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Effect Of Jigsaw II Learning Strategy On Students' Achievement In Cell And Its Environment In Niger State, Nigeria

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ABSTRACT
This study investigated the effect of Jigsaw II learning Strategy on Students' Achievement in Cell and its Environment in Niger State, Nigeria. Two research questions guided the study and two hypotheses were tested at 0.05 level of significance. The population of the study was made up of 3460 SS II students from 82 public co-educational senior secondary schools in Niger State. Two intact classes from two public senior secondary schools were randomly selected using simple sampling technique. Cell Environment Achievement Test (CEAT) was employed for data collection. Means and standard deviations were utilized to answer the research questions and the testing of the hypotheses at 0.05 level of significance was carried out using Analysis of Covariance (ANCOVA). This found out that, a significant difference existed in the mean achievement scores of SS II biology students taught Cell and its environment, implying that SS II biology students exposed to Jigsaw II learning strategy achieved higher than those exposed to conventional method ($F_{(1,127)} = 5.664$; $P = 0.021 < \alpha = 0.05$), also no significant difference existed in the mean achievement scores of SS II biology male and female students exposed to Cell and its environment using Jigsaw II learning strategy ($F_{(1,59)} = 2.011$; $P = 0.161 > \alpha = 0.05$). Based on the findings of this study; it was recommended that; Biology teachers should in cooperate the use of Jigsaw II learning strategy in their classrooms for effective teaching thereby improving on the achievement of students in Cell and its environment.
Keywords: Achievement, Biology, Cell and its Environment and Jigsaw II Learning strategy

INTRODUCTION

Biology is defined as the science of life (Sunday, Egunyomi & Osakwe, 2016; Okebukola, 2015). The study of Biology has undergone rapid changes and has a significant impact on human lives. Humans can now produce antibiotics and vaccines, grow disease-resistant crops, organs-transplant and genes manipulation (Augustine, 2018). The knowledge of Biology has help immensely in researching solutions to vital concerns such as increasing world food supply, controlling pest and diseases, environmental protection and studying the biology of certain microorganisms such viruses causing global pandemic such as the corona virus. It is worth noting that at the senior secondary level, Biology is taught to students as if they will all be Science students at the University (FRN, 2014). Interestingly, it is a popular science subject among students and its popular nature among other science subjects has made it a distinct choice for most students (Lawal, 2011). Today, Biology pervades literally every field of human endeavour and plays a fundamental role in educational advancement (Mberekpe, 2013). It is a key to economic, intellectual, sociological, human resource development and well- being of any society. It is a very

important science subject and stands as the bedrock upon which are based many other science courses like Medicine, Pharmacy, Nursing, Biochemistry, Genetic, Agriculture etc., that are of great economic importance to a nation. Besides, the importance of Biology to mankind as science of life, it is one of the science subject mostly preferred by many students in the secondary schools because it has less mathematical calculations unlike Physics and Chemistry and deals with non-abstract things (Abimbola, 2016; Adeyemo, 2010; Adegoke, 2010). Because of these reasons, Biology has a very high enrolment of students in the external examination (Senior School Certificate Examination) more than Physics and Chemistry. Regardless of the high number of students' enrolment in Biology in the senior school examinations conducted by West African Examination Council (WAEC) and National Examination Council (NECO), reports from Biology Chief Examiner's Report (2019) indicate students' poor achievement in Biology at the external examinations. This poor achievement of students in Biology in external examination is linked to the use of traditional method (lecture/expository method) in teaching secondary school biology (Awolabi & Okebukola, 2015; Chukwu & Arokoyu, 2019). Inspite of all the afore-mentioned that are aimed at improving science and the subsequent developments and use of scientific products among the citizenry, students' achievement has remained largely discouraging (Efe & Efe, 2011). Although attempts have been made to improve students' achievement and the quality of Biology learning in schools, students' achievement in Niger State is low. There is therefore the need to use teaching strategies that encourage gender equality, positive interdependence and group work so as to motivate the students for higher academic achievement.

What constitutes a good teaching and learning of biology is the use of appropriate alternative means of imparting knowledge so as to ensure that all important concepts are passed on to the learner and not relegated to the background (Jiya, 2018). The shortcomings of traditional teaching methods employed by teachers lead to a search for an effective and more reliable method where students will be actively involved in the teaching learning process which will in turn enhance their achievement in Biological concepts they are exposed to, such as Jigsaw II learning strategy (Mandor, 2012; Ibe & Nwosu, 2013; Akpan 2010). This strategy encourages male and female participation in group work and in the search for knowledge. The use of Jigsaw II for teaching allows individualization of learning and encourages students to seek out the content they like. Students interact in a traditional classroom with their colleagues in order to learn new lessons. There is therefore a wide gap to be filled which the use of active interactive strategy can take care of. Based on the above, the study focused on the effect of Jigsaw II instructional strategy on secondary Biology school students' achievement in Niger State. Gender was used in this study as a moderating variable.

Gender refers to the roles and relationships between men and women in a given context (Oludipe, 2012). Gender factor is a responsible factor that challenges educational and sustainable development in Nigeria. And to eradicate illiteracy in Nigeria and enhance sustainable development, gender imbalance in achievement in Biology education must be overcome (Adarmola, 2012). Ezedu and Obi (2013) opined that bot male and female students' achievement high in Biology but Olakehinde and Olatoye (2014) reported female students achieve higher than their male counterparts in Biology. This study employed the use of Jigsaw II Learning Strategy to determine it effect on male and female Students' Achievement in Cell and its Environment in Niger State.

Statement of the Problem

The consistent poor achievement of secondary school students in Biology at the external examination in Nigeria has become a hydra-head problem. This poor achievement is traceable to inappropriate instructional strategies utilized by the teachers. This recurrent trend in the poor academic achievement of students in Biology if not mitigated will cause a devastating effect on the nation's scientific development in the fields of medicine, agriculture and biotechnology. There are many alternative methods and strategies that could help students develop interest in Biology and achieve higher. This study as an intervention tried one of such strategies - Jigsaw II learning strategy ascertain it effect on the achievement in cell and its environment concepts among senior secondary school students in Niger State.

Research Questions

The following research questions were formulated to guide the study:

1. What are the mean achievement scores of SSII students taught Cell and its environment using Jigsaw II cooperative Learning Strategy and those taught using Conventional Teaching Method?
2. What are the mean achievement scores of SSII biology students when taught Cell and its environment using Jigsaw II cooperative learning Strategy based on gender?

Objectives of the Study

The main purpose of this study is to investigate the effect of Jigsaw II learning Strategy on Students' Achievement in Cell and its Environment in Niger State, Nigeria. Specifically, the study sought to:

1. determine the effect of Jigsaw II cooperative learning Strategy and the Conventional Teaching Method on Students' Achievement in Cell and its environment
2. determine the effect of Jigsaw II on male and female Students' Academic Achievement.

Research Hypotheses

The following null hypotheses were formulated which will be tested at 0.05 level of significance.

Ho_1: There is no significant difference in the mean achievement scores of SS II Biology Students taught Cell and its environment using Jigsaw II learning strategy and those taught using conventional teaching Method.

Ho_2: There is no significance difference in the mean achievement scores of male and female SS II Biology students taught cell and its environment using Jigsaw II cooperative learning Strategy and those taught using Conventional Teaching Method.

METHODOLOGY

Quasi-Jigsaw II research design of non-randomized pre-test, post-test Conventional method was adopted for this study. The population was made up of 3460 SS II students from 82 public co-educational senior secondary schools in Niger State. Two intact classes from two public senior secondary schools were randomly selected using simple sampling technique. The sample of this study comprised of 130 (68 males and 62 females) SS II students.

Cell and its Environment Achievement Test (CEAT) was utilized as instrument for data collection. The CEAT consists of 30 multiple choice items with options A-D with only one correct option. CEAT items were based on the selected topics covered in the experiment (ie diffusion, Osmosis and Active transport) as contained in NERDC (2016) biology Curriculum for Senior Secondary Two. CEAT was employed as a pre-test before the commencement of the experiment and as post-test to determine students' achievement. The reliability coefficient of CEAT was estimated using split-test method, the coefficient of internal consistency obtained was 0.74.

Before the experiment began, both groups took a pre-test so as to establish their equivalence. After the pre-test, the selected cell and its environment topics were taught to the Jigsaw II using Jigsaw II and the Conventional method was taught the same lesson contents using conventional teaching method. The treatment lasted for three weeks. A post-test was conducted to all the groups a week after the experiment in order to measure the level of academic achievement.

Treatment Steps for Jigsaw II using Jigsaw II

Jigsaw II co-operative learning strategy is an instructional strategy that requires students to work as a team in a group of 4, 5 or 6 students. Here, a topic is shared into sub - topics equal to the number of students in each group. Each student in a group is given 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 the 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 home 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 cooperation to achieve group goal. The following steps will be followed to teach Jigsaw II using Jigsaw II

Step 1: Formation of mixed ability groups: Teacher forms mixed ability groups of 4 students group. This group is called home group.
Step 2: Assignment of group roles and individual tasks: Teacher distributes lesson materials, assigns group roles and task from the expert sheet to each member of the home group. An expert sheet contains 4 questions on various sub-topics of a particular topic to be learnt.
Step 3: Review of roles responsibility and Jigsaw II procedure: Students review the roles to play by each member during group work while the teacher explains the Jigsaw II procedures.
Step 4: Reading of assigned sub-topic: Each member of the home group reads his/her assigned sub-topic for some time using the reading material supplied.
Step 5: Expert group discussion: Home 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 gotten. Teacher goes round to assist groups with difficulty, facilitate and praise collaborative work.
Step 6: Home group reporting: Students come back to their home groups to teach what they have learnt on their assigned sub-topics during expert group's discussion to the remaining members of the home group.
Step 7: Whole class discussion: Teacher initiates a brief whole class discussion in order to clear some doubts arising from the group discussions held during the lesion.
Step 8: Evaluation: students take an individual short quiz to test their understanding of the topic learnt. The scripts will be marked and scores made known to each student.
Step 9: Group recognition: Individual improvement score as group average improvement score for each home group is calculated by the students under the teacher's guide. The group with the highest average improvement scores gets a group reward.
Step 10: Closure: Lesson ends by assigning a question from the expert sheet prepared for the next lesson to each member of the home 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 ready for expert group discussion in the next lesson.

PRESENTATION OF RESULTS

Means and standard deviations were used to answer the research questions and the testing of hypotheses was carried out using Analysis of Covariance (ANCOVA) at 0.05 level of significance.
Research Question 1: *What are the mean achievement scores of SS II students taught Cell and its environment using Jigsaw II Learning Strategy and those taught using Conventional Teaching Method?*

Table 4.1 Mean Achievement Score of the Jigsaw II and Conventional method

Variable	Group	N	Mean	Std. Dev
Achievement	Jigsaw II	68	62.74	13.285
	Conventional	62	42.02	11.644

Table 4.1 presents the mean and the standard deviation of the mean achievement of Jigsaw II taught with Jigsaw II learning and those students taught with conventional teaching method (Conventional method) in the study. The Jigsaw II had a mean achievement score of 62.74 while the conventional group had a mean achievement score of 42.02, this implies that the Jigsaw II achieved higher than the conventional method.
Hypothesis 1: there is no significant difference in the mean achievement scores of SS II Biology Students taught Cell and its environment using Jigsaw II learning strategy and those taught using conventional teaching method.

Table 4.2: ANCOVA Result on the Significant Difference in the Mean Achievement Scores of SS II Students Taught with Jigsaw II and Those Taught with Conventional Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	713.424[a]	1	713.424	5.664	.021
Intercept	1803.932	1	1803.932	14.322	.000
Posttest expt	713.424	1	713.424	5.664	.021
Error	7557.560	127	125.959		
Total	117723.000	130			
Corrected Total	8270.984	129			

Table 4.2 presents the ANCOVA result on the significant difference in the achievement scores of SS II Biology students taught Cell and its environment using Jigsaw II learning strategy and those taught with conventional method. The $F_{(1, 127)} = 5.664$ was obtained with an exact associate probability value of 0.021 ($F_{(1,127)} = 5.664$; $P = 0.021 < \alpha = 0.05$). Since the associate probability (0.021) is less than 0.05 set as level of significance, the null hypothesis was rejected. The hypothesis was not rejected since the p-value of 0.021 was less than the 0.05 significance level. Therefore, there is significant difference in the mean achievement scores of SS II biology students taught Cell and its environment. Hence, it was concluded that SS II biology students taught using Jigsaw II learning strategies achieved higher than those taught with conventional method.

Research Question 2: *What are the mean achievement scores of male and female SS II biology students when taught Cell and its environment using Jigsaw II learning Strategy?*

Table 4.3: Mean Achievement Scores of Male and Female in Jigsaw II

Variable	Group	N	Mean	Std. Dev
Achievement	Male	36	60.92	10.935
	Female	32	64.78	15.437

Table 4.3 presents the mean and the standard deviation of the mean achievement by the Jigsaw II taught with Jigsaw cooperative learning based on gender dichotomy in the study. The male of the Jigsaw II had a mean achievement score of 60.92 while the female group had a mean achievement score of 64.78. This implies that the female gender of the Jigsaw II achieved slightly higher than the male counterpart in the study.

Hypothesis 2: there is no significant difference in the mean achievement scores of SS II Biology Students taught Cell and its environment using Jigsaw II cooperative learning and those taught using conventional teaching strategy based on gender.

Table 4.4: ANCOVA Result on the Significant Difference in the Mean Achievement Scores of Male and Female SS II Students Taught with Jigsaw II and Those Taught with Conventional Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.498[a]	1	.498	2.011	.161
Intercept	19.536	1	19.536	78.897	.000
Gender	.498	1	.498	2.011	.161
Error	14.857	59	.248		
Total	146.000	62			
Corrected Total	15.355	61			

Table 4.4 presents the ANCOVA result on the significant difference in the achievement scores of SS II Biology students taught Cell and its environment using Jigsaw II learning strategy and those taught with conventional method based on their gender. The $F_{(1, 95)} = 2.011$ was obtained with an exact associate probability value of 0.161 ($F_{(1,59)} = 2.011$; $P = 0.161 > \alpha = 0.05$). Since the associate probability (0.161) is greater than 0.05 set as level of significance, the null hypothesis was not rejected. This implies that there is no significant difference in the mean achievement scores of SS II biology students taught Cell and its environment based on the students' gender. Hence, it was concluded that SS II biology students taught using Jigsaw II cooperative learning strategies.

DISCUSSION OF FINDINGS

The findings of this study revealed that SS II biology students taught using Jigsaw II learning strategies achieved higher than those taught with conventional method in favour of those exposed to Jigsaw II Learning Strategy. This means that the use of Jigsaw II Learning Strategy was more successful and effective compared to Conventional Teaching Method in teaching Cell and its environment in the study area. As a result of that, the research suggests that Jigsaw II Learning Strategy could assist in the enhancement of students' understanding of Cell and its environment in biology more than the conventional teaching method. This findings of study accepted the findings of Chianson, Kurumeh (2011), Gubbad (2013) that showed some levels of improvement in students' achievement and performance when Jigsaw II Learning Strategy was used in teaching secondary school students.

The superiority of Jigsaw II Learning Strategy in this study over conventional teaching method could be as a result of its emphasis on specialization on one part or portion of the topic by each member of the group. Each member of the group must specialize in one aspect the topic while in the expert group teach his portion or aspect to his group members, learn the whole lesson in the home group and individually solved some tasks. Similarly, the difference could be attributed to the group reward future in -built in the Jigsaw II Learning Strategy which serves as motivation to do more in term of performance in the subsequent lessons by earning higher improvement scores.

The findings also indicated that the mean achievement scores of females in the Jigsaw II is higher than that of the male counterpart. The findings also showed that both females and males in the Jigsaw II taught employing the use of Jigsaw II Learning Strategy achieved equally as no significant difference was found in the mean achievement scores. This result is in line with those of Garduna (2011) and Ajaya (2010) that snowed no significant difference in the gender group using Jigsaws II Learning Strategy also. This study implies that the use of Jigsaw II Learning Strategy favoured both the males and females taught and its environment and it is effective in teaching both male and females for greater students' achievement in biology.

CONCLUSION

The results obtained from this shows that Jigsaw II Learning Strategy could successfully enhance and improve the achievement of students in Cell and its environment compared to Conventional teaching method. The use of Jigsaw II Learning Strategy in study proved to be more successful in improving retention of the studied Cell and its environment concepts compared to the Conventional teaching method. Jigsaw II Learning Strategy could be used to increase the female students' achievement scores to bridge the gap in Cell and its environment. The use of Jigsaw II learning strategy improves the retention ability of both male students and female students as gender is not a factor in retaining Cell and its environment concepts in biology.

RECOMMENDATIONS

i. Jigsaw II learning strategy should be included in all their biology teaching methodology content by Teacher-training institutions to as produce reputable biology teachers with sound knowledge of how to use Jigsaw II cooperative learning strategy in teaching biology for greater students' achievement.

ii. Biology teachers should be adequately trained on effective steps for the implementation of Jigsaw II learning strategy in their classrooms by organizing extensive seminars and workshops to help improving students' achievement in biology.

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