EFFECTS OF JIGSAW II LEARNING STRATEGY ON GEOMETRY ACHIEVEMENT AND STUDENT ATTITUDE TOWARD MATHEMATICS OF SENIOR SECONDARY SCHOOL STUDENTS IN SULEJA METROPOLIS, NIGERIA

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Abstract
The purpose of the study was to determine the effect of Jigsaw cooperative strategy on mathematics achievement and attitude of senior secondary school students in Suleja metropolis. The research design adopted for the study was quasi- experimental design, using pretest, posttest nonequivalent control group design. A sample size of 280 SS2 students from two co-educational and two senior secondary schools from four schools were selected using simple random sampling technique. Two intact classes with 157 (male 102, female 55) students were randomly assigned to experimental group and 123 (90 male and 33 female) students assigned to control group. Mathematics Achievement Test (MAT) adapted from past WAEC questions was the instrument used for data collection. The test instrument used for the study was a thirty (30) multiple choice question, which was validated by four mathematics experts and pilot tested using Pearson product moment corelation coefficient, and a reliability coefficient of 0.80 and a reliability coefficient of 0.76 was obtained for student attitude toward mathematics. Four research questions formulated and Four null hypotheses tested at 0.05 level of significance. Mean and standard deviation were used to answer the research questions while ANOVA and ANCOVA were used to test the hypotheses. Results from the findings showed that the students were taught geometry aspect of Mathematics using Jigsaw II teaching strategy had better achievement score than those taught using conventional method. Also, there was no significant difference in the mean achievement scores of male and female students taught. On attitude, significant difference existed between the experimental and control groups in favour of the experimental group while there was no significant difference on the attitude of male and female students taught mathematics using Jigsaw II teaching strategy. It was therefore, recommended among that mathematics teachers should use Jigsaw II teaching strategy in the teaching and learning of Mathematics.

Keywords: Jigsaw II learning strategy, Senior Secondary School Students, Attitude, Achievement

Introduction

The position of Mathematics in the modern period of technological development in the world is wide and profound. In accordance with this reasoning Trisha, (2011) emphasized the importance of Mathematical knowledge as the science that deals with the logic of shape, quantity and arrangement. Mathematics is all around us, in everything we do. It is the building block for everything in our daily lives, including mobile devices, architecture (ancient and modern), art, money, engineering and even sports. Since the beginning of the world, mathematics discovery has been at the forefront of every civilized society, and in use in even the most primitive of cultures.

Teaching of mathematics had undergone a lot of reforms over the years. Mathematics educators are calling for reforms that will inculcate into students the habit of problem solving and also be able to apply mathematics to daily activities. The focus of the reforms according to Okeke (2011) can be described as teaching for understanding and improving all students' ability to apply mathematics knowledge in novel ways. In presenting some criteria for excellence in Geometry instruction, Arigabu (2010) suggested that mathematics teachers

should engage students in a variety of learning experience designed to promote mathematical exploration and reasoning.

Okeke (2011) highlighted the following pedagogies as contributing innovative strategies and variations in Senior Secondary School Mathematics transition courses: use of manipulation, a more integrated curriculum, a focus on the infusion of technology, active participation of student working together in groups and, an emphasis on problem solving and mathematics problems based on real-life situations. However, mathematics teachers are compelled to completely teach a list of topics irrespective of whether the students have understood the concepts or not. The aim is to prepare the students for end of programme examination. The teacher's aim here should be to build a firm mathematical foundation by doing deeper coverage of few concepts. The concept such as cooperative learning strategies had been found more effective in teaching and learning mathematics concept.

Cooperative learning is an effective teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Cooperative learning is an educational method in which aims to organize classroom activities into academic and social learning experiences. There is much more to cooperative learning than merely arranging students into groups, and it has been described as structuring positive interdependence. In order to improve students cognitive' outcomes, an alternative to lecture-based teaching could cooperative (Tran & Lewis, 2012). This approach has been reported to improve students' achievement and knowledge attitude (Johnson & Johnson, 2010). Educators have identified various co-operative learning strategies. Some of the strategies utilize students pairing while others use small groups of 4, 5 or 6 students. Siltala (2010) examined the following strategies which he said can be used in any content area:

Think – pair – share in this technique, students are allowed to contemplate a posed question or problem silently. The student may write his thoughts or may simply just brainstorm in his mind. After that, the student pairs up with a peer and discusses his/her ideas with and listens to his partners ideas. Following pair dialogue, the teacher solicits responses from the whole group. Jigsaw technique as well seen as, the cooperative learning strategy were students are members of two groups, i.e Main Group and expert group. In the heterogeneous Main Group, students are each assigned a different topic. After that students leave the Main Group and group with the other students with their assigned topic. In the new group (expert group), students learn the material together before returning to their Main Group. Once back in their Main Group, each student is responsible for teaching his assigned topic, so as Jigsaw II cooperative learning, according to Slavin's (2010) version of Jigsaw. Here, members of the Main Group are assigned the same material but focus on separate portions of the material. Each member must become an expert on his assigned portion and teach the other members of the Main Group.

Reverse Jigsaw which was developed by Slavin (2010). The difference between jigsaw and reverse jigsaw is that students in the expert group teach the whole class rather than returning to their Main Groups to teach the content and Students-Teams-Achievement-Divisions where students are placed in small groups. The class, in its entirety, is presented with a lesson and students are subsequently tested. Individuals are graded on the team's Achievement. Although the tests are taken individually, students are encouraged to work together to improve the overall group performance.

Jigsaw is a cooperative learning model that involves small group of students 5- 6 teaching each other subject matter with success dependent upon student cooperation.

The experimental group used cooperative Jigsaw II as an instructional method while the control group used traditional teacher-centered instruction.

In this Jigsaw or main group students are asked to assign separate portions of the materials is to learnt each members in the main group is asked to focus on reading one portion of the materials. Upon finishing the reading, students who read the same portion of the materials come together to form an expert group to discuss their assigned portion. After the discussion, groups members go back to their main group to teach what they learnt in their expert group to other members. After mastering all the sub-topics taught by each expert, individual groups members take a short quiz. Individual score is compared with the base score to calculate the individual improvement score, based on which a group's average improvement score is worked out. The group having the highest average group improvement score is given recognition by getting a group reward.

Moreover, scholars have observed and reported the problem of gender disparity in the student's achievement in geometry and participation in mathematics (Haruna, 2012). Researchers in mathematics education have attributed gender achievement differences in mathematics to the instructional strategies employed by teachers (Ifegbesan, 2010).

Therefore, it can be seen that other strategies need to be evolved and tried in order to realize the much-desired improved academic achievement, attitude of learning and gender parity in mathematics. Sahin (2010) observed that the use of Jigsaw II Teaching Strategy in teaching Mathematics concepts improved students' achievement in geometry than lecture method. The study indicated the significant difference between the achievement of students taught using Jigsaw II co-operative learning strategy and those taught using conventional lecture method in favour of those subjected to Jigsaw II co-operative learning.

Geometry as a mathematics concept does not awaken great delight among secondary school students and their subsequent interest in it at the higher level of the studies. Perhaps one of the reasons for the poor achievement in geometry and subsequent low achievement in mathematics in secondary school could be attributed to the absence of innovative teaching and once a student mind is not captured in the classroom, there is little or nothing any teacher can do to improve the achievement of such a student. Frank(2010) opined that reasons for the observe poor achievement in mathematics is lack of mathematics teaching equipment and materials, method of teaching right and anxiety, low level of achievement and some government policies. Achievement is an important variable in learning because when one retains the knowledge of what he learnt and sustains it, he is likely to be more deeply involved in its activity.

Though, some students may be intellectually and physically capable of learning, they may never learn until their interest is stimulated an achievement level sustained once students are stimulated, they will continue to learn as long as the teacher is capable of sustaining their retentive knowledge in the subject matter through using the appropriate methodology in teaching them. The West African Examination Council (WAEC) Chief Examiner's report (2012) after noticing candidates' greater weakness in geometry suggested that teachers should help students improve their achievement and develop right attitude and Interest in geometry by reducing their abstractness of the concept taught in it, and remove their apathy and fear of the subject. It becomes necessary to look for interventions that could be to improve student's achievement in learning Geometry as a concept in mathematics in the secondary schools. dents should develop good attitude towards learning geometry as a topic in mathematics.

is a settle way of thinking or feeling about something. In psychology Student

attitude is a psychological construct, a metal and emotionally entity inheres in, characteristics of person. A predisposition or a tendency to respond positively or negatively towards a certain idea, object, person, or situation. Student attitude influences on individuals choice of action, and responses to challenges, incentives, and rewards (together called stimuli). Evaluative positive or negative response to stimuli. Student attitude is an individual's predisposed state of mind regarding a value and it is precipitated through a responsive expression toward a person, place, thing or event (the student attitude, which in turn influence the individuals though and action. Student attitude towards mathematics is a disposition towards an aspect of mathematics that has been acquire by an individual through his or her beliefs and experiences but which could be change. Student attitude toward mathematics (SATM) is the students organized predisposition to think, feel, perceive, and behave toward mathematics concepts such as Geometry. Gender refers to differences in sex as one is either a male or a female, socio-cultural phenomenon that divide people into various categories such as male and female with each having associated dress, roles, stereotypes, gender to refer to those male and female differences that are thought to arise from social or environmental influences.

Gender difference is difference in successful Achievement in mathematics for males and females, with females achieving better gender in school and male achieving higher scores on test designs for admissions. Hassan (2010) pointed out gender differences in geometry performance were neither as marked nor always in favor of males. This indicates that jigsaw II cooperative learning favored both males and females in mathematics of geometry and the strategy is more effective in enhancing both male and female students" achievement in mathematics. This suggests that when teachers use the right strategies and activities, female students would learn equally as their male counterparts. It can also be deduced that jigsaw II co-operative learning strategy bridges the gap in mathematics achievement between males and females. It also indicated that females are good in mathematics when they are allowed to share ideas and interact freely among themselves.

The report of West Africa Examination Council (WAEC) chief examiner (WAEC, 2012) pointed out that mathematics continued to be dreadful to candidates in the area of geometry and geometrical drawings and their interpretations. The report further lamented that candidates" responses to questions on geometry reflected their weaknesses in geometry compared with other aspects of mathematics.

Based on the identified students and teachers` difficulties in geometry, the researcher is of the view that most teachers failed to deliver the geometry content to the student because of the use of inappropriate and irrelevant instructional strategy. This and other factors, immensely contributes to students` poor achievement and attitude in geometry and mathematics generally. This calls for the urgent need in exploring and apply other effective instructional strategies that have been found to improve achievement attitude and attitude and gender achievement in theorems aspect of geometry at senior secondary school level in Suleja metropolis of Niger State. The Jigsaw II strategy is an effective teachning method that stimulates students learning of geometry because it involves students with varied learning abilities, undergoing group work in small terms in other to attain the group goals and group reward and also it is a collaborative strategy.

The purpose of the study to determine the influence of Jigsaw Cooperative Strategy on mathematics achievement and attitude among senior secondary school students Suleja, Metropolis. The specific objectives are as follows: Determine the differences in the achievement of students taught Mathematics concept through Jigsaw cooperative teaching strategies and those taught through lecture method or conventional method and then

determine influence of jigsaw II cooperative learning strategy with respect to gender and find out the differences in the achievement of male and female students taught geometry concept through of Jigsaw teaching strategy ad determine Students attitude towards mathematics and also determine the student's attitude towards mathematics as perceived by students based on gender.

Research Questions

The following research questions were raised:

(i) What is the difference in the mean achievement score of students taught Mathematics through Jigsaw II learning strategy and those taught through conventional lecture method?

(ii) What is the gender difference on the mean achievement score of students taught through Jigsaw II learning strategy?

(iii) What is the attitude of students towards mathematics when taught through Jigsaw II learning strategies?

(iv) What is the difference in male and female students' attitude toward mathematics when taught using Jigsaw II learning strategy?

Research Hypotheses

Based on the above questions, the following null hypotheses were formulated:

(i) There is no significant difference in the mean achievement scores of students taught geometry using Jigsaw teaching strategy and those taught using lecture method.

(ii) There is no significant difference in the achievement of male and female students taught Mathematics (geometry) using Jigsaw teaching strategy.

(iii) There is no significant difference in students' attitude toward mathematics.

(iv) There is no significant difference in male and female students' attitude toward mathematics when taught using Jigsaw II learning strategy.

Methodology

The design adopted for this study was quasi- experimental. The population for this study are all the Senior Secondary School two (SS2) students in the co-education schools in Suleja metropolis of Niger State, Nigeria. The total population of the students in all the schools is 1020. The choice of SSII was based on the fact that the concepts to be taught falls under their syllabus and scheme of work. The sample of study was 280 students (146 males and 134 female) drawn from the four Secondary Schools. Two intact classes with 157 (male 102, female 55) students were randomly assigned to experimental group and 123 (90 male and 33 female) students assigned to control group. For the purpose of this research work, Mathematics Achievement Test (MAT) were used as research instrument.

Mathematics Achievement (MAT) is a test instrument that covers all the areas of Geometry that was taught with regard to the study. The MAT is thirty (30) items multiple choice question (with option A-D). The Student Attitude (SAT) is divided in to two sections (Section A and B). Section A contains the Bio-data of each respondent, while section B contains information attitude. A likert type scale of strongly agree, Agree, Disagree and Strongly Disagree was used to determine the opinion of the respondent, with regards to their feelings on the influence of the teaching style under study.

The Validity of the research instrument (face and content) was established by two lecturers from science education Department, Federal University of Technology, Minna and a Mathematic teachers from Federal Government College, Minna. Corrections and suggestions made by the validators were used to modify the instruments.

The first test was administered to the students and collected. After a period of two weeks the

same test was administered to the same group of students. The two scores were collated and analyzed using Pearson Product Moment Correlation (PPMC) formula and coefficient of 0.82 was obtained after pilot test.

This shows that the items were reliable according to "thumb rule" suggested by Wallen and Frankle (2008) who suggested that a reliability coefficient should range from 0.70. Two experts from science education of Federal University of Technology validated the instrument treatments used.

Administration of treatment Two groups were involved in the study (experimental and control groups). The experimental group was taught using jigsaw II co-operative learning strategy while the control group was exposed to the conventional lecture method

Treatment procedure for experimental group using jigsaw II cooperative learning: Jigsaw II co-operative learning is an instructional strategy that requires students to work in groups of 4,5 or 6 students. In this strategy, a topic is divided into sub-topics equal to the number of students in each group. Each student in a group is assigned a sub-topic and is given a learning material relevant to his/her assigned portion of the topic to study for some moment. Members of different groups who have studied the same material meet together, to share information and solve the task. Their expert knowledge is shared with other members in the original Main Group. The group that excels in terms of improved performance is awarded group reward. Therefore, jigsaw II emphasizes the use of group work and reward for co-operation to achieve group goal.

The following steps were followed in teaching the experimental group using jigsaw II co-operative learning strategy:

The formation of mixed ability groups, where teacher formed mixed ability groups of four students per group. This group is called Main Group, and assignment of group roles and individual tasks here, teacher distributes lesson materials, assigns group roles and a task from the expert sheet to each member of the Main Group. An expert sheet contains four questions on various sub-topics of a particular topic to be learnt, another one is Review of roles responsibilities and jigsaw II procedure, here Students review the roles to play by each member during group work while teacher explains the jigsaw II co-operative learning procedures, and then reading of assigned sub-topic, each member of Main Group reads his/her assigned sub-topic for some time using the reading material supplied, and expert group discussion, main Group members assigned the same question on the expert sheet meet to form an expert group. In the expert group, students discuss and share their ideas on the question until a solution is obtained. Teacher goes round to assist groups with difficulty, facilitate and praise collaborative work.

Other steps are main Group reporting which students come back to their Main Groups to teach what they have learnt on their assigned sub-topics during expert group discussion to the remaining members of Main Group and whole class discussion. Teacher initiates a brief whole class discussion in order to clear doubts arising from the group discussions held during the lesson, followed by evaluation, students take an individual short quiz to test their understanding of the topic taught. The scripts are marked and scores made known to each student, also group recognition in individual improvement score as well as group average improvement score for each Main Group is calculated by the students under the teacher's guide. The group with the highest average improvement score receives a group reward, and **Closure, t**his lesson ends by assigning a question from the expert sheet prepared for the next

lesson to each member of the Main Group so that students read their assigned sub-topic as home work. This is to save the next lesson's time and for students to come fully prepared for expert group discussion in the next lesson.

The researcher visited the selected schools that were purposely sampled two weeks before the commencement of the experiment to seek for permission from the principal of each school with a letter from the Head of the Department of Science Education, Federal University of Technology, Minna to examine the facilities and the students so as to determine their suitability for the study.

Mathematics teachers of sampled schools were trained as research assistants for the purpose of the research. During the third-fourth week of the visit to sampled schools before administration of the treatments, pretest was administered to determine the entry knowledge equivalence of the subjects' assigned to as experimental group and control groups. Treatment was administered thereafter and it lasted for six weeks, each lesson lasted for ninety minutes per week and this gives a total of eight hours twenty minutes per school and a total of thirty-two hours twenty minutes for the four schools sampled. After a period of six weeks of the treatment, there was revision of one week. For ease of marking, each of the items in the geometry question was scored one marking a total of 30 marks.

Descriptive statistics of Mean and Standard Deviation was used to analyze the research questions while inferential statistics. Hypothesis one and two could be analyzed using ANCOVA while hypothesis three and four could be analyzed using ANOVA. The significance of the various statistical analysis were ascertained at 0.05 alpha levels.

Results

Research Question One: What is the difference in the mean achievement score of students taught Mathematics through Jigsaw II learning strategy and those taught through conventional lecture method?

Table 1: Mean and standard deviation of experimental and control groups

		Pretest		Post-test	
Groups	**N**	**Mean (x)**	**SD**	**Mean (x)**	**SD**
Experimental	157	57.68	11.40	78.88	8.56
Control	123	45.83	7.87	53.56	7.50

Table 1 shows the pretest comparison between the mean achievement scores of students in both experimental and control groups at the commencement of the study. The table reveals that the mean score of experimental and control is 57.68 and 45.83 and standard deviation of 11.40 and 7.87 respectively.

The table also shows the posttest mean score of 78.88 for the experimental group and standard deviation of 8.56, which is greater than mean of control group (53.56) with standard deviation of 7.50. This shows that students exposed to Jigsaw had higher mean score.

Research Question Two: What is the gender difference in the mean achievement score of students taught through Jigsaw II learning strategy?

Table 2: Mean and standard deviation of male and female students of experimental group

Variable	N	Pre-test Mean ($\bar{x}$)	SD	Post-test Mean ($\bar{x}$)	SD
Male	102	48.92	7.42	80.27	10.24
Female	55	47.00	6.97	78.13	7.46

Table 2 shows that male has ($\bar{X}$ = 80.27 and SD = 10.24); and Female ($\bar{X}$= 78.13 and SD = 7.46). This shows the achievement of Male students was better than Female students after treatment with a mean difference of 2.14.

Research Question 3: What is the attitude of students towards mathematics when taught through Jigsaw II learning strategies?

Table 3: Mean rank and standard deviation of experimental and control groups attitude towards mathematics

S/N	Rating Items	Mean	S.D	Decision
i.	**Students attitude towards Mathematics**			
a.	Boys score higher in mathematics	3.47	0.97	Agree
ii.	**The reason for liking**			
a.	Mathematics is interesting	2.64	1.01	Agree
b.	Mathematics is my best subject	2.99	1.10	Agree
c.	Mathematics is useful in future employment.	3.68	0.56	Agree
d.	I enjoy mathematics	3.82	0.55	Agree
e.	Mathematics is fun	3.68	0.74	Agree
iii.	**The reasons for disliking**			
a.	Mathematics is boring	3.88	0.42	Agree
b.	Some Mathematics topics are difficult	3.49	0.94	Agree
c.	Mathematics is not pet	3.19	1.10	Agree
d.	Learning mathematics is a west of time	2.39	1.11	Disagree
iv.	**Because Language use in Mathematics is difficult**			
a.	We have both male and female mathematics teachers teaching us mathematics	3.67	0.57	Agree
b.	We do not have both male and female mathematics teachers teaching us mathematics.	2.40	1.08	Disagree
c.	Our mathematics teachers are all male	2.22	1.21	Disagree
d.	Our mathematics teachers are all female	2.35	1.15	Disagree
e.	Our mathematics teachers are using effective methods to teach mathematics	3.67	0.65	Agree
f.	Mathematics is male domain	2.33	1.18	Disagree
g.	Mathematics is female domain	2.81	1.21	Agree
h.	It is good to have mathematician as a role model	3.72	0.80	Agree
i.	Female tends to be more anxious towards mathematics than male	3.49	0.98	Agree
j.	Male tends to be more anxious towards mathematics than female.	2.43	2.16	Disagree
k.	Our mathematics teacher is using good method like problem solving and cooperative learning approach to teach us.	3.68	0.74	Agree

l. Our teacher is teaching geometry using real life object.	3.88	0.42	Agree
m. Jigsaw 2 Cooperative learning strategy is better than conventional teacher method because it is student centered.	3.49	0.94	Agree
n. Geometry is a difficult topic in mathematics	3.19	1.01	Agree
o. Geometry is co abstract that it requires real life materials	2.48	1.13	Disagree
p. I enjoy proving geometric proofs	3.67	0.57	Agree
v. **I believe I can effectively use mathematics in my daily life.**			
a. I think mathematically what I am planning my day/time	3.15	1.00	Agree
b. I believe that mathematics is not suitable engagement for me	3.66	0.62	Agree
c. I feel my self- sufficient in solving mathematical problems	3.42	0.84	Agree
d. I can solve all kinds of mathematical problems, if I strived sufficiently	3.67	0.65	Agree
e. I always have the feelin gs that I take wrong steps while solving problems	3.88	0.42	Agree
Grand Mean	**3.35**		

Table 3, shows students' attitude towards mathematics, the result above shows item ia, ii. a-d, iii. a-c, iv. a, e, g, h, I, k, l, m, n and p, v. a- e have their mean scores as 3.47, 2.65, 2.99, 3.68, 3.88, 3.49, 3.19, 3.67, 3.67, 2.81, 3.72, 3.49, 3.19, 3.67, 3.15, 3.66, 3.42, 3.67 and 3.88 with their corresponding standard deviation above are agree. While item iii. a, iv. b, c, d, f, j and o with mean score 2.39, 2.40, 2.22, 2.35, 2.33, 2.34 and 2.48 standard deviation of 1.11, 1.08, 1.21, 1.15, 1.18 and 2.16 was said to be disagree. That is, the classrooms are also well ventilated for well conducive learning. Thus, the grand mean of twelve items 3.35 is above the decision mean of 2.5, therefore this indicates that students' have better attitude towards mathematics when exposed to Jigsaw instructional strategy.

Hypotheses

Hypothesis One: There is no significant difference in the mean achievement scores of students taught Mathematics using Jigsaw teaching strategy and those taught using lecture method.

Table 4: Summary of ANCOVA post-test of experimental and control groups

Source	Sum of Squares	df	Mean Square	F - Value	P - Value
Corrected Model	47536.987[a]	2	23768.493	439.438	.000
Intercept	23301.851	1	23301.851	430.810	.000
Covariate(Pretest)	3328.494	1	3328.494	61.538	.000
Treatment	22860.254	1	22860.254	422.646	.000
Error	14982.499	277	54.088		
Total	1348008.000	280			
Corrected Total	62519.486	279			

a. R Squared = .760 (Adjusted R Squared = .759)

*: Significant at $p < 0.05$

Table 4 shows the ANCOVA result of experimental and control groups, when pre-test score was used as covariance the table reveals that ($F(1, 279) = 422.646$, $p = 0.000$) the treatment was significant. Hence, hypothesis one was rejected. This implies that significant differnce exist between the achievement of students taught Mathematics through Jigsaw II strategy and

those taught through lecture method. Therefore there was significance difference between the experimental group and control group.

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female students taught Mathematics using Jigsaw Teaching Strategy.

Table 5: Summary of ANCOVA male and female students from experimental groups

Source	Type III Sum of Squares	df	Mean Square	F-Value	P-Value
Corrected Model	1015.237[a]	1	1015.237[a]	7.497	.001
Intercept	23913.481	1	23913.481	353.171	.000
Covariate(Gender)	850.789	1	850.789	12.565	.001
Treatment	30.499	1	30.499	.450	.503
Error	10427.463	155	67.274		
Total	988280.000	157			
Corrected Total	11442.701	156			

[nt] Significant at P>0.05

Table 5 shows the ANCOVA result of experimental, while post-test was used as covariance, the table reveals that covariance (F(1,154) = 0.450, P = 0.503 which was not significant at 0.05 alpha level. Hence, hypothesis two retained. This implies that there was no significant difference between the achievement of male and female students taught mathematics through Jigsaw II strategy and those taught through lecture method. Therefore, hypothesis two was retained.

Hypothesis Three: There is no significant difference in students' attitude toward mathematics using Jigsaw II Learning strategy and lecture method.

Table 6: Summary of ANOVA result on attitude of students before and after taught Mathematics using Jigsaw II instructional strategy.

	Sum of Squares	df	Mean Square	F - Value	P - Value
Between Groups	256016.420	1	256016.420	1336.966	.000
Within Groups	59745.083	312	191.491		
Total	315761.503	313			

*: Significant at P<0.05

Table 7: Summary of ANOVA result on attitude of male and female students taught Mathematics using Jigsaw II instructional strategy

	Sum of Squares	df	Mean Square	F - Value	P - Value
Between Groups	229.581	1	229.581	5.629	.019
Within Groups	6321.476	155	40.784		
Total	6551.057	156			

*: Significant at P<0.05

Table 7 indicates that the F (1, 155) = 5.629 p = 0.019 which was significant at 0.05 alpha level. This shows that there was significant difference in the attitude of male and female students when taught mathematics using Jigsaw II cooperative learning strategy. Therefore, hypothesis four was rejected.

Discussion

This findings revealed that students taught mathematics with Jigsaw II cooperative learning strategy improved on their achievement in mathematics better than those taught with the conventional lecture method. This result agrees with the assertion made by Sahin (2010) that conducted a research on achievement in written expression. In national university seoul, korea and revealed that students taught using Jigsaw II cooperative learning strategy achieved significantly better than those taught using conventional method.

Another findings reveal that the results of this study (Table 2.) also revealed that there was significant difference in the achievement of student taught using jigsaw II co-operative learning, although the mean Achievement scores of males was higher than that of the females. The findings showed that both males and females taught by jigsaw II co-operative learning performed equally as no significant difference was found in their mean Achievement score. This result is in line with those of Chianson (2010), as well as Gambari, Shittu and Taiwo (2013) who showed that gender had no effect on academic performance of students in co-operative learning. It also supports the view point of Hassan (2010) that gender differences in geometry performance were neither as marked nor always in favor of males.

Another Finding indicates that jigsaw II cooperative learning strategy favoured both male and female in mathematics as the strategy was effective in enhancing both male and female students' achievement. This suggests that when teachers use the right strategies and activities, female students would learn equally as their male counterparts. It can also be deduced that Jigsaw II co-operative learning strategy bridges the gap in mathematics achievement between male and female.

This table therefore indicates that students' have better attitude towards mathematics when exposed to Jigsaw instructional strategy. This shows that there was significant difference in the attitude of students when taught mathematics using Jigsaw II cooperative learning strategy.

Findings revealed that students taught mathematics with Jigsaw II cooperative learning strategy improved on their achievement in mathematics more than that taught mathematics with the conventional teaching method. This result agrees with the assertion made by Sahin (2010) that conducted a research on achievement in written expression. In National University Seoul, Korea and revealed that students taught using Jigsaw II cooperative learning strategy achieved significantly better than those taught using conventional method. This shows the achievement of Male students was better than Female students after treatment with a mean difference of 2.14.the mean attitude towards mathematics with the Jigsaw II cooperative learning strategy is higher than those taught mathematics with the conventional method.

Findings show that there was no significant difference between the post-test means scores of male and female students. This indicates that both the male and female achieved equally, through the male students in Jigsaw II cooperative learning strategy can bridge the gender gap in achievement of the senior secondary school students in mathematics. This finding agree with Hassan (2010) who conducted a research on effect of school type on visual perception of geometry shapes and performance of Junior Secondary School and discovered that gender difference in geometry achievement were neither as marked nor always in favour of males. This result indicates that Jigsaw II cooperative learning strategy favoured both male and female in mathematics.

Finding also revealed that there was no significant difference in the attitude ability of males and females when exposed to Jigsaw II co-operative learning strategy. This implies that jigsaw II co-operative learning produces similar attitude effects on male and female attitude towards mathematics. This finding further implies that Jigsaw II bridge the gap in female" attitude toward mathematics as well as their male counterparts. Also, the strategy is useful effective in improving both male and female students' attitude toward mathematics. Therefore, it could be that when female are taught using Jigsaw II co-operative learning strategy that would provide them with the opportunity to work in groups and discuss their mathematical reasoning.

Conclusion

Base on the findings of this study, the students exposed to Geometry using Jigsaw Teaching Method performed better than those taught with lecture method which indicates that there was a significance difference in favour of experimental groups. Science student taught Geometry Jigsaw II Teaching Method.

There was a significant difference in the mean achievement scores of male and female students taught using Jigsaw II Teaching Method favouring the male. However, there was a significant difference in the mean achievement of male. The interaction effect on the treatment on gender was significant when exposed to Jigsaw II Teaching Method. It was revealed that the higher achievement scores of experimental group is as result of the achievement by the use of instructional strategy such as Jigsaw II Teaching Method.

Recommendations

Based on the findings of this study, the following recommendation are proffered:

(i) Jigsaw Cooperation II Teaching Method should be adopted by Mathematics teachers in the teaching and learning process in secondary schools

(ii) Government should encourage the use of Jigsaw instructional strategy in the teaching and learning Mathematics and other in secondary schools

(iii) Secondary school curriculum and syllabus should be developed by experts in Mathematics using Jigsaw II Teaching Method and mode of instruction.

(iv) Jigsaw II Teaching Method should be adopted in the teaching of Mathematics concepts at all level to bridge the gap between male and female student Achievement.

(v) Secondary school administration should recognize workshop, conferences and seminars to expose mathematics teachers on the use of Jigsaw II Teaching Method to improve teaching and learning process in the classroom.

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