EFFECT OF JIGSAW 1 JIGSAW 1 COOPERATIVE-LEARNING STRATEGY ON ACADEMIC PERFORMANCE IN BASIC SCIENCE AMONG STUDENTS IN MAKURDI, BENUE STATE, NIGERIA

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ABSTRACT: *The aim of this study was to determine the effect of Jigsaw 1 Jigsaw 1 Cooperative-Learning Strategy on academic Performance among students in Makurdi, Nigeria. The research design used for this study was quasi-experimental design of non-equivalent group involving pretest and posttest. The population of this study was 1,677 (1,000 males and 677 females) Upper Basic II students for 2018/2019 academic session. Sample size of 63 (38 males and 25 females) students were randomly selected using a simple random sampling technique. The instrument for data collection was Basic Science Academic Performance Test (BSAPT). The instrument was adapted and validated by four experts. The Pearson-Product Moment Correlation Coefficient was used to determine the reliability coefficient of BSAPT. The reliability coefficient found was 0.81. Two research questions were raised and two null hypotheses were tested. Descriptive statistics of mean and standard deviation were used for answering the research questions. Inferential statistics of independent t-test was used to test the hypotheses at $p \leq 0.05$ level of significance. The experimental group (EG) was exposed to Jigsaw 1 Jigsaw 1 Cooperative-Learning Strategy while the control group was exposed to Lecture Method. The findings among others revealed that: there was significant difference between the mean academic performance scores of students' taught Basic science using Jigsaw 1 Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method in favour of the students taught using Jigsaw 1 Jigsaw 1 Cooperative-Learning Strategy. Also, there was no significant difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Jigsaw 1 Cooperative-Learning Strategy. It was therefore recommended among others that Jigsaw 1 Jigsaw 1 Cooperative-Learning Strategy should be used to teach students irrespective of gender.*

KEYWORDS: science, cooperative-learning-strategy, jigsaw 1 model, basic science, performance, gender

INTRODUCTION

Science is a body of organized knowledge and a process of inquiry. Science is defined by Ellah, Nworgu and Achor (2018), as a field of study that involves a dynamic process of seeking for knowledge about nature through observation and experimentation. Tofi, Adejoh and Ochu (2017) opined that science plays important roles in health, nutrition, agriculture, transportation and industrial development for national growth. These important roles of science for national growth, according to Eriba and Samuel (2018a), made the Federal Republic of Nigeria, in the

National Policy on Education (FRN, 2013), to emphasize the teaching and learning of science to her citizenry in the Junior Secondary School curriculum.

In line with the Federal Republic of Nigeria policy of Basic Education, Integrated science was introduced into Nigerian Secondary Schools in 1972 and in line with the 6-3-3 system of education at the Junior Secondary School level (Usman, 2000). After decades of teaching Integrated science, Usman, Auta, Mohammed, David, Buba and Baffa (2017) explained that it became imperative in Nigeria to restructure and review Integrated science curriculum. Due to the Federal Republic of Nigeria policy on Basic Education (FRN, 2013) Integrated science was reviewed as Basic Science. Basic Science is one of the compulsory science subjects that is taught at the Basic education level. The Nigerian Educational Research and Development Council (2007) gave the overall objectives of Basic Science curriculum as follow: Develop interest in science and technology, Acquire basic knowledge and skills in science and technology, among others.

Despite all these important objectives of Basic Science curriculum to national growth and academic pursuit students still perform poor. To confirm this, Agbidye, Achor and Ogbeba (2019) revealed that poor academic performance of students in Basic Science remains a problem. This poor academic performance in Basic Science at the Basic Education level has become a major worry to all education stakeholders, including parents and government. The Government and educational planners in Nigeria have taken several steps of motivating science teachers in form of encouraging them through science allowances and giving them opportunities to attend conferences in order to acquire knowledge and be informed of innovative teaching methods among others (Eze, Egbo & Omeje, 2018). This was in an attempt to overcome the problem of poor academic performance of students in Basic Science and science at large. Despite all these attempts, the ugly trend of poor academic performance in science, particularly Basic Science still persists.

Research studies of Lakpini and Atadoga (2013); and Achor and Kalu (2014) among others have revealed factors that may be responsible for the persistence in students' poor academic performance. One among the factor responsible for poor academic performance is the teaching method employed by teachers as stated by Jirgba, Eriba and Achor (2018). Researchers such as Lawal, Bichi and Shuaibu (2017) stated that most teachers employ lecture method in the teaching of science. Lecture method is the predominantly used teaching method in the teaching of science subjects, which is teacher-centered. Here the teacher dominates the class while the students do the listening (passive) and take down notes and rarely ask questions. The method has the advantage of covering a wider content within a short time in a large classroom but it is not student-centered. It has been criticized by many educators such as Ahmad (2019) and Jirgba *et al* (2018) that, it is an ineffective method of teaching which does not yield positive result on students' academic performance. However, teachers of Basic science are expected to actively engage the students in the learning process with effective teaching methods which are student-centered. Such methods include problem solving instructional strategy, concept mapping and Cooperative-Learning Strategy among others.

Cooperative-Learning Strategy can be defined as a teaching and learning process which involves students working together in small groups to accomplish shared goals while the teacher guides or facilitates (Ahmad, 2019). There are several models of Cooperative-Learning Strategy namely: Jigsaw II, III, and IV, Think-Pair-Share and Jigsaw 1 among others. This study is focused on Jigsaw 1 model. Jigsaw 1 according to Abdullahi and Salisu (2017) was first developed by Aronson in 1978. In Jigsaw 1 Cooperative-Learning model structure Amedu (2015) asserted that, students are assigned to 4-6 member groups called original/home group, to work on an instructional material. Each student in the original/home group is assigned a section/topic on which to become an expert. Students with the same section/topic meet in 'expert groups' to study extensively on their assigned topic, after which they return to their original/home groups to teach what they have learned to their teammates. After completion, students are assessed individually. Jigsaw 1 Cooperative-Learning Strategy is an activity-based mode of teaching which may enhance the academic performance of students irrespective of gender.

Gender is defined by Ugwu and Nwagbo (2019) as the socially/culturally constructed characteristics and roles which are ascribed to males and females in any society. Review of literature has shown inconsistency in the results of male and female students' academic performance in Basic Science and science at large. For instance, Alamri (2018) found that female students performed better than the male students; conversely Nwachukwu (2014), Amedu (2015) and Eze and Obiekwe (2017) revealed that boys performed better than their female counterparts. While Timayi (2016) and Kingdom-Aaron, Etokeren and Okwelle (2019) found no significant difference between male and female students performance scores. These disparities suggest that research findings on gender and students' academic performance is still inconclusive hence need for more empirical evidence to further generalize how much influence has gender on students' academic performance in Basic Science. This present study therefore investigated the effect Jigsaw 1 Cooperative-Learning Strategy on academic performance of male and female students studying Basic Science.

Statement of the Problem

Despite the importance of Basic Science, researchers continue to report students' poor academic performance in Basic Science. This is confirmed by the performance of Basic Science students in Basic Education Certificate Examination (Benue State Examination Board, 2018). This poor academic performance in Basic Science at the Basic Education level has become a major worry to all education stakeholders. Researchers have revealed factors that are responsible for the poor academic performance of students. One of the major factors is the teaching method employed by teachers in teaching Basic Science. Lecture Method is the predominantly used teaching method. Lecture method of teaching is deficient in the active participation students in science which leads to their poor academic performance in science subjects. However, there should be a paradigm shift to activity-based methods which student-centered such as problem solving instructional strategy, concept mapping and Cooperative-Learning Strategy. This study therefore investigated the effect of Jigsaw 1 Cooperative-Learning Strategy on academic performance among students in Basic Science.

Objectives of the Study

The objectives of this study are to:

1.   determine the effect of Jigsaw 1 Cooperative-Learning Strategy on mean academic performance scores of students taught Basic Science and those taught using Lecture Method.

2.   ascertain the effect of Jigsaw 1 Cooperative-Learning Strategy on mean academic performance scores of male and female students taught Basic Science.

Research Questions

The following research questions were answered in the study:

1.   What is the difference between the mean academic performance scores of students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method?

2.   What is the difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy?

Hypotheses

The following hypotheses were formulated based on research questions which were tested at $p \leq 0.05$ level of significance.

Ho_1: There is no significant difference between the mean academic performance scores of students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method.

Ho_2: There is no significant difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy.

Research Design

This study employed a quasi-experimental design of non-equivalent group involving pretest and posttest. The reason for the adoption of a Quasi-experimental design is that the researcher used intact classes for the study. This is because it was not be possible to have a complete randomization of participants as this would have disrupted the normal classroom organization of the schools. The population of this study comprised of 1,677 (1000 males and 677 females) Upper Basic two students for 2018/2019 academic session in Makurdi Local Government Area of Benue state (Benue State Ministry of Education, Science and Technology, 2019).

Four schools were randomly selected and used for data collection. A pre-BSAPT was given to students as pretest in the four sampled schools to determine the equivalence of academic performance of the students among the four sampled schools. The results of pre-BSAPT of were subjected to Analysis of Variance (ANOVA) statistical tool at $p \leq 0.05$ and the result obtained showed that there was no difference. Then a simple random sampling technique involving selection without replacement was used to select two schools. Furthermore, a simple random sampling technique of "Hat and Draw" was used to assign the two schools into the experimental group and control group. The choice of this technique was to give every sampled school an equal chance of been selected. Total number of participants randomly sampled was 63 (38 males and 25 females) students.

The instrument used for data collection was Basic Science Academic Performance Test (BSAPT). The instrument (BSAPT) was adapted from Tofi (2016) and validated by four (4) experts, two (2) Professors in the field of science education, one Senior Lecturer in Test and Measurement and one Basic science teacher with a qualification of Master's in Science Education (M. Ed). The Basic Science Academic Performance Test (BSAPT) comprised of twenty-five (25) multiple choice questions with four options (A, B, C and D), from the option there is a correct answer and three distractors. The BSAPT items were based on the upper Basic two syllabus covering the concepts: Work, Energy and Power; Thermal Energy and Crude Oil and Petrochemicals which were taught by the researcher. The data collected from the Upper Basic II students during pilot test was used to determine the reliability coefficient of the instruments. Test-retest method was administered within the period of two weeks to determine the reliability of the Basic Science Academic Performance Test (BSAPT). The reliability coefficient of BSAPT was found to be 0.81 using Pearson Product Moment Correlation Coefficient (PPMCC).

Pre-BSAPT was administered to experimental and control groups before the commencement of the experiment. The items of pre-BSAPT were reshuffled for the posttest. After the treatment which lasted to a period of six weeks, the post-BSAPT was administered. Both the pre-BSAPT and post-BSAPT were administered and marked by the researcher according to the marking guide. The research questions were answered using descriptive statistics of mean and standard deviation. The hypotheses formulated were tested at $p \leq 0.05$ level of significance using inferential statistics of independent t-test statistics.

Data Analysis and Result Presentation
The results were presented as follows
Table 1: ANOVA Summary Analysis of students pretest performance between experimental and control groups.

Table 1

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	22.286	3	7.429	.526	.666
Within Groups	1370.882	97	14.133		
Total	1393.168	100			

Table 1 shows that there is no significant difference in students pretest performance between experimental and control group since p-value (0.67) is greater than – (0.05) level of significance. This result established the homogeneity in the pretest performance of the groups. Therefore, only the posttest scores were used in the rest of the analysis.

Research Question 1: What is the difference between the mean performance scores of students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method?

Table 2: Mean and Standard Deviation of Academic Performance scores of students in Experimental and Control Groups

Groups	N	Mean	Standard Deviation	Mean Difference
Experimental Group	35	17.46	4.05	
				5.82
Control Group	28	11.64	4.99	

The results in Table 2 shows that the students in experimental group taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy had a mean performance scores of 17.46 with a standard deviation of 4.05, while those taught Basic Science using Lecture Method had a mean performance score of 11.64 with a standard deviation of 4.99. Therefore, the difference between the mean performance scores of students taught Basic Science with Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method is 5.82. This implies that there is difference in the posttest mean scores of students of the experimental and control groups, in favour of the students taught using Jigsaw 1 Cooperative-Learning Strategy.

Research Question 2: What is the difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy?

Table 3: Mean and Standard Deviation of Academic Performance of male and female Students in Experimental Group

Experimental Group	N	Mean	Standard Deviation	Mean Difference
Male	19	18.11	4.24	
				0.47
Female	16	16.69	3.77	

The results in Table 3 shows that the female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy had a mean performance scores of 18.11 with a standard deviation of 4.24 while the male students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy had a mean performance scores of 16.69 with a standard deviation of 3.77. Therefore, the difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy 0.47. Hence, there

was a difference in the posttest mean scores of female and male students. This indicates that the male students performed slightly higher female students.

Ho₁: There is no significant difference between the mean academic performance scores of students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method.

Table 4: Analysis of independent t-test on Academic Performance scores students in Experimental and Control Groups

Groups	N	Mean	SD	df	t-cal	p-value	Remark
Experimental Group Students	35	17.46	4.05				
				61	5.12	0.00	Sig.
Control Group Students	28	11.64	4.09				

Significant at $p \leq 0.05$

Table 4 reveals that calculated t-value is 5.12 and the p-value 0.00. Therefore, p-value of 0.00 is less than significant level of $p \leq 0.05$. Based on this evidence, the null hypothesis was rejected. This shows that there is significant difference between the mean academic performance scores of students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method in favour of the students taught using Jigsaw 1 Cooperative-Learning Strategy. This implies that Jigsaw 1 Cooperative-Learning Strategy was more effective than Lecture Method in teaching and learning of Basic Science.

Ho₂: There is no significant difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy.

Table 5: Analysis of independent t-test of Academic Performance of Male and Female Students of Experimental Group

Experimental Group	N	Mean	SD	df	t-cal	p-value	Remark
Male Students	19	18.11	4.24				
				33	1.04	0.31	Not Sig.
Female Students	16	16.69	3.77				

Significant at $p \leq 0.05$

Table 5 reveals that calculated t-value is 1.04 and the p-value 0.31. Therefore, p-value of 0.31 is greater than significant value of $p \leq 0.05$. Based on this evidence, the null hypothesis was retained. This shows that there was no significant difference between the mean academic

performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy. This implies that Jigsaw 1 Cooperative-Learning Strategy bridged the gap on academic performance between male and female students.

DISCUSSIONS

The finding of this study shows that there was a significant difference between the mean academic performance scores of students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy and those taught using Lecture Method in favour of the students taught using Jigsaw 1 Cooperative-Learning Strategy. This outcome supports Alamri (2018) as well as Kindom-Aaron *et al* (2019), who all found that students taught using Jigsaw 1 Cooperative-Learning Strategy tend to perform better than their counterpart in the control group who were taught using Lecture Method. The result could be due to the Jigsaw 1 Cooperative-Learning Strategy employed for the experimental group which was student centered-method. This implies that Jigsaw 1 Cooperative-Learning Strategy was more effective than Lecture Method in teaching and learning of Basic Science. This result further suggests that Jigsaw 1 Cooperative-Learning Strategy improved performance of students in Basic Science more than their counterparts in the control group who were taught using Lecture Method. There was no significant difference between the mean academic performance scores of male and female students taught Basic Science using Jigsaw 1 Cooperative-Learning Strategy. This finding is in credence with Kingdom-Aaron et al (2019) whom results showed no significant difference in academic performance of male and female students taught using Jigsaw 1 Cooperative-Learning Strategy. It also agrees with the views of Timayi (2016) that no significant difference in performance of male and female students in the experimental group taught using Cooperative-Learning Strategy.

This finding, however, disagrees with Nwachukwu (2014), Amedu (2015), and Eze and Obiekwe (2017) who revealed that males performed higher from the Jigsaw Cooperative method compared with the female counterparts. On the other hand Alamri (2018) showed that female students performed more than their male counterparts taught using Jigsaw 1 Cooperative-Learning Strategy. This implies that Jigsaw 1 Cooperative-Learning Strategy produces similar effect on male and female students' performance in Basic Science. The finding showed that both male and female students taught using Jigsaw 1 Cooperative-Learning Strategy performed equally as no significant difference was found in their mean performance scores.

CONCLUSION

The following conclusion were drawn from the findings of this study: it was revealed that Jigsaw 1 Cooperative-Learning Strategy was found to be an effective method in improving academic performance of students in Basic Science than those taught using Lecture Method. Jigsaw 1 Cooperative-Learning Strategy proved to be an effective strategy in enhancing the performance of Basic Science students irrespective of gender.

Recommendation

Based on the findings of the study, it was therefore recommended among others that Jigsaw 1 Cooperative-Learning Strategy should be used to teach both male and female students, as it is gender friendly.

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