

EFFECT OF COOPERATIVE LEARNING STRATEGIES ON MOTIVATION AND RETENTION IN MATHEMATICS AMONG SENIOR SECONDARY SCHOOL STUDENTS IN KATSINA STATE, NIGERIA

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Abstract

This study investigated the effect of Cooperative learning strategy in enhancing the motivation and retention in Mathematics among senior secondary school students in Katsina state. The study was carried out on SSS II students in Katsina Education Quality Assurance Zone in Katsina State, Nigeria. Quasi-experimental design was adopted for the study. The sample size of this study consists of eighty-five (85) SSS II students were which drawn from two public co-educational schools in Katsina metropolis. Purposive sampling technique was used to select two schools for the study. The instruments used are Mathematics Achievement Test (MAT), Motivation and Retention Scale (MRS). The reliability co-efficient of MAT and MRS are 0.89 and 0.85 respectively. ANOVA was used to test the hypotheses at 0.05 level of significant. The findings revealed that: students taught Mathematics using the cooperative learning strategy are more motivated to learning than those taught using conventional learning strategy [$F(2, 85) = 243.512, P = 0.000$]. Students taught Mathematics using Cooperative learning strategy retained to learning than those taught with Conventional learning strategy [$F(2, 85) = 235.876, P = 0.000$]. Students taught Mathematics using the cooperative learning strategy performed better than those taught with conventional learning strategy [$F(2, 85) = 190.878, P = 0.000$]. It concluded that cooperative learning strategy is more effective in improving the motivation, retention and academic performance of students in Mathematics when compared with conventional method of teaching. It was recommended that Mathematics teachers should be encouraged to use Cooperative learning strategy in their teaching instruction in order to improving students' academic performance. Seminars, conferences and workshops should be organized by Ministry officials, Zonal Educational Authority, and Local Educational Authority in order to educate practicing teachers on how to implement Cooperative teaching strategy in schools at all levels.

Keywords: Cooperative Learning Strategy, Motivation, Retention, Mathematics Academic Performance

Introduction

Mathematics is a science of critical and analytical thinking. Much more than its important concepts and solutions are the values that can be instill in the young minds of students. The students are trained not only to solve mathematical problems but they are also taught with the essential methods necessary for them to survive in this wonderful yet complex world. One of such method is cooperative learning means a small dedicated group of students learn together and take advantages of each other's expertise to achieve a common goal (Abdullah, 2010). It is instructional method used in small groups through which students work together to maximize their own and each other's learning. Cooperative learning is working together to accomplish shared goals. It is also an instructional approach in which high-ability and low-ability students work together to solve a problem (Aziz & Hossain, 2010). Cooperative learning comprises instructional methods in which teachers organize students into small groups, which then work together to help one another learn academic content (Van, 2014 & Slavin, 2011).

Cooperative Learning Strategies is an individualistic and competitive learning strategy for all types of students that help them to improve relationship between high-ability and low-ability students, increasing self-esteem and development of positive attitudes toward mathematics. Cooperative learning strategies helps in promotion of student learning and academic achievement, enhancing content retention and satisfaction with learning experiences, and developing students' self-esteem and a positive attitude towards learning. Provide a suitable educational environment of appropriate action to support and promote teamwork and collaboration between students and increase internal motivation (Abdullah, 2010). He further lamented that, provision of social communication mechanisms, to allow exchange of ideas and ask questions freely from peers, also and motivation retention of learning impact for a longer period.

A series of research studies has found a appreciate relationship between the higher cognitive and affective outcomes, and cooperative learning strategies (Tran & Lewis, 2012). In the setting of education lecture-based teaching is one kind of conventional strategies has been still the most prevalent instructional approach. In comparison with cooperative learning techniques, lecture-based teaching has been reported to be less effective to the demands of high rates of cognitive and affective outcomes (Slavin, 2011 & Van, 2014). In order to improve students' cognitive outcomes, an alternative to lecture-based teaching could be cooperative learning strategy (Tran & Lewis, 2012). This strategy has been reported to improve students' achievement, motivation and their knowledge retention of learning materials.

Many researches in the field of educational psychology have been interested in understanding students' motivation to improve their academic performance. Motivation is an internal process that activates guides and maintains the behaviours of an individual (In'am & Sutrisno, 2021; Lai, 2011). It involves a collection of individuals' closely related beliefs, perceptions, values, interests, and actions that human takes. Motivation plays an important role in the conceptual change process of students by enhancing positive perceptions of value in learning activities, learning engagement and critical thinking, which then lead to learning achievement. Motivation can be intrinsic or extrinsic motivation.

Intrinsic motivation refers to the motivation that comes from rewards inherent to a task or activity itself (Lai, 2011). It is the motivation that is emanated by personal enjoyment, interest, pleasure for example, the enjoyment of a puzzle or the love of playing games, (Lai, 2011). According to Lai (2011), intrinsic motivation manifests in behaviours such as exploration, challenge and collaboration and has therefore been considered by educators as more desirable to result in better learning outcomes than extrinsic motivation.

Extrinsic motivation refers to the motivation that comes from outside of the individual. There are people who are motivated to complete a task because of the incentives that are attached to them such as prizes, gift, reward or promotions to the next grade (Lai, 2011). Students may answer question well because teacher promise to give out money and sweets. Students might keep up performing higher only because their parents reward their consistent excellent performance. Sometimes though, instead of rewards, external coercion may force a person to engage in an action. This external factor may be seen as a punishment or a necessary action that is forced on an individual. Threat of a punishment is a common form of extrinsic motivation in learners (Lai, 2011).

Retention has to do with students' ability to recall or recognize the mathematics concepts which have been learned before. According to Chianson et al. (2011), retention is a preservative factor of the mind. The mind acquires the materials of knowledge through sensation and perception. These acquired materials in the mind need to be preserved in form of images for knowledge to develop. Whenever a

stimulating situation occurs, retained images are revived or reproduced to make memorization possible. Hence mathematics concepts need to be presented to the students in a way or method that touches their sub-consciousness mind that can trigger quick recalling of the concept being taught or learnt (Salam et al. 2015). Using such a teaching method as cooperative learning strategies, both high ability and low ability learners would be able to collaborate in terms of understanding, comprehension, explaining and retaining the concept they have learnt in a mathematics class.

The study conducted by Abdullah (2010) study showed that there is a statistical significance difference between the means of the performance of the experimental and control groups on the achievement and retention test for the benefit of the experimental group. Arbin, Ghani, and Hamzah (2014) pointed out that co-operative learning strategy could make learners be motivated and have a positive attitude towards the available learning material. Similarly, Sofroniou and Poutos (2016) also reported that co-operative learning strategies allows learners to think analytically and critically, enhance their teamwork spirit, independent learning, develop communication skills and acquire techniques of solving classroom or real-life problems. Finally, cooperative learning strategy improved learners' performance in Mathematics and also increased their motivation and retention in learning Mathematics.

Statement of the Problem

The decline of performance in school subjects might be due to the lack of motivation in learners. When students work cooperatively, they share their ideas and listen to others' perspectives, seek new ways of clarifying differences, resolving problems, and constructing new understandings and knowledge. The result is that students attain higher academic outcomes and are more motivated to achieve than they would be if they worked alone. According to Iyambo (2010), other than the poor performance of learners at ordinary level Mathematics, there is a dilemma that few students take up Mathematics at higher level of education. It appears that many students did Mathematics on ordinary level and obtained poor grades.

Recent studies (Mbuguan, 2012; Frans, 2012) investigated reasons for poor performance in Mathematics and among their findings listed lack of proper teaching methods, insufficient resources and low motivation to study. It might be that the poor performance of students in Mathematics due to inappropriate teaching methods (Salam et al. 2015; Frans, 2012) and the lack of motivation to study Mathematics might be the factor deterring students from study Mathematics at tertiary level. The ability of students to grasp and memorize a mathematical concept or topic that was taught has become a basic problem in secondary schools (Chianson et al. 2011). These problems may arise due to inappropriate teaching methods being used to explain these topics. It is against this background that the study is to determine the effectiveness of cooperative learning strategies on student's motivation and retention on academic performance in senior secondary school Mathematics in Katsina state.

Objectives of the Study

The main objective of this study is to investigate the effect of Cooperative learning strategy in enhancing the motivation and retention of Mathematics academic performance of senior secondary school students in Katsina state. Specifically, the following objectives of the study are to:

- 1) investigate whether difference exist in the academic performance of students who taught using the Cooperative learning method (experimental group), and those who taught using the Conventional method (control group).
- 2) determine whether difference exist in motivation of students taught Mathematics using the Cooperative learning strategy and those taught using Conventional method.
- 3) examine whether difference exist in retention of students taught Mathematics using the

Cooperative learning strategy and those taught using Conventional method.

Research Questions

The following research question was formulated to guide the study:

- 1) What is the difference in the mean motivation scores of students taught Mathematics using the Cooperative learning strategy and those taught using the Conventional approach?
- 2) What is the difference in the mean retention scores of students taught Mathematics using the Cooperative learning strategy and those taught using the Conventional approach?
- 3) What is the difference academic performance between students who taught using the Cooperative learning method (experimental group), and those taught using the Conventional method (control group)?

Hypotheses

Based on the objectives of this study, the following null hypotheses were postulated to provide further guide to the study:

H₀₁: There is no significant difference in the motivation scores of students taught Mathematics using Cooperative learning strategy and those taught using Conventional method.

H₀₂: There is no significant difference in the retention scores of students taught Mathematics using the Cooperative learning strategy and those taught using Conventional method.

H₀₃: There is no statistical significance difference in the academic performance of students who were taught using the Cooperative learning method (experimental group), and those taught using the Conventional method (control group).

Methodology

The quasi-experimental design was adopted for the study. Quasi-experimental design involve the creation of a comparison group that are most often used when it is not possible to randomize individuals or groups to treatment and control groups (Mamman, 2019). Specifically, the pre-test, post-test, non-equivalent group design was employed for the study. This design is adopted because it was not possible to have complete randomization of the subjects to avoid the disruption of school organization (streaming of classes).

The population of this study consists of all SS II students in all the public senior secondary schools in Katsina Metropolis. The sample size of this study consists of eighty-five (85) SSS II students were drawn from two public co-educational senior secondary schools in Katsina metropolis. The purposive sampling technique was used to select two schools that have at least two streams inter-class of SS II class from the schools in the metropolis.

Instrumentations

Two research instruments were used for this study. The instrument, were tagged; Mathematics Achievement Test (MAT) and Motivation and Retention Scale (MRS). MAT consists of 30-items simple structure essay questions grouped in to five adapted from West African Senior School Certificate Examination (WASSCE) past questions (2020-2022) to serve as pre-test to ascertain equivalence of ability of subject and as post-test to determine the effect of the treatment on students' performance in Mathematics based on current topics on the syllabus. Motivation and Retention Scale (MRS) was used to determine the motivation and retention of the students towards the Mathematics subject before the application and to see whether there is significant difference in their motivation and retention towards the Mathematics as a result of implemented method. This instrument was developed by researcher based on literature reviewed. The scale consists twenty (20) items which was based on

a four-point Likert type Scale ranging from strongly agree, (SA) Agree, (A) Disagree, (D) and Strongly Disagree (SD).

The MAT was structure essay questions grouped on concept of mathematics topic (Binary, Algebraic, Equation and Approximation). The test items were given to Mathematics expert and expert in Department of Educational Psychology and Counselling, Federal University Dutsin-ma for construct validity and correctness of questions and options. They evaluate the instrument for its validity for accuracy and clarity of the test items. The instruments are relevance, sentence are well structured, and adequacy of the instrument for the study.

The instruments were subjected for pilot testing to a group of 20 students in a school within metropolis. The instrument was administered using test-retest method with interval of two weeks. The exercise was conducted in a selected secondary school which was not included in the actual study. The Kuder-Richardson 21 formula was adopted in determining the reliability co-efficient of 0.89 was obtained in MAT, internal consistency of the items in the instrument using K-R21 formula was used because the responses to the items was dichotomously scored. The Cronbach’s Alpha Analysis was used for MRS; the coefficient of 0.85 was obtained.

The instruments for data collection for this study were administered to the students before the treatment. Scores obtained at this stage was served as pre-test scores. After treatment, a post-test (MAT & MRS) was administered to all the subjects in both groups. Data for the tests was recorded separately for each of the groups. The mean, standard deviation pre-test and post-tests scores obtained from the was analyzed before using Analysis of Variance (ANOVA) to test hypotheses at 0.05 level of significance.

Results

Data were presented, analyzed and interpreted based on the research questions and hypotheses.

Table 1: Analysis of Means, Standard Deviations and Mean Difference for Motivation, Retention and Academic Performance

Variables	Group	N	Mean	Std. Deviation	Mean Difference
Motivation	Control	45	22.40	5.39	13.65
	Experiment	40	36.05	2.95	
Retention	Control	45	23.93	5.56	12.09
	Experiment	40	36.02	2.64	
Academic Performance	Control	45	11.55	2.39	13.50
	Experiment	40	25.05	2.29	

Table 1 shows that the mean and standard deviation for motivation on cooperative learning strategy are control group 22.40 and 5.39, and that of experimental group are 36.05 and 2.95, the mean score difference was 13.65. This indicates that intervention is positively improved students’ motivation for learning. The mean and standard deviation for retention on cooperative learning strategy are control group 23.93 and 5.56, and that of experimental group are 36.02 and 2.64, the mean score difference was 12.09. This indicates that intervention is positively improved students’ retention for learning. The mean and standard deviation for academic performance on cooperative learning strategy are control group 11.55 and 2.39, and that of experimental group are 25.05 and 2.29, the mean score difference was 13.50. This indicates that intervention is positively improved students’ academic performance for learning.

Hypothesis 1: There is no significant difference in motivation scores of students taught Mathematics using the Cooperative learning strategy and those taught using Conventional method.

Table 2: ANCOVA test of students’ motivation scores of students taught Mathematics using the Cooperative learning strategy and those taught using Conventional method.

Source of Squares	Type III Sum	Df	Mean Square	F	Sig
Corrected Model	3664.386 ^a	2	1832.193	347.131	.000
Intercept	790.847	1	790.847	149.836	.000
MOTIVATION	19.386	1	19.386	3.673	.059
GROUPS	1285.280	1	1285.280	243.512	.000
Error	432.796	82	5.278		
Total	30862.000	85			
Corrected Total	4070.800	84			

a. R Squared = .900 (Adjusted R Squared = .898)

Table 2 revealed that the F value analyzed was 243.512 and the p-value of 0.000 was observed. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, the null hypotheses is rejected. This implies that there is significant difference in motivation scores of students taught Mathematics using the cooperative learning strategy and those taught using conventional method ($F(2, 85) = 243.512, P = 0.000$).

Hypothesis 2: There is no significant difference in the retention scores of students taught Mathematics using the cooperative learning strategy and those taught using conventional method.

Table 3: ANCOVA test of students’ retention scores of students taught Mathematics using the cooperative learning strategy and those taught using conventional method.

Source of Squares	Type III Sum	Df	Mean Square	F	Sig
Corrected Model	3646.790 ^a	2	1832.395	331.128	.000
Intercept	602.229	1	602.229	109.365	.000
RETENTION	1.790	1	1.790	.325	.570
GROUPS	1298.879	1	1285.879	235.876	.000
Error	451.574	82	5.507		
Total	30862.000	85			
Corrected Total	4070.800	84			

a. R Squared = .896 (Adjusted R Squared = .893)

Table 3 revealed that the F value analyzed was 235.876 and the p-value of 0.000 was observed. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, the null hypotheses is rejected. This implies that there is significant difference in retention scores of students taught Mathematics using the cooperative learning strategy and those taught using conventional method ($F(2, 85) = 235.876, P = 0.000$).

Hypothesis 3: There is no statistical significance difference in the academic performance of students taught using the cooperative learning method (experimental group), and those taught using the conventional method (control group).

Table 4: ANCOVA test of students’ academic performance scores of students taught Mathematics using the cooperative learning strategy and those taught using conventional method.

Source of Squares	Type III Sum	Df	Mean Square	F	Sig
Corrected Model	3647.405 ^a	2	1823.703	331.703	.000
Intercept	963.336	1	963.336	175.196	.000
ACADEMIC PER. GROUPS	2.405	1	2.405	.437	.510
Error	1049.567	1	1049.567	190.878	.000
Total	450.918	82	5.499		
Corrected Total	30862.000	85			
	4070.800	84			

a. R Squared = .896 (Adjusted R Squared = .893)

Table 4 revealed that the F value analyzed was 190.878 and the p-value of 0.000 was observed. Since the obtained p-value of 0.000 is less than the alpha value of 0.05, the null hypotheses is rejected. This implies that there is statistical significance difference in the academic performance of students taught using the cooperative learning method and those taught using the conventional method {F (2, 80) = 190.878, P = 0.000}.

Discussion of the Findings

The findings of the study revealed that there is significant difference in the motivation scores of students taught Mathematics using the cooperative learning strategy and those taught using conventional method. The study support the findings of Frans (2012) who found that there are significant differences in the performance and in the motivation level of the experimental and control group. The findings suggested that cooperative learning strategy improved learners’ performance in Mathematics and also increased their motivation of learning Mathematics as well. Iyambo (2010) urges teachers to motivate their learners to study Mathematics and be able to further their education in science related fields such as Geology, Engineering and Information Technology.

The findings of the study revealed that there is significant difference in retention scores of students taught Mathematics using cooperative learning strategy and those taught using conventional method. The study support the findings of Van (2014) whose finding showed that students taught using cooperative learning strategies achieved significantly higher scores on the achievement and knowledge retention than did students who were instructed using lecture-based method of teaching. Abdullah (2010) agree that retention of learning impact for a longer period of time in one’s life. Slavin (2011) indicate that cooperative learning results in greater long-term retention of achievement in learning than the traditional lecture-based teaching group. The findings of Chianson et al (2011) confirmed that students who were subjected to the cooperative learning strategy were able to retain the concepts of circle geometry more than those students who were taught using the conventional learning approach.

The findings of the study revealed that there is statistical significance difference in the academic performance students who were taught using the cooperative learning method and those who were taught using the conventional method. The result supports the findings of Zakaria, et al (2013) whose finding showed that there is significant difference of mean in students’ Mathematics performance between the cooperative group and the traditional group. The study of Epifanio and Denis (2018) found that students exposed to cooperative learning strategy have significantly higher performance than those exposed to conventional method of teaching in terms of posttest and retention test scores. The results

of this study indicate that the cooperative learning approach resulted in higher performance than the conventional teaching method. The reason for the increase in students' performance could be caused by the students' involvement in explaining and receiving explanation in which the concepts can be easily understood, cooperative learning gives more space and opportunities for students to discuss, solve problems, create solutions, provide ideas and help each other.

Conclusion

This study had been able to show that cooperative learning strategy is more effective in improving the motivation, retention and academic performance of students in Mathematics when compared with conventional method of teaching. The cooperative learning strategy had the capacity to help students to associate, think and share ideas among themselves in order to recall what have been learnt in mathematics class. The study show students are motivated to learn and are more confident to ask questions from one another for better understanding and retention of the tasks being learnt.

Recommendations

1. Mathematics teachers should be encouraged to use cooperative learning strategy in their teaching instruction in order to improve students' academic performance.
2. Mathematics teachers should place emphasis on learners' understanding of particular concepts, guiding learners in active learning, providing opportunities for discussion and elaboration and encouraging them to work with peers to enhance learners' motivation and academic performance.
3. Seminars, Conferences and Workshops should be organized by Ministry officials, Zonal Educational Authority, and Local Educational Authority in order to educate practicing teachers on how to implement cooperative teaching strategy in schools at all levels.

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