IMPACT OF CONSTRUCTIVIST TEACHING STRATEGY ON ACADEMIC PERFORMANCE AND RETENTION IN MATHEMATICS AMONG SENIOR SECONDARY SCHOOL STUDENTS

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Abstract

This study focused on the Impact of Constructivist Teaching Strategy on Academic Performance and Retention in Mathematics among Senior Secondary School Students in Bosso Local Government Area, Niger State. The study was quasi-experimental design. This design was considered suitable for the study because intact classes were assigned to two differentiate groups. Two research questions and hypotheses were formulated to guide the study. The simple random sampling technique was employed to select sample size of 216 SS II students (110 students for experimental group, 106 students for control group). An instrument was developed by researchers and was validated by experts with reliability coefficient is at r= 0.84. The instrument was used as post–test and post-test for data collection and analyses. The study result revealed that there was a significant difference in the academic performance scores of students taught using the constructivist teaching method and those taught using conventional teaching method. The result also revealed that there was significance difference in the retention ability of students taught mathematics using constructivist teaching method and those taught using conventional teaching method. It was recommended among others that Seminar and workshops should be organized for mathematics teachers to educate then on the constructivist teaching method strategy. Also constructivist teaching method should be used as another alternative teaching method to teach mathematics in secondary schools.

Keywords: Constructivist teaching method, Conventional teaching method, Academic performance, Retention and Mathematics

INTRODUCTION

Mathematics is the pivotal of science and technology, without the knowledge of mathematics, scientific and technological development aimed in Nigeria cannot be achieve. Anigbo and Ndukwe (2019) stressed that every individual requires the knowledge of mathematics to function effectively and efficiently in the modern world of technology. Mathematics knowledge promotes science and technological development as well as facilitates the training of reasonable, meaningful thought and productive citizens. Mathematics provides students

opportunities to engage into different ways of problem solving as well as prepares them to discovery, analyses and interprets findings (Salman, 2018). In recognition of the importance of mathematics, the Federal Government of Nigeria gives priority to acquisition of mathematical knowledge and skills. The study of mathematics is compulsory at both secondary and primary schools in Nigeria. It is one of major requirement for admission into tertiary institutional to study science and science related courses and is based on credit pass in the subject at the West Africa Examination Council (WAEC) or National Examination Council (NECO) (Aliyu & Ahmad, 2020).

However, as important as mathematics is to men, society and national development, students continue to record poor performance in both internal and external examinations (Aliyu & Ahmad, 2020). No doubt there are evidences of high rate of failure in mathematics as contained in the WAEC (2018 & 2019) Chief examiner's report. It is worrisome that senior secondary students in Nigeria often perform poorly in mathematics at the senior secondary school certificate examination (SSCE) conducted by public examination bodies such as the West Africa Examination Council (WAEC) and National Examination Council (NECO), they attributed several factors responsible for high rate of poor performance, such as mathematics anxiety, teacher's attitude, low retention ability, shortage of qualified teacher, large class size and adherence to Conventional Teaching Method (CTM).

Thus mathematics teachers generally teach their students by conventional mode. Teachers select a set of mathematical tasks; demonstrate the necessary steps leading to their solutions and students then follow the same steps in finding solutions to similar problems. This method only favors educational advantage students (gifted, high ability). It does not promote students' abilities and is teachers' centered. The method has not been successful in promoting students' performance and retention in learning mathematics (Etsu & Manko, 2018). One of the strategies that has proved to promote students' performance and retention in learning mathematics in the constructivist mode of presentation.

The constructivists view learning as resulting from attempts by the individual to construct meaning into what he or she was taught and to make sense of the various concepts, principles, or facts presented by the teacher (Zakariyya, 2008). It argue that learners be actively involved in the learning processes. Constructivist strategy creates students' active participation and collaborative conversations to construct and reconstruct their reasoning (Muhammad, 2019). Also to Ahumareze and Ekwueme (2019) postulates that constructivist classroom has some characteristics to be followed. These are:

- The learner are actively involved
- The environment is democratic
- The activities are interactive and student-centered
- The teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous.

Furthermore, in the constructivist classroom, students are groups and emphasis is greatly focused on social interaction, problem-solving skills and communication skills. The students get involved in active exploration and meaningful group work as they learn mathematics

concepts progressively. The goals of the learning are made known to learners beforehand, thus the learning is goal directed. Students in constructivist classroom learn how to articulate their ideas and clearly as well as to collaborate on tasks effectively. Students are found to be agent and provides guide to their peers. Learning is achieved through repetition, and the subjects are strictly adhered to. The learning is retained longer because the method encourages group work and repetition as opposed to traditional classroom in which students are passive and work primarily alone (Aliyu & Ahmad, 2020).

In constructivist classroom, the teacher role is to prompt and facilitate discussion. Thus, the teacher mainly direct on guided questions that will lead the learners to develop their own conclusions on the task. Teacher as a facilitator in constructivist classroom involves creating rich environment and activities for linking new task. In addition, provide opportunities for collaborative work and problem solving as well as offering students a multiplicity of authentic learning task. The three major roles for facilitators to support student in constructivist class room are: Modeling, coaching and scaffolding. Since collaboration and problem solving skills are learned during learning, they work together to accomplish tasks and monitor their progress, they assess their performances and plan for future learning. It is against this background that the study was initiated to investigate the impact of constructivist teaching strategy on academic performance and retention in mathematics.

Retention can be defined as the ability to retain tasks been learnt. According to (Etsu & Manko, 2020) retention is the ability to retain and later recall information or knowledge gained after learning. It is a process in which a long term memory preserves learning material, so that it is hold, store and recall in the future. Most students in secondary school viewed mathematics as very abstract and difficult in understanding, assimilating and retaining concepts as reported by (Salman, 2018). Accordingly the Chief examiner WAEC report (2019) revealed that some of the problems encounter by students in mathematics is their inability to recall mathematical processes. These are associated with instructional methods adopted by some mathematics teachers. Salman (2018) stressed that retention can be improved upon in several approaches, such as collaborative learning, concept mapping and problem solving approach. These diverse views are indicator to the fact that mathematics educators have not reached consensus on the issue of instructional method.

Therefore, there is need to investigate constructivist teaching strategy based on constructivist learning theory. According to the theory; students learn by building on their previous knowledge and experience, as well as actively engaging in the learning process (Biong & Ayuba, 2021). This method belief that learning occurs as learner is actively involved in a process of meaningful and knowledge constructivist as opposed to passiveness. This strategy employed peering tutoring, guided discovery, and scaffolding, discussion on thoughts and ideas as well as activities to assist students to learn (Anigbo & Ndukwe, 2019).

PURPOSE OF THE STUDY

The purpose of this study was to investigate the impact of constructivist teaching strategy on academic performance and retention among senior secondary school students in Bosso Local Government Area Niger State, specifically, it has the following objectives:

1. Determine the impact of constructivist teaching strategy on academic performance in mathematics among senior secondary school students.
2. Examine whether students who were taught mathematics using constructivist will improve their retention ability.

RESEARCH QUESTIONS

To guide this study, the following research questions were asked:

1. What is the impact of constructivist teaching strategy on the academic performance of students in mathematics?
2. What is the impact of a constructivist teaching strategy on the retention ability of students in mathematics?

NULL HYPOTHESES

The following null hypotheses were formulated and tested at **$p < 0.05$** level of significance.

HO_1: There is no significant difference between the mean academic performance scores of students taught using constructivist teaching strategy and those taught using conventional teaching method in mathematics.

HO_2: There is no significant difference between the retention ability of students taught using constructivist teaching strategy and those taught using conventional teaching methods in mathematics.

METHODOLOGY

Research Design

This study was a quasi-experimental design. This design was considered suitable for the study because intact classes were assigned to the two difference group in this study.

Sample and Sampling Technique

The target population of the study consisted of all (4345) SS II Students in seventeen senior secondary schools of Bosso Local Government Area of Niger State. Multistage sampling procedure was adopted, in the first stage a cluster sampling was use to divide the schools into two cluster according to their location. In the second stage, simple random sampling technique was used by writing the name of the school in each cluster and picking one school in each cluster. In the third stage one school was randomly assign to experimental and the other control using flipping of a coin. The sample size involved two hundred and sixteen (216) students, (110) students for experimental group, while (106) students for control group which were randomly selected for the study.

Research Instruments

The instruments for data collection for this study were pre-test and Mathematics Performance Test (MPT), lesson plan for experimental group and lesson plan for the control group. Mathematics Performance Test (MPT) was developed by the researchers. The content areas covered during the treatment were: indices and logarithms, quadratic equation and change of subject of formulae. The test instrument consisted of 20 multiple choice objective questions with five options (A-E). The MPT constructed by researchers is of two versions (I) and (II).

MPT (I) has 20 items but has all its items and options reshuffled which give birth to MPT (II). This reshufflement is to control against familiarization of students with and arrangement pattern.

The version tagged MPT (I) was used for post-test while version tagged MPT (II) was used for post-post test. MPT was validated by two expertises in mathematics education section of COE, Minna and FUT, Minna. The reliability of the modified instrument was recorded as r= 0.84 through test-retest method, using Person Product Moment Correlation Coefficient (PPMCC).

Experimental Procedure

The study lasted for a period of six (6) weeks. The researchers used one (1) week intensive training programme to trained teachers from sampled schools, who served as research assistants for the study as well as administration of the post-test and post-post test to the two groups. Two different lesson models were designed for treatment for the two groups; experimental and control group. After which proper teaching commenced then posttest was administered to evaluate their academic performance after the content has been taught to them. The reshuffled MPT (II) was re- administered to the students to examine the student retention after the posttest. The answer scripts were collected immediately from students for marking. The study was conducted among senior secondary two students in Bosso Local Government Area in Niger State with a sample size of 216 students. Two groups were selected and the results obtained from the study were presented according to the research questions and hypotheses. The data collected were analyzed using descriptive statistics of means, difference to answer research questions and inferential statistics of t-test for hypotheses testing at alpha = 0.05 level of significance.

Result of Findings

Answering the research questions:

Research Question 1: What is the impact of the constructivist teaching method on academic performance of students in mathematics? To answer this research question a descriptive statistics of means, standard deviation and mean difference were carried out. The result was presented in Table1.

Table 1: Means and standard deviations of the experimental and control groups in Post test

GROUP	N	MEAN	SD	Mean Difference
Exp. Gp	110	43.26	13.75	3.01
Control Gp	106	40.25	12.29	

Result in Table 1 showed that the mean score of the experimental was 43.26 and the mean of the control group was 40.25. The mean gain score was 3.01 in favor of the experimental group. This indicates that there was improvement in the academic performance of the students exposed to constructivist teaching strategy.

Null Hypothesis One: There is no significant difference between the mean academic performance scores of students taught using constructivist teaching strategy and those taught using conventional teaching method in mathematics at senior secondary schools. To verify whether there is statistical significant difference in the mean scores of the groups, a t-test statistic was used. The result is presented in Table 2.

Table 2: T-test analysis of Experimental and control group in post-test

Group	N	Mean	Sd	Df	t-cal	P- value	Remark
Exp. Gp	110	43.26	13.75	214	6.71	0.00	Sig
Control gp	106	40.25	12.29				

Results of Table 2 showed that p-value was 0.00 which was much less than ∞= 0.05. This indicated there was significance difference in the mean performance scores of students taught using constructivist teaching strategy and students taught using conventional teaching method. The null hypothesis was therefore rejected.

Research Question Two: What is the impact of constructivist teaching strategy on retention ability in mathematics among senior secondary school students? To answer this research question descriptive statistics of mean, standard deviation and mean difference were employed. The result is presented in Table 3.

Table 3: Means and standard deviations of experimental and control groups in Post-post test

Group	N	Mean	SD	Mean Difference
Exp. Gp	110	45.41	13.80	
Control Gp	106	41.85	12.25	3.56

The results in Table 3 showed that the mean score of the experiment group was 45.41 and the mean of the control group was 41.85. The mean difference scores 3.56 is in favor of the experimental group. This showed that there was improvement in the retention ability when the students taught using constructivist teaching method.

Null Hypothesis Two: there is no significant different between the mean retention scores of students taught using constructivist teaching method and those taught using conventional teaching method. To test the stated hypothesis the scores were subjected to an independent simple t-test statistic and the result in Table 4 was presented as follows:

Table 4: T-test Analysis of Experimental and Control Groups in Post-post test

Group	N	Mean	SD	DF	T-cal	P- value	Remark
Exp. Gp	110	45.41	13.80				
Control gp	106	41.85	12.25	214	2.32	0.00	Sign

The result in Table 4 proved that the constructivist teaching method was in improving ability therefore the null hypothesis which says there no significant difference was rejected. By the results obtained there was significant difference in the mean scores of the groups' retention ability.

DISCUSSING OF FINDINGS

The study revealed that there was significant difference in the academic performance scores of students taught using constructivist teaching method and those taught using conventional teaching method. This in line with positions of Ahumareze and Ekwuemwe (2019) who found that students taught with constructivist teaching method performed better than those taught with conventional teaching method because the constructivist strategy encourages students' active participation and collaborative conversation to construct and reconstruct reasoning and provides them with cognitive development. The constructive learning theory says that students learn best when they construct a personal understanding based on experiencing things and reflecting in those experiences. It was also observed by Biong and Ayuba (2021) that the participation of the students in the constructivist classroom and their ability to become active learners and perform in their environment given in the constructivist teaching method, are things that made students in experimental group perform better than control group.

The findings also revealed that there was significance difference in the retention ability of students taught mathematics using constructivist teaching method and those taught using conventional teaching method. This proven that the constructivist classroom favors the experimental group than control group. This confirmed the findings of Muhammad (2010) and Blong & Ayuba (2021) that constructivist classroom involves creating rich environment for collaboration and activities for repetition of task, which in turn provide opportunities for higher level thinking and reserve information for longer period than students working individual alone. Furthermore, it was also reported that students participated more in the constructivist classroom, increase in retention ability and become more active learners in their environment of constructivist teaching method. Anigbo and Ndukwe (2019) reported that subject matters discussed and clarified in the constructivist classroom are retained. Significant difference could be recorded because of the collaborative and problem-solving approaches that are involved in the constructivist classroom which allows students active participation and good rehearsal.

CONCLUSION

It is observed during this study that learners are actively involved, the environment is democratic and the activities are interactive, which encouraged learners to be responsible and autonomous.

Furthermore, researchers found a significance difference in students' academic performance when taught using constructive teaching method. Also there was significant difference in retention ability of students taught mathematics when using constructivist teaching method and those taught using conventional teaching method.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

1. Seminars and workshops should be organized for mathematics teachers to educate then on the constructivist teaching method strategy.

2. Constructivist teaching should be included into mathematics curriculum by curriculum planners.
3. Mathematics teachers should be encouraged to adopt CTS approach in teaching and learning of mathematics, especially in Senior Secondary Schools.

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