**55.57**
2009	**468,546**	**43.74**	**56.26**
2010	**465,546**	**50.73**	**49.28**
2011	**349,936**	**30.94**	**69.06**
2012	**352,242**	**30.95**	**69.05**

2013	**432,234**	**35.96**	**64.04**	**Table 1:**
2014	**428,513**	**34.44**	**65.56**	
2015	**442,091**	**35.97**	64.03	
2016	**1,544,234**	**38.68**	61.32	

Performance of Students in Mathematics in WAEC from 2002-2011

Source: WAEC (2016).

The Table above showed poor performance of students in mathematics through all the years. Indeed, the observed poor performance in mathematics in general and geometry required an effective strategy of teaching (Chainson, et al, 2011). This without any argument cooperative learning was reported as effective strategy of teaching mathematics at various places (Johnson & Smith, 1998). This is why the researcher used cooperative learning which according to Chianson et al (2011); is one of the many teaching methods which result in positive impact and retention of information among students.Cooperative learning here means: a small group of learners working together to achieve common educational objectives. Hence, to possibly promote the performance and retention and equally solve the problem of poor performance of students in geometry at JSSIII in Sokoto metropolis, impact of cooperative learning strategy on performance and retention in geometry among junior secondary school students in Sokoto metropolis is proposed in our own setting to see if it could address this problem.

Objectives of the Study

The objectives of the study were to:

1) Determine the impact of cooperative learning on students' performance in geometry construction of JSS
2) Determine the impact of cooperative learning on students' retention ability in geometry construction of JSS.
3) Ascertain the impact of cooperative learning as a teaching strategy on gender among male and female students in geometry construction of JSS students.
4) Assess whether cooperative learning improve retention ability of male and female students in geometry construction of JSS.

Research Questions

The following research questions guided the conduct of this study:

1) Is there any difference between the mean performances scores of students taught geometry construction using cooperative learning strategy and their counterparts taught using lecture method?
2) Is there any difference between the mean retention scores of students taught geometry construction using cooperative learning strategy and that of students taught using lecture method?
3) What is the impact of CLS on the mean performance scores of male and female students taught geometry construction and those taught with lecture method?
4) What is the effect of CLS on mean retention scores of male and female students taught geometry construction using cooperative learning strategy and those taught with lecture method?

Research Hypotheses

To achieve the objectives of this study the following null hypotheses were formulated and tested at 0.05 level of significance:

H_{01}: There is no significant difference in the mean performance of students taught geometry construction using cooperative learning strategy and those taught with the lecture method.

H_{02}: There is no significant difference in the mean retention scores of students taught geometry construction with CLS and those taught with the lecture method.

H_{03}: There is no significant difference in the mean performance of male and female students taught geometry construction using CLS and those taught with the lecture method.

H_{04}: There is no significant difference in the mean retention scores of male and female students taught geometry using cooperative learning and those taught using the lecture method.

Research Methodology

The design for this study was qausi-experimental-control group design adopting Pretest, post-test, and post posttest. The design is diagrammatically illustrated as follows:

EG = $O_1 \longrightarrow X_1 \longrightarrow O_2 \longrightarrow O_3$

CG = $O_1 \longrightarrow X_0 \longrightarrow O_2 \longrightarrow O_3$

Key:**EG** = Experimental Groups, **CG** = Control Groups, O_1= Pretest, O_2= Posttest, O_3 = Post-posttest, X_1 = Treatment (cooperative learning strategy), X_o =No treatment (conventional lecture method).Population of the Study consisted 34 public coeducational junior secondary schools in Sokoto State, which together sums up to a total of ten thousand one hundred and three (10,103) JSS III students. Six thousand and twelve (6012) male and four thousand and ninety-one (4091) were female which all together sums up to ten thousand one hundred and three (10,103) JSS III students. Sample and Sampling Procedure out of 34 schools in the population, two schools were purposively selected. Purposive sampling technique was used here to enable the researcher to reach the targeted sample quickly. The sampled is 240.Allocation of schools in to experimental and control groups were done by the flip of a coin (Abakpa & Igwue, 2013). All the teachers that choose head became experimental group while teacher that chose tail remained control group; this was merely for the convenience of the researcher. Hat and draw sampling technique was used to draw one class from each school, to serve as Experimental and Control groups which all together sums of to three hundred and fifty-four (354) students, 207 males and 147 females' students out of 10,103 students from the population which correspond to (Krejecie & Mogan, 1970). The content and face validity of the GCPT was further validated by subjects experts in the unit of Science Education Ahmadu Bello University Zaria, such as: Senior lectures in mathematics education and some experts with degree and masters with averagely 30 years of teaching mathematics at secondary schools from Sokoto state. Their observations were incorporated in modifying the instrument for data collection and lesson plans. These experts assessed the suitability of the instrument to ascertain whether the instrument is related to the objective of the study. After the validation of the instrument, it was suggested that content of the instrument was appropriate and relevant to the objectives of the study. Test retest was used in this study,a pilot study was carried out in one secondary school within Sokoto metropolis; this was to test the reliability coefficient of the instrument used in the study. The result obtained was 0.63. This indicated that the internal consistency of the instrument is within the acceptable region.

Results and discussion

Ho_1: There is no significant difference in the mean performance scores of students taught geometry using cooperative learning strategy and those taught using lecture method.

Table 2: t- test analysis of Mean Performance Scores of Students Exposed to CLS and Lecture methods.

Post-test	N	$\bar{x}$	S	df	t_{cal}	t_{crict}	P	Remark
Exp. Group	132	23.10	7.77	260	4.33	1.66	0.00	Significant
Cont. Group	130	19.02	7.54					

- Significant at $P \leq 0.05$

Result of Table 2 shows t_{cal}= 4.33 and $t_{crit.}$ = 1.66. At 0.05 level of significance, $t_{cal.}$ = 4.33>t_{crict} = 1.66., at df= 260, this shows that there is significant difference in the mean performance scores of students taught geometry using cooperative learning strategy, and those taught using lecture method. The null hypothesis of no significance difference in mean performance scores of students taught geometry using cooperative learning and students taught using lecture method was therefore rejected.

Ho_2: There is no significant difference in the mean retention scores of students taught geometry using cooperative learning strategy, and those taught with lecture method.

Table 3: t- test analysis of Mean Retention Scores of Male and Female Exposed to CLS.

Post-post test	N	$\bar{x}$	S	df	t_{cal}	t_{crict}	P	Remark
Male	67	24.21	9.16	131	1.67	1.64	0.01	**Significant**
Female	66	21.97	5.91					

- Significant at $P \leq 0.05$

Results of Table 4.8.1 shows that, at α = 0.05 level of significance, $t_{cal.}$ =1.67>$t_{crict.}$ = 1.64, at df = 133, this shows that there is significant difference in the mean retention ability scores of male students guided geometry construction using CLSovertheir counterpart female guided with the same CLS. The null hypothesis of no significant difference in the mean retention ability scores of male student guided geometry using CLS and their

counterpart female guide with the same CLS, is therefore rejected. Therefore, the use of CLS enhanced the retention ability of male students in geometry construction of JSS III over their counterpart guided with the same CLS at JSS III geometry construction.

Ho_3: There is no significant difference in the mean performance Scores of male and female taught geometry constructions using cooperative learning strategy and those taught with lecture method.

Table 4: t- test analysis of Mean Performance Scores of Males and Male Exposed to CLS and Conventional Lecture Methods.

Post- test	N	$\bar{x}$	S	df	t_{cal}	t_{crict}	P	Remark
Male. Exp.	66	24.36	9.14	160	5.05	1.96	0.01	Sign.
Male Cont.	96	18.25	6.23					

- Significant at $P \leq 0.05$

Results of Table 4.7.1 shows that, $t_{cal.}$= 5.05>$t_{crict.}$ = 1.96. Atα = 0.05 level of significance,t_{cal}= 5.05 >$t_{crict.}$ = 1.96, at df = 160. This shows that there is significant difference in the mean performance scores of male guided geometry construction using CLS over male taught geometry construction using conventional lecture method. The null hypothesis of no significant difference in performance scores of male students taught geometry construction using CLS over male students taught using lecture method, is therefore, rejected, hence the use ofCLS enhances the performance of male students, over male students taught geometry constructions using lecture method.

Ho_4: There is no significant difference between the mean retention scores of male and female students taught geometry using cooperative learning strategy and those taught using lecture method.

Table 5: t- test analysis of Mean Retention Scores of Males and Male Exposed to CLS and Conventional Lecture Methods.

Post-post	N	$\bar{x}$	S	Df	t_{cal}	t_{crict}	P	Remark
Male (Exp.)	66	21.97	5.91	101	0.60	1.96	0.54	**Not. Sig**
Male (Cont.)	31	21.03	10.01					

- Significant at $P \leq 0.05$

Results of Table 4.8.3 show that, $t_{cal.} = 0.60 < t_{crict.} = 1.96$. At $\alpha = 0.05$ level of significance, $t_{cal.}=0.60 < t_{crict.} = 1.96$, at df = 101. This shows that there is no significant difference in the mean performance scores of males guided by CLS in geometry construction over male taught geometry construction using conventional lecture method. The null hypothesis of no significant difference in retention scores of male students taught geometry construction using CLS and male students taught using lecture method, is therefore, accepted, hence the use of CLS did enhances the performance of male students, over male students taught geometry constructions using lecture method.

Discussions of Results

An independent t-test was conducted to assess the impact of cooperative learning strategy in learning geometry construction. After the treatment of five (5) weeks, the findings have shown that, students in the experimental group had a higher post-test mean performance and retention scores in geometry construction than the control group, this shows that there is significant difference between the two groups in terms of performance scores.

The findings of this study concretized the earlier findings of Davidson, and Kroll (1991) who worked with cooperative learning and found that cooperative learning improve students' academic performance. This is also agrees with the findings of the following researchers whom discovered that students engaged in cooperative learning strategy performed significantly higher than their counter part been exposed to conventional lecture method among them include: Watson, Sutton and Jones (1996),Leikin and Zesty (1997) who investigated the effect of cooperative learning in learning mathematics. Their finding indicated that students been exposed to cooperative learning method have a higher score than their counterpart.

Whickers, Jacob, whickers, Bol and nunnery (1997) and King (1999), in their studies entitled Impact of cooperative learning on students' retention on geometry construction, the findings of this study based on the retention in geometry construction revealed that students taught using cooperative learning strategy gained retention more than the control group taught using lecture method. This was also confirmed by the result of hypothesis 4, which showed that method is a significant factor on students' retention in mathematics in general and geometry construction.

Conclusion

This study was carried out on the impact of cooperative learning strategy on performance and retention in geometry among junior secondary schools' students in Sokoto State. Literature on cooperative learning shown that cooperative learning occurred when more than one student come together to solve a common problem. In the same way, findings of this study revealed that students in experimental group performed significantly better than their counterpart in the control group. A comparison of male and female performance in the experimental group revealed that the difference is not significance, but comparison of male taught using cooperative learning and female taught using lecture

method in terms of retention is significant. From these, it has been found that 1. Students who were taught with CLS performed significantly batter then student who were taught using conventional lecture method. 2. Students who were taught with CLS retained higher than students who were taught using conventional lecture method. The findings of this study support much of the existing knowledge on cooperative learning strategy. Based on the empirical evidences presented, cooperative learning strategy has gained more than the lecture method and enhances the performance and retention of students in mathematics.

Recommendations

This study shown that cooperative learning strategy, found effective and has a positive impact on students' academic performance and retention in mathematics, therefore, the following points are recommended:

1. Sokoto state Mathematics teachers are advice to use cooperative learning strategy as it improves students' academic performance and retention in learning Mathematics.
2. In view of the population explosion in our secondary schools and inadequate learning environments, Sokoto state government shall provide conducive learning atmosphere that can accommodate cooperative learning activities.
3. Sokoto state School authorities should encourage their teachers to use cooperative learning strategy in their lessons since the method improve students' academic performance in learning geometry construction.
4. Nigeria curriculum planers should incorporate cooperative learning strategy in their curriculum design and implementation to simplify the identified difficulties in teaching and learning of mathematics.
5. MAN, STAN and NMS should make a workshop about the cooperative learning strategy as their members met annually to update their knowledge about the problems in teaching and learning of mathematics.

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