



**EFFECTS OF JIGSAW STRATEGY ON ACADEMIC ACHIEVEMENT AND
RETENTION OF SENIOR SECONDARY STUDENTS' IN CONCEPT OF
BIOLOGY AT JOS NORTH PLATEAU STATE, NIGERIA**

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ABSTRACT

This study investigated the effects of Jigsaw strategy on the academic achievement and retention of senior secondary school students in Biology in Jos North Local Government area of Plateau State, Nigeria. The quasi-experimental, pre-test-post-test group design was used for the study involving the experimental and control groups. 1,196 SS II students of Biology constituted the population of the study where 196 were sampled and assigned as experimental and control groups as intact classes. School A was selected as the control group with 165 students consisted of 68 participants with 38 male students and 30 female and School B with 97 students was selected as the experimental group with 58 males and 39 females for the study. A Biology Achievement Test (BAT) was used for Data collection. Findings from the study indicated a gap between the students taught using the Jigsaw strategy and those taught using the lecture method in favour of the Jigsaw method. Recommendations were made on bridging the gap between the use of teacher-centred and student-centred pedagogical approach to improve the teaching and learning of biology in senior secondary schools in the area of study.

Key words: Biology, achievement, retention, Jigsaw IV, gender and lecture method.

INTRODUCTION

Biology is the natural science that deals with the study of living organisms having certain recognizable characteristics such as movement, respiration, growth, excretion, irritability, reproduction, and nutrition, Nakano (2017). Concerned with the study of plants and animals, Biology provides an in-depth, scientific understanding of how the living and non-living organisms interact with each other and also, it gives insight on how diverse life forms interact with their environment, Bioexplorer, (2018). The content of Biology encompasses other fields related to sustainability of life such as the environment, eco-system, food qualities, and causes of illnesses. It helps in shaping the professional career of individuals such, as doctors, chemist, drugs and biomedical engineers, environmentalists, nurses, psychologists, teachers among others. The study of life has helped in shaping the world by giving credible and reliable answers that explain life and how it functions. Biology is one of the core sciences that is studied in senior secondary schools in Nigeria.

There is focus on a new approach to the teaching of science such as Biology in secondary schools and particularly with an increasing emphasis on lesson clarity, gender disparities, stimulation of interest, and curiosity. This calls for the exploration of other instructional approaches for teaching this important science subject like Biology. The teacher-centred approach has been used for a very long time in Nigerian schools, creating room for gender stereotypes in the class (Arzel, 2016). The method that teachers of Biology adopt for teaching and learning may be among factors that contribute to gender disparities, low retention and achievement by students. In this 21st century where technological advancement is the order of the day and where the nature of learners has changed, there is need for change from the predominant teacher-centred method in the teaching of Biology to a student-centred approach such as Jigsaw IV strategy.

Jigsaw IV learning strategy is an innovative student-centred approach where students with different abilities, use different learning activities to improve their understanding of a lesson in small groups. In this process, students listen to their peers and are engaged in effective learning of classroom material as a team to achieve a common goal (Sulisworo, Ishafit

& Firdausy, 2016, Timayi 2016). The students are grouped as members of jigsaw or home group where they are assigned separate portions of the material to be learnt. After reading, the students who read the same portion of the material come together to form an expert group to discuss their assigned portion. Students then go back to their home group after the discussion to teach what they have learnt in their expert group to other members to promote active participation, retention, encourage listening, engagement, and empathy, material cognitive and psychosocial development in a cooperative classroom.

A close examination of the submission of Ogunleye & Ojekwu (2020) reveals that academic achievement may be dependent upon teachers' instructional strategies. This is an indication that teachers' instructional strategy and students' retention could exert some influence on the success of the academic achievement of students, Agommuoh and Ifeanacho (2013) posited the use of effective teaching strategy in teaching physics leads to proper understanding. Retention is an important variable in learning which Gonzalez (2015), views as the faculty of the mind that stores experience and information in the long-term memory and produces or retrieves it when required later. Retention leads to successful transfer of knowledge but it has been a very challenging area of learning. He further stressed that within an hour, learners forget an average of 50% of information, 70% within a day and up to 90% in a week. Therefore, student-centred strategy such as Jigsaw can boost learner's retention rate since they are involved in the learning process and consequently improve students' academic achievement irrespective of their gender differences. Students' achievement in Biology as a science subject in the recent time has not been good, WAEC, (2019). The Nigerian Government, educators, parents and students themselves are concerned about the causes of this poor achievement. Based on this, it is important to carry out a research on the effect of the use of Jigsaw strategy on the retention and achievement of Biology students with gender in view.

STATEMENT OF PROBLEM

Students' low achievement in Biology in WAEC examination continues to be a cause for concern for students, parents and policy makers in education (Ezeaghasi, 2017). This portends that students in seeking admission into

tertiary institutions will not succeed. Besides, they will suffer setbacks in the pursuit of career in professions that require good performance in Biology.

OBJECTIVES OF THE STUDY

The aim of this study was to investigate the effects of Jigsaw IV strategy on senior secondary II (SSII) Biology students' retention and achievement in Jos North, Plateau State, Nigeria. The objectives of the study are to:

1. Find out the pre-test and post-test achievement of SS II Biology male and female students for both the experimental and control groups.
2. Determine the post-test retention of the SS II Biology male and female students experimental and control groups after exposure to the Jigsaw strategy.

RESEARCH QUESTIONS

The following research questions were formulated to guide the study:

- i. What is the pre-test and post-test achievement of SS II Biology students (male and female) for both the experimental and control groups?
- ii. What is the post-test retention of the SS II Biology students (male and female) for both experimental and control groups after exposure to the Jigsaw strategy?

NULL HYPOTHESES

The following hypotheses were formulated to guide the study:

- Ho₁: There is no significant difference between the pre-test and post-test achievement of SS II Biology students (male and female) for both the experimental and control groups.
- Ho₂: There is no significant difference between the post-test retention of SS II Biology (male and female) students in the experimental and control groups after exposure to the Jigsaw strategy.

METHODOLOGY

The quasi-experimental research design was used for this study involving the pre-test and post-test of the experimental and control groups. The

population of the study comprises all SS II Biology students of the 22 Public Secondary School in Jos North Local Government Area of Plateau State. The total population was one thousand, one hundred and ninety-six (1,196) comprising 583 male and 613 female students for the study. Two schools were purposively selected consisting of two intact classes of the SS II students with a sample size of 165; 96 male and 69 females. School A consisted of 68 participants with 38 male students and 30 female students. School B consisted of 97 participants with 58 male students and 39 female students. Schools A was the control group while school B was the experimental group for the pilot study.

A self-designed instrument titled Biology Students' Achievement Test (BSAT) was used to collect data for the study. The test was given to the control and experimental groups as pre-test, post-test and was reshuffled for the retention test. BSAT consisted of 50 multiple choice questions. Each of the 50 items carried 1 mark to give a total of 50 marks. Three (3) Senior Lecturers with two from the Biology Unit of the Science and Technology Department, and one from the Test and Measurement Unit of the Faculty of Education, University of Jos, validated the instrument.

Lesson plan on concepts of Biology was formed and used for teaching for six weeks from the Senior Secondary II Biology Syllabus. The pre-test and post-test were administered to the experimental and the control groups to determine the academic achievement of the students. The retention test was administered, after two weeks to both groups. Data collected were analysed using Statistical Package for the Social Sciences (SPSS). Mean and standard deviations were used to answer two research questions. The analysis of covariance (ANCOVA) was used to test hypothesis one and the t-test of independence was used to test hypothesis two at $p \leq 0.05$ level of significance.

RESULTS

Research Question 1: What is the pre-test and post-test achievement of SS II Biology male and female students for both the experimental and control groups?

Table 1:

Pre-Test and Post-Test Achievement of SS II Biology Students for the
Experimental and Control Groups

Groups		N	Mean	SD	Mean Difference
Experimental	Pre-Test	68	22.88	7.13	34.69
	Post-Test	68	57.57	10.69	
Control	Pre-Test	97	22.12	7.85	20.96
	Post-Test	97	43.08	9.71	

Table 1 reveals the Pre-Test and Post-Test Achievement mean scores of SS II Biology Male and Female Students in Experimental and Control Groups. Before intervention, Female students had a mean and standard deviation of 22.17 ± 7.46 and male students had 23.45 ± 6.92 with a pre-test mean score difference of 1.28, while students in the control group had 24.00 ± 9.05 and male students had 20.86 ± 6.72 with a pre-test mean score difference of 3.14.

After intervention, female students in experimental group had a mean score and standard deviation of 60.10 ± 10.84 and male students had 55.58 ± 10.29 with a post-test mean score difference of 4.52. Students in the control group had a mean score and standard deviation of 44.44 ± 9.52 and male students had 42.17 ± 9.82 with a pre-test mean score difference of 2.27.

This implies that before intervention the pre-test Achievement mean scores of SS II Biology Male and Female Students in Experimental and Control Groups were low and after intervention the difference between post-test achievements mean scores of SS II Biology Male and Female Students in Experimental and Control Groups were also low.

Research Question 2: What is the post-test retention of the SS II Biology male and female students experimental and control groups after exposure to the Jigsaw strategy?

Table 2

Pre-Test and Post-Test Achievement Mean Scores of SS II Biology Male and Female Students in Experimental and Control Groups

Groups	Test	Gender	N	Mean	SD	Mean Difference
Experimental	Pretest	Female	30	22.17	7.46	1.28
		Male	38	23.45	6.92	
	Posttest	Female	30	60.10	10.84	
		Male	38	55.58	10.29	4.52
Control	Pretest	Female	39	24.00	9.05	3.14
		Male	58	20.86	6.72	
	Posttest	Female	39	44.44	9.53	2.27
		Male	58	42.17	9.82	

Table 2 reveals the Post-Test Retention Mean scores of SS II Biology Students in Experimental and Control Groups after intervention. In experimental group, female students had a Post-test Retention mean score and standard deviation of 57.37 ± 8.46 and male students had 55.21 ± 9.28 with a Retention Post-test mean score difference of 2.16 in favour of female students. Students in the control group had a post-test retention mean score and standard deviation of 36.03 ± 7.77 and male students had 38.48 ± 8.19 with a post-test retention mean score difference of 2.45 in favour of the male. This implies that Post-Test Retention Mean scores of SS II Biology Students in Experimental Groups were higher.

Hypothesis 1

There is no significant difference in the pre-test and post-test achievement of SS II Biology male and female students for both the experimental and control groups.

Table 3:

Source	Dependent Variable	Type Sum Squares	III of Df	Mean Square	F	Sig.
Corrected Model	Pretest	23.008 ^a	1	23.008	.402	.527
	Posttest	8394.537 ^b	1	8394.537	81.798	.000
Intercept	Pretest	80972.729	1	80972.729	1415.611	.000
	Posttest	405019.627	1	405019.627	3946.575	.000
GROUPS	Pretest	23.008	1	23.008	.402	.527
	Posttest	8394.537	1	8394.537	81.798	.000
Error	Pretest	9323.574	163	57.200		
	Posttest	16727.973	163	102.626		
Total	Pretest	92406.000	165			
	Posttest	422170.000	165			
Corrected Total	Pretest	9346.582	164			
	Posttest	25122.509	164			

a. R Squared = .002 (Adjusted R Squared = -.004)
b. R Squared = .334 (Adjusted R Squared = .330)

Table 3 showed the summary of Analysis of Covariance (ANCOVA) on pre-test and post-test achievement of SS II Biology male and female students for both the experimental and control groups. Before intervention in experimental group, female students had a mean and standard deviation of 22.17 ± 7.46 and male students had 23.45 ± 6.92 with a pre-test mean score difference of 1.28. Students in the control group had 24.00 ± 9.05 and male students had 20.86 ± 6.72 with a pre-test mean score difference of 3.14

with an F-value of 0.597 and p-value of 0.441. Since the p-value is greater than the prior value of 0.05, therefore there was no significant difference between pre-test achievement of SS II Biology students for the experimental and control groups.

While students in experimental group, female students had, a mean score and standard deviation of 60.10 ± 10.84 and male students had 55.58 ± 10.29 with a post-test mean score difference of 4.52. Students in the control group had a mean score and standard deviation of 44.44 ± 9.52 and male students had 42.17 ± 9.82 with a post-test mean score difference of 2.27 with an F-value of 4.444 and p-value of 0.037. Since the p-value is less than the prior value of 0.05, therefore there was a significant difference between post-test achievement of SS II Biology male and female students for both the experimental and control groups. This implies that both female and male students exposed to Jigsaw strategy of instruction improved significantly than female and male students in the control group thought with lecture method.

Hypothesis 2

There is no significant difference in the post-test retention of the SS II Biology male and female students for the experimental and control groups.

Table 4:

Analysis of Covariance (ANCOVA) on Post-Test Retention of SS II Biology Male and Female Students in Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	14148.436 ^a	3	4716.145	66.730	.000	.554
Intercept	341368.355	1	341368.355	4830.087	.000	.968
GROUPS	14134.511	1	14134.511	199.992	.000	.554
GENDER	.884	1	.884	.013	.911	.000
GROUPS * GENDER	207.567	1	207.567	2.937	.089	.018
Error	11378.740	161	70.675			
Total	362448.000	165				
Corrected Total	25527.176	164				

a. R Squared = .554 (Adjusted R Squared = .546)

Table 4 reveals the Analysis of Covariance (ANCOVA) on post-test retention of the SS II Biology male and female students for the experimental and control groups. In experimental group, female students had a Post-test Retention mean score and standard deviation of 57.37 ± 8.46 and male students had 55.21 ± 9.28 with a Retention Post-test mean score difference of 2.16 in favour of female students. Students in the control group had a post-test retention mean score and standard deviation of 36.03 ± 7.77 and male students had 38.48 ± 8.19 with a post-test retention mean score difference of 2.45 in favour of the male, with a F-value of 0.013 and p-value of 0.911. Since the p-value is greater than 0.05, therefore there is no significant difference between the post-test retention of the SS II Biology male and female students for the experimental and control groups.

Based on groups experimental and control groups with an F-value of 199.992 and p-value of 0.00. Since the p-value is less than 0.05, therefore there is a significant difference between the post-test retention of the SS II Biology students in experimental and control groups. This implies that Post-Test Retention Mean scores of SS II Biology female and males Students in Experimental Groups improved more than female and males in control group.

SUMMARY OF FINDINGS

The study focused on the effect of Jigsaw strategy on senior secondary Biology students' retention and achievement in Jos North, Nigeria. The validity of the Biology achievement was sought through expert judgement. Content validity index of 0.83 showed that the instrument was valid. The reliability of the Biology achievement test was established using Cronbach Alpha and it was found to be 0.861. The results of the findings from research question one showed that the achievement of the students who were exposed to Jigsaw instruction was higher than students that were not exposed to Jigsaw instructional strategy. This finding is in agreement with the findings of Ogunleye and Ojekwu (2020), and Chukwu and Arakoyo (2019) who found that Jigsaw strategy improves students' achievement in Biology. The implication of this is that Jigsaw strategy can improve students' achievement in Biology.

Findings from research questions revealed that the female students achieved better than the male after their exposed to Jigsaw strategy. This

finding is contrary to the findings of Obi (2016), who found that there was disparity in the performance of males and females in Mathematics. Findings from research questions then showed that students that were exposed to Jigsaws instructional strategy retained higher than students that were not exposed to Jigsaw instructional strategy. This finding is in tandem with studies by Namasaka, Mandala, and Wasike (2017) who reported that students who were exposed to Jigsaw strategy performed better in Biology in Kenya. The implication is that Jigsaw helps to improve student's retention ability.

Findings from hypothesis one showed that there is a significant difference in the achievement of mean scores between the experimental and control groups. This finding is in accordance with the findings by Shahri, Mohammad, Esmaeili, and Kianmehr (2017) who found that students that were exposed to Jigsaw strategy performed significantly better than students that were exposed to lecture method. The implication of this is that students that were exposed to Jigsaw performed significantly better than students that were exposed to lecture method. The result of the findings from hypothesis two revealed that there is a significant difference in the achievement mean scores between male and female students after exposure to jigsaw strategy. This is also in disagreement with the findings by Madin (2010) who reported that there was no significant difference in the achievement of male and female students in languages and the findings of Yaduvanshi and Singh (2018) whose work showed that students' achievement in biology at the secondary level and gender issues were addressed by cooperative learning strategy.

CONCLUSION

The type of pedagogical approach used by the Biology teachers influenced students' retention and achievement. The Jigsaw strategy was effective as a student-centred approach of teaching Biology. Jigsaw learning strategy affects students' learning outcomes by enhancing their overall performance. It is gender-friendly. The male and female students performed equally, indicating that the treatment is not gender biased.

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