EFFECT OF CONSTRUCTIVISM BASED BLENDED LEARNING APPROACH ON SENIOR
SECONDARY SCHOOL STUDENT MATHEMATICS ACADEMIC PERFORMANCE AND RETENTION OF IN KATSINA STATE

Dr. Usman Tukur, OLAOYE, A. E.

Teaching Mathematics Methods in the Department of Curriculum and Instructional Technology, Federal College of Education Katsina
tukurusman56@gmail.com, abiodune.emmanuel@fcekatsina.edu.ng

AUDU, Hauwa

Teaching Mathematics Methods in the Department of Primary Education, Federal College of Education Katsina
hauwaauduedoh@gmail.com

Abstract

This study was carried out on effects of constructivism based blended learning approach on senior secondary school students mathematics academic performance and retention . The research adopted quasi-experimental non-equivalent control group design. Data were collected from a sample of 120 students comprising 59 boys and 61 girls from two randomly selected public schools in Katsina educational zone of Katsina state. The schools were grouped into experimental and control group. Mathematics Performance Test (MPT) was used to gather data. The MPT was a researcher made instrument consisting of forty multiple choice (40) items based on SSII mathematics second term topics. The MPT was administered thrice, before experiment (Pre), after experiment (Post) and two weeks after post MPT (Retention test). The reliability coefficient of MPT was found to be 0.85. Data collected were analyzed using descriptive statistics of mean and standard deviation for answering the research questions and ANCOVA at coefficient alpha level of 0.05 for testing the hypotheses. The findings of this study are: there was a significant difference between the mean academic performance scores of students' taught mathematics with constructivism based blended learning approach and those in the control group. There is no significant difference between the mean achievement score of male and female students'

taught mathematics with constructivism based blended learning approach. It was recommended that Mathematics teachers should be encouraged to use constructivism based blended learning approach to teach mathematics at senior secondary level.

---***--

Introduction

The knowledge of mathematics is a basic requirement in the quest for present day scientific and technological advancement. The idea of numbers, structures and relationships which mathematics connotes stand out in medicine, business, education, agriculture, and every field of human endeavor. In the 21st century in particular, sound mathematical background is needed for life sustenance and workplace competence. Mathematics expands the human intellect, broadening our conceptual horizons and opens up vast areas of pure thought. Mathematics is a powerful exploration of pure thought, truth and ideas for their intrinsic beauty, intellectual power and interest. In its development mathematics creates and describes wondrous worlds of beauty, populated by linked crystalline forms that stretch off to infinity in richly etched exquisiteness, like the vision of the net of Indra (Ernest, 2010).

Mathematics equips students with uniquely powerful ways to describe, analyze and change the world. It can stimulate moment of pleasure and wonder for all students when they solve a problem for the first time, discover a more elegant solution or notice hidden connections. Students who are functionally capable can think independently in applied and abstract ways and can reason, solve problem and assess risks. However, vast majority of Nigerian students fear and dread mathematics, because of the seemingly abstractness of its concepts. Anaduaka and Okafor (2013) observed that many students do not immediately see the use or applicability of the subject to their lives and to the world of work around them; so they wonder why they should be troubled with the study of the subject. To these young minds, mathematics still remains a mystery that has no place in reality.

In spite of great importance of mathematics in nation building, scientific and technological development, it is still notable that students' performance in mathematics external examinations have remained poor. Table 1 presents the result statistics of students' performance in West African Secondary School Certificate Examination (WASSCE) in mathematics from 2011 to 2020 in Katsina State Nigeria.

Table 1: Students Performance in May/June WASSCE Mathematics (2011-2020) in Katsina State

Year	Total No. of Students	NO. of Students That Obtained Credit & Above(A1-C6)	% of Students With Credit & Above(A1 C6)	NO. of Students With (D7-F9)	% of Students With (D7-F9)
2011	36,798	478	1.30	36,320	98.70
2012	38,602	494	1.28	38, 108	98.72
2013	41,758	4,342	10.40	37,416	89.60
2014	43,065	4,421	10.27	38,644	89.73
2015	44,439	5,566	12.53	38,873	87.47
2016	20,404	7,790	38.20	12,614	61.80
2017	21,717	11,612	53.47	10,105	46.53

2018	23,916	7,188	30.06	16,728	69.94
2019	21,589	7, 276	33.70	14,313	66.30
2020	22,884	9,313	40.70	13,571	59.30
Total	315,172	58,480	231.91	256,692	768.09
Average	**31,517**	**5, 848**	**23.19**	**25,669.2**	**76.81**

Source: Test Development Division, West African Examination Council (WAEC) Lagos, Nigeria.

The overall performance in mathematics at the Senior Secondary Certificate Examination in Katsina state secondary schools has been poor as evidenced in Table 1. As the average percentage credit in mathematics was found to be 23.19 and the average percentage without credit is 76.81. The results shows; there are problem yet to be solved in mathematics. The search for an explanation for students' poor performance in schools is far from being concluded as it remains one major controversial issue in education. Some of the reasons for poor performance could be attributed to low utilization and sometimes non - availability of instructional materials (audio - visual aids in particular) for teaching of mathematics in schools, the pattern of teaching adopted by teachers today is mostly abstract in form, without been supported by the use of appropriate aids, inability to select appropriate audio - visual materials and sometimes its irregular use as support to the teaching of mathematics in classrooms by its teachers was observed to be a strong hindrance to students achievement.

The major issue that faces mathematics educators anywhere is how they can provide a better and interactive educational environment and which method can lead them to this aim (Olaoye, 2018). The traditional method "talk and chalk", do not enhance students achievement. It cannot be compared with the use of computer technology which uses pictures, stored information, simulation and immediate evaluation. The rapid increase in using technologies in different fields and introducing new educational ways such as e-learning, e-school and virtual class make sense, considering that technology is a major partner and effective educational tool. The integration of these concepts into mathematics classroom knows as blended learning. Generally, Blended learning is a new type of education prepared for a certain group by combining the positive aspects of different learning approaches. Blended learning will provide a big convenience for the course to achieve its target by combining the face to face interaction in traditional learning and time, place and material richness provided by Web-based learning. Yılmaz and Orhan (2010) state that the best way to solve the lack of interaction problem faced in technology-based learning is to blend traditional learning and online learning.

Blended learning aims to employ multi-educational methods to achieve the final goal behind education (Tsoi, 2009 Cited Igonoh, 2020).The uniqueness of the blended learning is represented by its ability to use the refined techniques from both, e-learning and traditional method, thus, the output will be a version of the best from each method. Blended learning is about a mixture of online and in-person delivery where the online portion effectively replaces some of the face-to-face contact time rather than supplementing it. (Graham, Charles, Woodfield and Harrison 2013).

Constructivism theory is based on the idea that people construct their own knowledge through their personal experience. The effectiveness of Constructivism is that it prepares students for problem solving in complex environment. In Constructivism approach; students are more active in building and creating knowledge, individually and socially, based on their experiences and interpretations. Teacher's role is essential and important in learning process. The role of the teacher in Constructivism theory is to try to understand how students interpret knowledge and to guide and help them to refine their understanding and interpretations to correct any misconception that arises between students at an early stage and improve learned knowledge quality.

A few studies, however, explored constructivism based blended learning approach from different dimensions as it concerns teachers and educators from different field of study: Turki (2014) investigated the impact of teaching science using blended learning strategy in the development of achievement skill among students in United Arab Emirate. The study finding out that using blended learning strategy to teach science, has a positive impact in achievement skill and attitudes. The study also showed high level of performance on achievement test as a whole after applying blended learning strategy. Gideon (2016) investigated the effects

of constructivist instructional methods on learner achievement in biology in secondary schools in Homabay County, Kenya. The findings of the study shown that constructivist instruction is more effective in learning biology compared to conventional instruction. When taught through the constructivist instruction, girls learn and perform better in biology than boys. When learning achievement was compared along classroom category, girls performed better than students in mixed sex classrooms and students in boys' classrooms. The study also revealed that girls have a more positive attitude towards constructivist instruction than boys. The study recommends that biology teachers be encouraged to use constructivist method of instruction in order to improve students' performance. Feras (2015) investigated Blended Learning approach compared to the traditional learning approach on fifth grade students' achievement in language textbook and the development of their verbal creative thinking in Saudi Arabia. The result shows that that the experiment group which was taught using the blended approach of learning outperformed the Control Group in both tests. Thus, learning Language Textbook using the blended approach is more effective than the traditional method in terms of achievement and the development of verbal creative thinking skills.

In adopting constructivism based blended learning approach as an instructional strategy, other observed factors that can influence the students' participation in the instructional delivery process such as gender and retention need to be addressed. Gender is the sum total of cultural values, attitudes, roles practices and characteristics based on sex. Sex is the innate biological differences between a man and a woman. Gender influence on students' academic achievement has been of concern to researchers, but no consistent result has been established. Oludipe (2012) agreed that gender bias is very prevalent in Africa and particularly Nigeria. He argued that in Nigeria, harder tasks are assigned to males while females are given the relatively easy and less demanding tasks. Stefanelli (2006) confirmed that teachers ask boys higher level questions and engage them in conversation in the classroom than girls

Retention has been described as the process of maintaining the availability of a replica of the acquired new means or repeat performance by a learner with an acquired piece of knowledge (Nneji, 2011). Retention is the capacity to remember something, skills, knowledge, habits, attitudes or other responses initially acquired. Retention plays an important role for what is learned to be effectively applied. The teacher is usually faced with the task of how to help pupils/students improve on their ability to assimilate and retain what they have learnt.

This study is set to investigate the effect of constructivism based blended learning approach on senior secondary school students mathematics academic performance and retention of in Katsina State.

Statement of the Problem

The issue of poor performance and retention among students in mathematics in secondary schools has continued to persist despite the importance of the subject to nation building and development. Studies such as Iji, Ogbole and Uka (2014) and Charles-Ogan (2017) asserted that secondary school students' performance is less than 50 percent in mathematics for the past decades. Also, the Chief Examiners report for WAEC over the years expressed worries over the low achievement of students in mathematics which they attributed to weakness and difficulty in understanding mathematical concepts, lack of confidence, poor teaching methods, poor retention and interest in mathematics. The low performance among students in mathematics is also observed by Kurumeh, Onah and Mohammed (2012) who asserted that it is a function of the instructional method adopted by the teacher. The instructional method employed by the teacher plays an important role in the acquisition of instructional content for meaningful learning and development of necessary skills. Nigerian senior secondary school classrooms are predominantly dominated by the conventional method of instruction, which does not encourage students' interaction. It is teacher-centered instructional methods that make students passive with less interaction. The lack of active participation of students in their learning was also indicted for students' poor performances in mathematics (Gambari & Olumorin, 2013). Research in many areas of education has shown that the methods of teaching utilized by the teacher are very important factor in students' learning and subsequent performance in examinations (Obeka, 2014). Hence there is the need to try out other methods to salvage the situation. Based on the above, this study is set to investigate the of constructivism based blended learning approach on senior secondary school students mathematics academic performance and retention of in Katsina State

Research Objectives

The purpose of this study is to find out the effects of constructivism based blended learning approach on senior secondary school students' mathematics academic performance and retention in Katsina State. Specifically, the objectives of the study are to:

1. Find out if there is any difference between the mathematics academic performance of senior secondary school students taught with constructivism based blended learning approach and those taught with the conventional method.

2. Investigate if there is any difference between the mathematics academic performance of male and female senior secondary school students taught with constructivism based blended learning approach.

3. Determine the difference in the retention of students taught mathematics with constructivism based blended learning approach and those students taught with conventional teaching method.

4. Find out the difference in the retention of male and female students taught mathematics with constructivism based blended learning approach.

Research Questions

The following research questions were posed to guide the study:

1. What is the difference between the mathematics academic performance of senior secondary school students taught with constructivism based blended learning approach and those taught with the conventional method?

2. What is the difference between the mathematics academic performance of male and female senior secondary school students taught with constructivism based blended learning approach?

3. What is the difference between the retention of students taught mathematics with constructivism based blended learning approach and those students taught with conventional teaching method?

4. What is the difference in the retention of male and female students taught mathematics with constructivism based blended learning approach?

Hypotheses

The following Hypotheses were tested at 0.05significant level

Ho$_1$: There is no significant difference difference between the mathematics academic performance of senior secondary school students taught with constructivism based blended learning approach and those taught with the conventional method

Ho2: There is no significant difference between the mathematics academic performance of male and female senior secondary school students taught with constructivism based blended learning approach

Ho3: There is no the difference between the retention of students taught mathematics with constructivism based blended learning approach and those students taught with conventional teaching method

Ho4: There is no significant difference in the retention of male and female students taught mathematics with constructivism based blended learning approach

Delimitation of the Study

This study aims at finding out the the effects of constructivism based blended learning approach on senior secondary school students' mathematics academic performance and retention in Katsina State. The study involved SSII students in the Katsina Educational Zone. The choice of public schools was due to their students' population so they have many arms of the same class and many students in each class that may not affect the normal class activity. The study was limited to co-educational schools that have SSII class as at the time of this study. The reason for choosing this level of students was that it is a more stable class, in addition to being reasonably exposed to mathematics concept in the senior secondary school syllabus,

moreover they are not yet at the stage of writing their external examination. Only the content of the SSII mathematics syllabus for the second term was used to carry out this research work

Significance of the Study

This study would be of great benefit to benefit to teachers, students and contributes to existing literature. The study could be useful to mathematics teachers to improve in the way they impart knowledge by changing their teaching methods which are usually teacher-centred to students centre thereby making learning more participatory and interesting in order to produce critically minded students. It would also serve as a model and guide for teachers on how to construct and effectively use constructivism based blended learning to promote meaningful learning and interest of mathematical concepts across all content areas.

For students the findings of study would encourage active classroom participation and interaction, interpersonal relationship, build students' self-confidence and get them always prepared for meaningful learning thereby increasing academic performance. The study is an academic research work and would add to the existing stock of knowledge as well as serve as a basis of reference in future studies in the field of mathematics education

Methodology

The research design for the study was the quasi-experimental non-equivalent control group design, which makes use of pre-test, treatment, post-test and delay post-test as intact classes were used for the research and there was no randomization of the students. The design also makes it possible to test the assumption of equality of the two groups. The population for this study comprised all the secondary school students in Katsina Educational zone of Katsina state. The target population of the study consists of all SSII students in Public Secondary Schools in Katsina educational zones numbering 19,572 from twenty five(25) Government Secondary Schools in the study area. The study used one experimental group and a control group.

Students in the experimental group were taught with constructivism based blended learning approach while t he control group was taught with conventional method. Simple random sampling technique was used to sele ct two schools for this study. The two schools have four arms for each gender of SSII each and simple random sampling technique was used to select two arms from each school for the purpose of this research one arm for boys and one arm for girls. Each arms in the school was randomly assigned to either experimental or control group. The experimental group comprised 37 male and 35 female students and the control group comprised 22 male and 26 female students, making a total of 120 students. A Mathematics Performance Test (MPT) was used to collect data for the study. The MPT was developed by the researchers based on SSII Mathematics syllabus covering the scheme of work for the term. Forty (40) items were put together following specifications on a test blue print. Kuder-Richardson (KR- 21) formula was used to ascertain the internal consistency of the instrument which gave 0.85. Each of the 40 items was a multiple-choice objective question with four options (A, B, C, and D). Time allowed was one hour. Before the commencement of the teaching, each class were given a pre-test (first version of MPT) to determine the level of homogeneity of students knowledge. The researchers later organize a day training for teachers of the experimental group to be familiar with guides and procedures describe in the lesson plan and how to use the constructivism based blended learning approach lesson plan prepared by the researchers while the control group would use the conventional method this group used teacher's typical method; where chalk and talk instructional technique usually dominate. For the period of the study, the teachers would meticulously use the lesson plans prepared by the researcher for both experimental and control groups to cover the mathematics contents for the whole term.

During this period, the teachers of the experimental groups meticulously used the lesson plans prepared by the researcher and based on the principles of each teaching strategy to cover the Mathematics contents for the whole term. The post-test (that is, the second version of the MPT) was administered at the end of the term when the two groups might have cover the expected contents and two weeks after, delayed post-test of MPT was administered. The MPT was scored 100 percent in all versions. The teachers distributed the MPT and gave the students one hour to answer the questions. The researchers availed themselves to the

respondents for possible clarification and explanation. Descriptive statistics of mean and standard deviation was used to answer the research questions while ANCOVA at coefficient alpha level of 0.05 was used to test the hypotheses.

Data Analysis and Results

Answer to Research Questions

Research Question One: What is the difference between the mathematics academic performance of senior secondary school students taught with constructivism based blended learning approach and those taught with the conventional method?

Table 2: Descriptive Statistics Showing Experimental Group (Constructivism Based Blended Learning) and Control Group Academic Performance in the Pre-test and Post test

Groups	No. of Students	Pre-Test		Post-Test		Mean Gain
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Experimental	72	15.00	6.77	57.78	7.02	42.78
Control	48	15.10	6.15	46.67	9.34	31.57
Mean Difference		0.10		11.11		11.21
Total	120					

Results on Table 2 indicated that the mean gain of the students taught with constructivism based blended learning approach (Experimental Group) was 42.78 and that of the control group who were taught using conventional method 31.57. The overall mean difference between the groups was 11.21 and this favored students' in Experimental group. The mean performance scores of students who were taught mathematics with constructivism based blended learning approach was higher than those taught using conventional method with a mean gain of 11.11 which favored the experimental group. Therefore, a difference in performance existed between the group taught mathematics with constructivism based blended learning approach and those taught using conventional method. The students who were taught with constructivism based blended learning approach higher than the other students who were taught in the control group.

Research Question Two: What is the difference between the mathematics academic performance of male and female senior secondary school students taught with constructivism based blended learning approach?

Table 3: Descriptive Statistics Showing Experimental Group (Constructivism Based Blended Learning) on Gender Academic Performance in the Pre-test and Post test.

Groups	No. of Students	Pre-Test		Post-Test		Mean Gain
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Male	37	13.78	6.50	58.11	9.27	44.33
Female	35	13.86	5.57	57.43	9.53	43.57
Mean Difference		0.10		0.68		0.76
Total	72					

Result of Table 3 indicated that the mean gain of the male students taught mathematics with constructivism based blended learning approach (Experimental Group) was 58.11 and that of the female students who were also taught mathematics with constructivism based blended learning approach (Experimental Group) was 57.43. The overall mean difference between the performance scores of male and female students was 0.76 which favored the male students. The mean performance score of the male was higher than that of the female students with a mean gain of 0.68 which favored the male students. Therefore, the effect of constructivism based blended learning approach of the male students was higher than that of the female students.

Research Question Three: What is the difference between the retention of students taught mathematics with constructivism based blended learning approach and those students taught with conventional teaching method?

Table 4: Descriptive Statistics Showing Retention of Students in Experimental Group (Constructivism Based Blended Learning) and Control Group Academic Performance in the Pretest and Retention test

Groups	No. of Students	Pre-Test		Post-Test		Mean Gain
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Experimental	72	15.00	6.77	42.64	5.86	27.64
Control	48	15.10	6.15	39.48	8.42	24.38
Mean Difference		0.10		3.16		3.26
Total	120					

Results on Table 4 indicated that the retention mean gain of the students taught mathematics with constructivism based blended learning approach (Experimental Group) was 42.64 and that of the control group who were taught using conventional method 39.48. The overall retention mean difference between the groups was 3.16 and this favored students taught mathematics with constructivism based blended learning approach (Experimental Group). The retention mean performance scores of students who were taught mathematics with constructivism based blended learning approach (Experimental Group) was higher than those taught using conventional method with a mean gain of 3.26 which favored the experimental group. Therefore, there are difference in retention performance existed between the group taught mathematics with constructivism based blended learning approach (Experimental Group)and those taught using conventional method.

Research Question Four: What is the difference in the retention of male and female students taught mathematics with constructivism based blended learning approach?

Table 5: Descriptive Statistics Showing Constructivism Based Blended Learning on Gender in the Pretest and Retention Scores.

Groups	No. of Students	Pre-Test		Post-Test		Mean Gain
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Male	37	13.78	6.50	40.95	6.94	27.17
Female	35	13.86	5.57	44.43	9.42	30.57
Mean Difference		0.08		3.48		3.4
Total	72					

Result of Table 5 indicated that the retention mean gain of the male students taught mathematics with constructivism based blended learning approach (Experimental Group) was 40.95 and that of the female students who were also taught mathematics with constructivism based blended learning approach (Experimental Group) was 44.43. The overall mean difference between the retention performance scores of male and female students was 6.8 which favored the male students. The retention mean performance score of the male was higher than that of the female students with a mean gain of 3.48 which favored the female students. Therefore, the effect of constructivism based blended learning approach of the female students was higher than that of the male students in the retention performance.

Test Hypotheses

Table 6: ANCOVA of the Difference in Mean Scores of Students Taught with Constructivism Based Blended Learning Approach and those Taught with Conventional method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3569.686[a]	2	1784.843	24.577	.000
Pretest	.114	1	.114	.002	.969
Intercept	33248.873	1	33248.873	457.824	.000
GENDER	14.130	1	14.130	.195	.660
METHOD	3520.691	1	3520.691	48.478	.000
Error	8496.981	117	72.624		
Total	353400.000	120			
Corrected Total	12066.667	119			

a. R Squared = .296 (Adjusted R Squared = .284)

Ho1: There is no significant difference difference between the mathematics academic performance of senior secondary school students taught with constructivism based blended learning approach and those taught with the conventional method

Table 6 shows that teaching method as a main factor has significant effect on students' academic performance in mathematics. This is because, from the table, method is significant at p-value of 0.000 and therefore at a higher p-value of 0.05, teaching method is also significant. This leads to the rejection of the null hypothesis of no significant difference in the mean mathematics academic performance scores of students taught with constructivism based blended learning approach and those taught with conventional method.

Ho2: There is no significant difference between the mathematics academic performance of male and female senior secondary school students taught with constructivism based blended learning approach

Table 6 shows that the computed F - ratio for the effect of gender on academic performance of students in the Mathematics Achievement Test was 0.198 which was not significant at P-value of 0.05. Thus, the null hypothesis of no significant effect of gender on the achievement performance of students in MAT was accepted.

Table 7: ANCOVA of the Difference in Retention Mean Scores of Students Taught with Constructivism Based Blended Learning Approach and those Taught with Conventional method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	328.763[a]	3	109.588	1.579	.203
Intercept	20774.023	1	20774.023	299.296	.000
PRETEST	44.771	1	44.771	.645	.425
GENDER	149.595	1	149.595	2.155	.147
GROUP	61.585	1	61.585	.887	.000
GENDER * GROUP	.000	0	.	.	.
Error	4719.848	68	69.410		
Total	135950.000	72			
Corrected Total	5048.611	71			

a. R Squared = .065 (Adjusted R Squared = .024)

Ho3: There is no the difference between the retention of students taught mathematics with constructivism based blended learning approach and those students taught with conventional teaching method.

Table 7 shows that teaching method as a main factor has significant effect on retention of students' academic performance in mathematics. This is because, from the table, method is significant at p-value of 0.000 and therefore at a higher p-value of 0.05, teaching method is also significant. This leads to the rejection of the null hypothesis of no the difference between the retention of students taught mathematics with

constructivism based blended learning approach and those students taught with conventional teaching method

Ho₄: There is no significant difference in the retention of male and female students taught mathematics with constructivism based blended learning approach

Table 7 shows that the computed F - ratio for the effect of gender on academic performance of students in the Mathematics Achievement Test was 2.155 which were not significant at P-value of 0.05. Thus, the null hypothesis of no significant difference in the retention of male and female students taught mathematics with constructivism based blended learning approach in MAT was accepted.

Discussion of Findings

Results presented in table 2 showed that experimental group that were taught with constructivism based blended learning approach performed significantly better than the control group who were taught with the same contents with the conventional method. The students in both groups were found to be relatively homogeneous before the start of the experiment, judging from the result of the pre-test where they had a difference in mean of 0.10. The result of ANCOVA as reported in Table 6 showed that there was a statistically significant difference between mean academic performance of students taught mathematics through constructivism based blended learning and those taught with conventional method. The finding agreed with the work of Turki (2014) who found that using blended learning strategy to teach science, has a positive impact in achievement skill and attitudes. The study showed high level of performance on achievement test as a whole after applying blended learning strategy than traditional teaching method.

Table 3 and 6 show that the teaching method of constructivism based blended learning approach is not biased as male and female students taught mathematics with the approach achieved almost at the same high level in the post-test, with male students doing even slightly better than female. This finding contradicts that of Gideon (2016) who find that when taught through the constructivist instruction, girls learn and perform better in biology than boys. When learning achievement was compared along classroom category, girls performed better than students in mixed sex classrooms and students in boys' classrooms.

Results presented in table 4 showed that experimental group that were taught with constructivism based blended learning approach retained significantly better than the control group who were taught with the same contents with the conventional method. The result of ANCOVA as reported in Table 7 showed that there was statistically significant differences between retention mean academic performance of students taught mathematics through constructivism based blended learning and those taught with conventional method. This implies that constructivism based blended learning produced a greater impact on students' performance in mathematics .The finding agreed with Nneji, (2011) that retention has been described as the process of maintaining the availability of a replica of the acquired new means or repeat performance by a learner with an acquired piece of knowledge.

Table 4 and 7 show that the teaching method of constructivism based blended learning approach is not biased as male and female students taught mathematics with the approach retained almost at the same high level in the post-test, with female students doing even retained slightly better than male. This is in line with the finding of Gideon (2016) that When taught through the constructivist instruction, girls learn and perform better in biology than boys. When learning achievement was compared along classroom category, girls performed better than students in mixed sex classrooms and students in boys' classrooms.

Conclusion

It is concluded from the finding of the study that students learn mathematics better when taught with constructivism based blended learning approach than conventional teaching method. The method is good for teaching mathematics to students. Constructivism based blended learning approach enhanced students' achievement and self-confidence, developed cooperation and interaction, activated students and aroused the idea of searching. The students do not seem to have a predictable view of intelligence as regards to gender, both achievement and retention when taught mathematics with constructivism based blended learning approach does not discriminate on academic achievement and retention of students based on their gender

and that is, it has effect on both male and female students. In other words, it was found constructivism based blended learning approach is gender-friendly if adequately utilized.

Recommendations

Based on the results of this study, the following recommendations were made:

1. Mathematics teachers should be encouraged to use constructivism based blended learning approach to teach mathematics at senior secondary level.

2. Teachers in training should be equipped with knowledge vast enough to implement constructivism based blended learning approach in teaching mathematics.

3. School supervisors, ministry officials and textbook authors should emphasize on the use of constructivism based blended learning approach in teaching mathematics in secondary schools.

4. Seminars, workshops and conferences should be organized to train teachers on the use of the constructivism based blended learning approach

References

1. Anaduaka, U.S & Okafor, C.F (2013). Poor performance of Nigerian students in mathematic in senior secondary certificate examination (SSCE): what is not working? JORIND 11(2),1-5.

2. Charles-Ogan, G (2017). Meta-cognition strategy and senior secondary school mathematics students' misconceptions in Rivers State, Nigeria. *ABACUS Journal of Mathematics Association of Nigeria,* 39(1), 234-246.

3. Ernest, J. (2010). Mathematics and sex. Santa Barbara, CA: University of California FDRE Education and training policy. Addis Ababa. April 1994 for middle school students with learning difficulties. Journal of Learning Disabilities, 40(5), 410–419.

4. Feras, M. A (2015).The effect of blended learning approach on fifth grade students' academic achievement in my beautiful language textbook and the development of their verbal creative thinking In Saudi Arabia. Journal of International Education Research.11 (4), 112-118

5. Gambari, I. A., & Olumorin, C. O (2013). Effectiveness of video-based cooperative learning strategy on high, medium and low academic achievers. The African Symposium: Journal of the African Research Network, 13(2), 77-85.

6. Gideon, M. M(2016). Effect of constructivist instructional methods on learner achievement in biology in secondary schools in Homabay county, Kenya. Unpolished PhD Thesis University of Nairobi Kenya

7. Graham, C., Charles, R., Woodfield, W. & Harrison J (2013).A framework for institutional adoption an implementation of blended learning in higher education. The Internet and Higher Education. Blended Learning in Higher Education: Policy and Implementation Issues.18:4-14

8. Igonoh, M.(2020).Effects of constructivism based learning approach on mathematics achievement and interest of junior secondary school students in AMAC, Abuja. Unpublished Master Dissertation, University of Abuja, Nigeria

9. Iji, C. O, Ogbole, P.O, &Uka, N. K. (2014). Effect of improvised instructional materials on students' achievement in geometry at the upper basic educational level in Makurdi metropolis, Benue State, Nigeria. *American Journal of Educational Research,* 2(7), 538-542.

10. Kurumeh, M.S., Onah, F. O., & Mohammed, A. S. (2012). Improving students' retention in junior secondary school statistics using the ethno- mathematics teaching approach in Obi and Oju Local Government Areas of Benue state, Nigeria. *Greener Journal of Educational research*, 2(3), 54-62.

11. Nneji, S.O. (2011). Effect of Q-Basic Quadratic Equation Game on Secondary School Students Achievement, Interest and Retention in Mathematics. *Unpublished M.Sc Thesis Enugu State University of Science and Technology, Enugu.*

12. Obeka, S. S (2014). Repositioning education through innovative teaching on academic performance in practical geography at SSCE in North Central Nigeria. A paper presented at the Multi- Cultural Conference of the Faculty of Education, Ahmadu Bello University, Zaria. Held 12th -16th August, 2014.

13. Olaoye, A.E (2018). Effect of students' team achievement division and jigsaw teaching strategy on students achievement in mathematics. Unpublished M.Ed Dissertation, University of Abuja, Abuja Nigeria

14. Oludipe, D. (2012). Gender difference in Nigerian junior secondary students' academic achievement in Basic Science. *Journal of Educational and Social Research,* 2(1), 93-98.

15. Stefanelli, R. (2006). Gender equity. Is there gender equity in your classroom? available at http/:www.cedu.niu.edu/~shumow/itt/gender

16. Tsoi, M. F. (2009). Applying TSOI Hybrid Learning Model to enhance blended learning experience in science education. Interactive Technology and Smart Education, 6(4), 223- 233.

17. Turki, F. A(2014)The effect of using blended learning strategy achievement and attitudes in teaching science among 9th grade students. European Scientific Journal. 31(10).134-139

18. West African Examinations Council (WAEC, 2011-2020). Chief Examiner's Report. Katsina State, Nigeria.

19. Yılmaz, M.B. & Orhan, F. (2010). Pre-service English teachers in blended learning environment in respect to their learning approaches. The Turkish Online Journal of Educational Technology. TOJET, 9(1), 157- 158.