EFFECTS OF COLLABORATIVE METHOD IN TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS IN EBONYI STATE

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Abstract

This study examined the effects of collaborative method in teaching and learning of mathematics in secondary schools in Ebonyi State. Quasi-experimental design was employed for the study. The population comprised all the public senior secondary schools two (SSS 2) students in Ohaukwu local Government Area in Ebonyi State of Nigeria. Three schools out of 16 were randomly selected using purposive random sampling technique. One hundred and fifty students were selected using intact classes. Four hypotheses were formulated and tested. Mathematics Achievement Test (MAT) instrument with reliability coefficient of 0.89 and test of stability of 0.62 respectively were used as pretest, posttest and retention tests through reshuffled the MAT items for data collection. T-test statistics were used to test the null hypotheses at a 0.05 level of significance. The results revealed that there is significant difference between the performance mean scores of students in experimental and control groups ; no significant difference between the performance mean scores of male and female students exposed to collaborative method ; significant difference existed between the retention mean scores of students in experimental and control groups ; no significant difference between the retention mean scores of male and female students exposed to collaborative method. Based on the findings of the study, it was recommended that Mathematics teachers should encourage their students to learn collaboratively; also the curriculum planner should include the use of collaborative method in the curriculum.
Keywords: Collaborative method, Teaching, Learning, Mathematics, Secondary School.

Introduction

Mathematics is a core subject from primary school to post-primary school levels of the Nigeria educational system. This important position occupied by the subject in the school curricula is borne out of the role of mathematics in science and technological development. A good foundation in mathematics is the basic requirement for development of a Nation. Mathematics is the central intellectual discipline of the technological societies. Kolawole (2004) described mathematics as the backbone of a National development which enables us to make scientific predictions that are to be drawn on the basis of logic.

Scientific ideas and findings are communicated into the world works using mathematical terminologies. Thus, Mathematics is the bedrock of science and technology which is the springboard of national development. Mathematics plays a vital role in the advancement of sciences information and technology (ICT). Mathematics in its dynamism has its tentacles spread into all other disciplines. This has been established by many scholars from diverse field of studies Popoola (2004) and Kolawole (2004). Mathematics is a tool in astronomy navigation, commerce, agriculture, geography and economics. Mathematics is a science that develops explicitly other kind of science to apply its capacity for speed and precision Ladder (2010).

Oladosu (2011) argued that the primary aim of mathematics is to teach people how to think. He wrote on" teaching to think" which means that the Mathematics teacher should not merely impart information, but to develop in the students the ability to think and Use the information imparted. For this to be achieved, Oladosu mentioned that the method used by the teacher should enhance learner self- discovery in mathematics. The question comes to the mind as to which method will be effective, efficient and reliable if improvement would be experienced in terms of students' teaching and learning performance in mathematics? The researcher realized that collaborative have not been put into consideration so as to examine what influence this combination would have on students teaching and learning of mathematics. Base On this fact, the researcher examined the effects of collaborative method of teaching and learning of mathematics in secondary schools. This method involve learner- learner interaction and teacher- learner interaction, group work help the learners to better understand the material and stimulate their thinking process. According to Zakaria and Yusoff (2010), collaborative learning method improves students' performance and attitudes towards mathematics.

Collaborative method is a method that provides opportunities for learners to present their own creative ideas; communicate with their peers and transfer knowledge mathematically. It limits the idea of teacher-oriented instructional method where the transfer of teachers' knowledge to students is the order. This encourages the individual learner to be industrious and be self-confident. It is a method of learning in which problems drive learning, that is, learning begins with a problem to be solved and the problem is posed in such a way that students need to gain new knowledge before they can solve the problem. Fernema and Sherman (2004) found that males also had higher scores on confidence in learning mathematics, viewing mathematics as a

male domain; therefore, the consideration of gender influence in a study like this might be a worthwhile excise.

Statement of the Problem

Mathematics Teachers are used to conventional chalk and talk method of teaching such as competitive and individualistic methods that are of low profit. Rooms are not given for interaction and sharing of ideas among the learners. It is also observed that students demonstrate laziness due to the lack of commitment on the part of the Mathematics Teachers in giving tasks to the students and also leading them on how to generate more tasks and solve them. Students' interest and achievement in mathematics have continued to decline in Nigeria year in year out. The performance of students in mathematics and the negative attitude of students to mathematics has been a matter of serious concern to all stakeholders, educators and parents.

Purpose of the Study

The purpose of the study was to investigate the effects of collaborative method of teaching and learning of mathematics in secondary schools in Ebonyi state. Specifically the study examined:

1. The effects of collaborative method in teaching and learning of mathematics in secondary schools.
2. The effects of collaborative method on students' performance in mathematics.
3. The effects of collaborative method on students' retention mean scores in mathematics.
4. The effects of collaborative method on students' retention mean scores of male and female.

Research Questions

1. Will there be any difference between the performance mean scores of students in the experimental and control groups?
2. Will there be any difference between the performance mean scores of male and female students' exposed to collaborative method?
3. Will there be any difference between the retention mean scores of students in the experimental and control groups?

4. Will there be any difference between the retention mean scores of male and female students exposed to collaborative method?

Research Hypotheses

1. There is no significant difference between the performance mean scores of students in the experimental and control groups.
2. There will be no significant difference between the performance mean scores of male and female students exposed to collaborative method.
3. There will be no significant difference between the retention mean scores of students in the experimental and control groups.
4. There will be no significant difference between the retention mean scores of male and female students exposed to collaborative method.

Research Methodology

This focused on the description of the methods that were used in carrying out the study. This was done under the following sub-headings:

Research Design

The design of the study was quasi-experimental design. According to Nworgu (2006), this research design is used to establish cause and effect relationships between two or more Variables. The design is chosen because it will be aimed at establishing the effect of learning method on students' performance in mathematics. Also class activities were not disrupted during the experimental treatment as intact classes were used.

Area of Study

The area of the study is Ohaukwu local government Area of Ebonyi state. The area is dominated by farmers, civil servants and all different kinds of people who engage in different occupations to earn their living such as fishing, petty trading, blacksmithing, commercial drivers and different kinds of handwork. It is bounded in the East by Izzi, in the West by Ishielu local government of Ebonyi state, in the North by Ado local government of Benue State respectively.

Population of the Study

The population of the study comprised all public secondary schools in Ohaukwu local government Area in Ebonyi state. There are 226 public secondary school in the State as that time of the study in all the 13 local government Area in the State with 10400 male and female.(source; statistics unit secondary Education Board Ebonyi state 2025)

Sample and Sampling Techniques

The sample for the study consisted of 150 senior secondary two (SS2) students. A simple random sampling technique was used to select one local government Area out of 13 local governments Area in Ebonyi state. From Ohaukwu local government Area, three schools were selected out of 16 public secondary schools in Ohaukwu local government Area in Ebonyi state using purposive sampling techniques. Fifty (50) students each will be used to determine a total of 150 students used for the study.

Instrument for Data Collection

The instrument that was used for this study is Mathematics Achievement Test (MAT). The instrument was developed by the researcher for the purpose of data collection. The test consisted of 30 questions draw from topic in mathematics curriculum.

The test consisted of multiple choice questions. The students were required to choose the right answers from the options (A-D), listed against each question, only one option was correct while other options were wrong. The options were draw from the Mathematics curriculum and generated by the researcher using the table of specification.

Validation of the Instrument

In the validation of the instrument (MAT), the following procedures were adopted. The test of blue print will be face validated by two specialists in mathematics education and one specialist in measurement and evaluation of science education both in Faculty of Education Ebonyi state university Abakaliki. They accessed the test items with regards to the cognitive learning objectives and examine the quality and suitability of the items.

The content validity of the Mathematics Achievement Test (MAT), was achieved using a test blue print. The preparation of the test blue print was based on the mathematical scheme of work for SS2 students used in constructing the instrument. These specialists examined the test items; check the correctness of the answers, clarity and language level of the items in MAT.

Reliability of the Instrument

To ensure the test reliability, the researcher used test/retest technique. It was applied to a pilot 30 students in the schools not used in the study within a two weeks period between the test and the retest. The data collected from the trial testing was used to determine the internal consistency of the MAT using K-R 20 (Kuder-Richadson formula) and test of Stability using test-Retest. The internal consistency reliability coefficient was 0.89 while test of Stability was 0.62 respectively.

Results

Hypotheses 1: There will be significant difference between the performance mean scores of students in experimental and control groups.

Table 1.t-test analysis of performance between experimental and control groups.

Variable	Group	N	Mean	Std.dev	df	t-cal	t-crit	Remarks
Performance	Experimental	75	78	8.77	148	14.29	1.96	Significant
	Control	75	57	9.19				

* Significant at $p<0.05$.

Table 1.Shows that, t-calculated observed was 14.29 and the t-critical was 1.96 at degree of freedom 148, since the t-calculated is greater than t-critical then the null hypotheses is rejected. Thus there is significant difference between the performance mean scores of students in experimental and control groups.

Hypotheses 2: There is no significant difference between the performance mean scores of male and female students exposed to collaborative methods.

Table 2.t-test analysis in the mean scores performance of male and female SS2 students exposed to collaborative methods.

Gender	N	Mean	Std.dev	Df	t-cal	t-crit	Remarks
Male	80	75	7.65	148	0	1.96	No significant
Female	70	75	6.42				

*Significant at p<0.05

Table 2 shows that, t-calculated observed was '0' and the t-critical was 1.96 at degree of freedom 148, since the t-calculated is less than t-critical then the null hypotheses is not rejected. Thus there is no significant difference between the performance mean scores of male and female students exposed to collaborative methods.

Hypotheses 3: There will be no significant difference between the retention mean scores of students in experimental and control groups.

Table 3.t-test analysis of the retention between experimental and control groups.

Variable	Group	N	Mean	Std.dev	df	t-cal	t-crit	Remarks
Retention	Experimental	75	66	8.49	148	5.69	1.96	Significant
	Control	75	59	6.45				

*Significant at p<0.05

Table 3 shows that, t-calculated observed was 5.69 and the t-critical was 1.96 at degree of freedom 148 , since the t-calculated is greater than t-critical then the null hypotheses is rejected. Thus there is significant difference between the retention mean scores of students in experimental and control groups.

Hypotheses 4: There will be no significant difference between the retention mean scores of male and female students exposed to collaborative methods.

Table 4.t-test analysis of the retention mean scores of male and female students exposed to collaborative methods.

Variable	Gender	N	Mean	std.dev	df	t-cal	t-crit	Remarks
Retention	Male	80	68	8	148	0.65	1.96	No significant
	Female	70	69	10.35				

* Significant at $p<0.05$

Table 4 shows that, t-calculated observed was 0.65 and t-critical was 1.96 at degree of freedom 148, since the t-calculated is less than t-critical then the null hypotheses is accepted. Thus there is no significant difference between the retention mean scores of male and female students exposed to collaborative methods.

Discussion

The result in table 1 showed that there is significant difference between the performance mean scores of students in experimental and control groups. This is in agreement with the findings of popoola 2007,at different times that there was positive change in the achievement of students in mathematics as a result of the method used by the teachers.

The findings further showed that there is no significant difference between the performance mean scores of male and female students exposed to collaborative methods. This was in line with Yusuf (2009) in his study on strategy for effective teaching and learning of calculus in secondary school which showed non-significant difference in the achievement mean scores of male and female students.

The result in table 3 showed that there is significant difference between the retention mean scores of students in experimental and control groups. Therefore the result of t-test analysis showed that the experimental group retrained the learnt some topics in mathematics significantly higher than control group. The result agree with the findings of Bello (2010) & Donnapid (2010) who in their separate studies reported that Mathematics computer Assisted instruction was very superior in increasing students academic achievement and retention.

The findings also further revealed that there is no significant difference between the retention mean scores of male and female students exposed to collaborative method. This findings is in line with Obioma (1985), Obodo (1993) and Okereke (2006), which they have reported gender as a significant factor in achievement when Mathematics is taught with certain strategies/techniques.

Conclusion

Base on the findings, it was concluded that collaborative method was effective for the teaching of mathematics. It was also concluded that the use of collaborative method enhance students academic performance and retention in mathematics at large. Collaborative method which encouraged sharing of ideas among the students fostered cordiality and friendliness in the class and this made lesson interested for the students.

Recommendations

1. Base on the findings of the study, the following recommendations were made:
2. Teachers of mathematics should be educated concerning the use of collaborative teaching method
3. Mathematics teachers should encourage their students to learn collaboratively.
4. The curriculum planners should include the use of collaborative teaching method in the curriculum.
5. Schools administrators should provide condusive atmosphere for the use of collaborative method.

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