



## Effect of Jigsaw Learning Strategy on Academic Performance of Senior Secondary Students in Biology Concepts at Soba Local Government Area, Kaduna State.

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### ABSTRACT

*This study investigated the Effect of the Jigsaw learning Strategy on the academic performance of biology students in the Soba Local Government Area, Kaduna State. The study used the quasi-experimental, pretest, posttest, control group design. A sample of 212 students from intact Science classes in public co-educational senior secondary schools participated in the study. Instruments include Biology Performance Test ( $r=0.88$ ) Treatment procedures for the experimental and control group lasted six weeks. Data obtained were analyzed using descriptive statistics for research questions and a simple independent t-test for null hypotheses. The findings indicated a significant difference in the biology performance of biology students taught with the Jigsaw learning strategy than those taught with the conventional lecture method. The treatment was also found to be gender friendly. Based on the results of the analysis of research data, the researchers conclude that Jigsaw learning strategy affects students' academic performance. The study recommended that teachers should adopt the use of the Jigsaw learning Strategy to teach biology in secondary schools.*

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### INTRODUCTION

Science especially at the secondary level is very important for students of the 21st century. It is a tool for social change, not only developing the ability of problem-solving approach, reasoning, creativity, curiosity, positive attitude but also helping to reduce the gap of unequal divisions in the society (Yaduvanshi & Singh 2018). The traditional pedagogical practices are predominately being practised in Nigerian school where the teacher dominates the class or sometimes use demonstration activities to verify the factual knowledge given in the textbook. Methods failed to ensure quality education according to the need of contemporary scenarios. These methods create room for gender stereotypes in the class (Arzel, 2016). This is because the teacher, who dominates the whole teaching-learning process, exhibits gender stereotypes either consciously or unconsciously.

For example, calling on boys to help hold instructional aids, clean the board or even answer questions considered more difficult while girls to answer simpler ones or sometimes left out. These eventually make a girl lose interest; thereby, discouraging them from full participation in the study of science. Gender refers to masculine and feminine qualities, behaviour patterns, roles and responsibilities. The position of Biology among other school science subjects is basic, complimentary as well as utilitarian. As a basic subject, it provides the necessary ingredients for the understanding of some chemistry and physics contents. It is complimentary as it provides certain processes and contents which presented side-by-side with constructs taught in other sciences, making learning more meaningful. The utilitarian place of Biology is such that it makes use of certain chemical and physical subject matter in the explanation of biological processes and principles



(Ogunleye & Ojekwu, 2020). These are in conjunction with the assertions of Bioexplorer (2018) that the preoccupations of Biology cover the study of and about life, provision of in-depth understanding of the several interactions between living and non-living organisms. The processes involved in the learning of Biology concepts require the application of scientific principles (Chukwu & Arakoyu, 2019). Despite the importance attached to biology subject by all stakeholders in education, senior secondary school students still perform poorly in the subject. This may be attributed to the way the subject is taught. Anaduaka, Olaoye, & Sunday, (2018) asserted that the success of teaching depends on the method of teaching adopted by the teachers. The biology curriculum recommends guided discovery, laboratory approach, demonstration, discussion, cooperative learning among others for teaching biology effectively in secondary schools in Nigeria. More recent reports of students' performance in the West Africa Examinations Council showed that 50.02% and 35.82% failed Biology in 2018 and 2019 respectively. While this trend calls for serious attention of all stakeholders, more effective strategies which can enhance the study of science where the students will be active participants have been advocated (Rotinga, Ruslan & Alesyanti, 2017) and need to be explored. To enhance learner comprehension and ability to internalize fundamental concepts and appreciate biological principles as a science subject, appropriate instructional materials and diverse teaching strategies have been advocated, tried and recommended based on facts obtained over the years. The success or otherwise of such teaching activities and use of resources depends to a large extent on the teaching methods employed by the classroom teacher (Ogunleye & Ojekwu, 2020).

There have been gradual paradigm shifts towards the adoption of cooperative teaching and learning strategy, where the students are expected to be active participants in the teaching-learning process. The sure sign of the cooperative learning strategy is to make the students themselves the drivers of their learning process. The essence is for the students to work in small groups and be actively engaged in researching the topics and concepts (Azmin, 2016

and Aydin & Biyikli, 2017). The cooperative learning strategies enables the students to synthesize, analyze, and apply different concepts involved in their study. Cooperative learning has become ingrained in the teaching-learning situation as an instructional strategy with great potential and impact (Damoeroem & Siyelen, 2021). Cooperative learning allows students to work together in small groups, with each participating in the learning process along with structured activities. The essence of cooperative learning strategies is to ensure the active participation of every member of the learning group, engender team spirit, entrench accountability and foster social cohesion among the workgroups (Khan, 2016 and Agu & Samuel, 2018). According to Slavin (2011), in Jigsaw practice, the students act interdependently to assist and learn the academic content from each other. This is based on the fact that Jigsaw learning strategy revolves around task specialization. Each student is assigned a specific task of the lesson module to work on, after which they are expected to teach the other members of the group. In this aspect, the students are expected to achieve a significant level of mastery of the lesson tasks assigned to them. Jigsaw-based cooperative learning is a cooperative learning strategy in which lesson contents are subdivided into different parts of information and given to groups of students who would later explain to each other their parts and these results in the whole jigsaw process to be completed. Appropriate teaching strategies have a profound influence on students' performance in diverse subjects. Existing literature has shown the increased influence of teaching methods on students' performance. Cooperative learning strategies have been shown to significantly increase students' achievement in different subjects. There have been studies that correlate jigsaw learning strategy with enhanced academic performance (Abdullahi & Salisu, 2017; Yaduvanshi & Singh, 2018; Tabiolo & Rogayan, 2019; Anaduaka, Olaoye & Sunday 2018; Kingdom, Ibemenji, Etokeren, & Chijioke, 2019; Ojekwu & Ogunleye, 2020; Damoeroem, 2021 and Damoeroem & Siyelen, 2021).

Another important reason for applying the appropriate teaching strategy is to engage the



student in the activities. It is given these that the study became necessary. The main aim of the study was the determination the academic performance of senior secondary school students in Biology when the Jigsaw learning strategy was applied.

The desire to carry out this research was due to the problem of poor examination performance by the senior secondary school Biology students, in Soba L.G.A. This poor examination performance has been recorded for some years by the State Education Management Board (2018). The low academic performance of students in Biology has been a major concern to parents, teachers, the government and the general public (Ezeaghasi, 2017). It was observed that some concepts in the secondary school Biology curriculum are difficult for students to learn. There is no doubt that students' performance can be substantially improved through the application of simple practice and the use of instructional strategies such as the Jigsaw method in teaching and learning situations. Therefore, the problem of this study hinges on the determination of the extent to which the use of the Jigsaw learning strategy can enhance students' performance in Biology at senior secondary school in Soba LGA, Kaduna State.

### **Objectives of the Study**

The major objective of the study is to investigate the effects of the Jigsaw learning strategy on the academic performance in Biology among Senior Secondary Students in the Soba Local Government Area of Kaduna State. Specifically, the study sought to:

- i. Determine the effect of the Jigsaw learning strategy on the academic performance of students taught biology concepts and those taught the same concept using the lecture method.
- ii. Determine the effect of the Jigsaw learning strategy on the academic performance of students based on gender.

### **Research Questions**

The following research questions were formulated to guide the study.

- i. What is the effect of the Jigsaw learning strategy on the mean academic performance scores of students taught biology concepts and those taught using the lecture method?
- ii. What is the difference in the mean academic performance scores of male and female students taught biology concepts using the Jigsaw learning strategy only?

### **Null Hypotheses**

The following hypotheses were formulated to guide the study:

- H0<sub>1</sub>:** There is no significant difference between the use of the Jigsaw learning strategy and the mean academic performance scores of students taught biology concepts and those taught the same concept using the lecture method.
- H0<sub>2</sub>:** There is no significant difference between the mean academic performance scores of male and female students taught biology concepts using the Jigsaw learning strategy.

### **METHODOLOGY**

The research design adopted for this study was quasi-experimental which involved pre-test and post-test of the experimental and control groups. The population of the study comprises all SS II Biology students of Public Secondary School Students of Soba L.G.A. The total population of the students is six hundred and ninety-nine (699) students. A simple random sampling technique was used to choose the sample for the study. The total sample size is two hundred and twelve (212). Table 1 presents the sample of the study. The instrument used for this study is Biology Performance Test (BPT) to measure the students' performance in Biology. It consists of 30 multiple choice questions carefully selected from the West African Examination Council (WAEC) past questions from 2011-2018 which are all standardized items. Each of the 30 items carried 1 mark each to give a total of 30 marks. The instrument was validated for clarity of language and appropriateness of the instrument by two (2) Senior Lecturers with a PhD from the Department



of Science Education, Ahmadu Bello University Zaria.

A lesson plan was prepared for the study subjects based on the topic selected for six weeks, one hour per period. Before the treatment, a pretest was administered to both the experimental group and control group to establish the equivalence of their prior knowledge. After which the same instrument was re-administered to students as a posttest. This was used to determine students' academic performance in the concept taught. The researchers taught the control group the same biology concepts by using

the usual lecture method. The topics taught were from the senior secondary II Syllabus (Digestive System Concept). The researchers adapted the Jigsaw learning package of Slavin, (1999).

Data collected were analyzed using Statistical Package for the Social Sciences. Mean and standard deviations were used to answer research questions. While an independent t-test was used to test the null hypotheses for significance at  $p \leq 0.05$  level. The scores were further divided based on gender i.e. female and male.

**Table 1:** Sample of the Population

| S/N | Type         | Name of School     | No of Students |        | Total |
|-----|--------------|--------------------|----------------|--------|-------|
|     |              |                    | Male           | Female |       |
| 1   | Experimental | G.S.S Yakasai      | 60             | 23     | 83    |
| 2   | Control      | G.S.S. Tudun Saibu | 90             | 39     | 129   |

## RESULTS

**Research Question One:** What is the difference in the mean academic performance scores of students taught Biology using the Jigsaw learning

strategy and those taught using lecture methods? Mean and Standard deviation were calculated and a summary is presented in Table 2.

**Table 2:** Summary of Mean Academic Performance Scores of Students in Experimental and Control Group

| Study Groups | N   | Mean  | Std. Dev | Mean Difference |
|--------------|-----|-------|----------|-----------------|
| Experimental | 83  | 20.24 | 4.74     | 9.32            |
| Control      | 129 | 10.92 | 3.13     |                 |

Results from the descriptive statistics in Table 2 revealed that a difference exists between the mean scores of students exposed to the Jigsaw learning strategy (20.24) and those exposed to the lecture method. The mean score of students exposed to the Jigsaw learning strategy and those exposed to the lecture method (10.92) with a mean difference of 9.32 between them in favour of students in the experimental group. This is an indication that students exposed to Jigsaw learning strategy performed better than students

taught the same concepts using the lecture method.

**Research Question two:** What is the difference in mean academic performance scores of male and female students taught biology concepts using the Jigsaw learning strategy? Descriptive statistics of mean and standard deviation were calculated and the summary of the analysis is presented in Table 3

**Table 3:** The Mean Performance Scores of Male and Female Students in the Experimental Group

| Study Groups | N  | Mean  | Std. Dev | Mean Difference |
|--------------|----|-------|----------|-----------------|
| Male         | 60 | 20.23 | 4.71     | 0.03            |
| Female       | 23 | 20.26 | 4.91     |                 |



Results from the descriptive statistics in Table 3 revealed that a difference exists between the mean scores of males (20.23) and female (20.26) students exposed to the Jigsaw learning strategy with a mean difference of 0.03. This is an indication that learning biology concepts using the Jigsaw strategy improved the academic performance of both male and female students. To test if the mean difference is significant for both male and female students taught Biology concepts using the Jigsaw learning strategy, the mean

scores were subjected to a hypothesis test at a  $p \leq 0.05$  level of significance.

#### **Testing of Null Hypotheses**

**HO<sub>1</sub>:** There is no significant difference in the mean academic performance scores of students taught biology concepts using the Jigsaw learning strategy and those taught the same concept using the lecture method. To test null hypothesis one, the mean performance scores of students exposed to the Jigsaw learning strategy and those exposed to the lecture method were used. The summary is presented in Table 4.

**Table 4:** Summary of t-test Analysis of Mean Academic Performance Scores of Students in the Experimental and Control Groups

| Study Groups | N   | Mean  | Std. Dev | Df  | t-cal | P    | Decision    |
|--------------|-----|-------|----------|-----|-------|------|-------------|
| Experimental | 83  | 20.24 | 4.74     | 210 | 17.26 | 0.00 | Significant |
| Control      | 129 | 10.92 | 3.13     |     |       |      |             |

#### **Significant at $p < 0.05$**

The result in Table 4 from the independent samples t-test analysis shows a p-value of 0.00 was obtained which is lower than the  $p$ -value  $\leq 0.05$  set for acceptance or rejection of the hypothesis. This is an indication that there is a significant difference in the mean academic performance of students exposed to the Jigsaw learning strategy and those exposed to the lecture method. Thus, the hypothesis which stated that there is no significant difference in the mean academic performance scores of students taught biology concepts using the Jigsaw learning strategy and those taught using the lecture method is rejected in favour of students in the experimental group. This implies that Jigsaw

learning strategy enhanced the academic performance of biology students who taught biology concepts more than their counterparts who taught the same concepts using the lecture method.

**HO<sub>2</sub>:** There is no significant difference in the mean academic performance scores of male and female students taught biology concepts using the Jigsaw learning strategy. To test null hypothesis two, the mean academic performance scores of male and female students taught biology concepts using the Jigsaw learning strategy were used. The summary is presented in Table 5.

**Table 5:** Summary of t-test statistics on the difference in the Academic Performance of Male and Female Students exposed to Jigsaw Learning Strategy.

| Study Groups | N  | Mean  | Std. Dev | Df | t-cal | P    | Decision        |
|--------------|----|-------|----------|----|-------|------|-----------------|
| Male         | 60 | 20.23 | 4.71     | 81 | 0.02  | 0.98 | Not Significant |
| Female       | 23 | 20.26 | 4.91     |    |       |      |                 |

#### **Not Significant at $p > 0.05$**

The summary of the independent samples t-test in Table 5 shows a p-value of 0.98 was obtained which is greater than the  $p$ -value  $\leq 0.05$  set for acceptance or rejection of the

hypothesis. This is an indication that there is no significant difference in the mean academic performance of male and female students exposed to the Jigsaw learning strategy. Thus, the





hypothesis which stated that there is no significant difference in the mean academic performance scores of male and female students taught biology concepts using the Jigsaw learning strategy is retained. This implies that teaching biology concepts using Jigsaw learning strategy improves the academic performance of both male and female students taught biology concepts thereby making the teaching method gender friendly.

### DISCUSSION OF THE FINDINGS

This study investigated the Effect of the Jigsaw learning Strategy on the academic performance of biology students in the Soba Local Government Area, Kaduna State. The data gathered was analysed using the Statistical Package for Social Science (SPSS) and the level of significance adopted for rejecting or retaining the stated hypotheses was  $P \leq 0.05$ .

The findings of the study revealed that Jigsaw learning Strategy is an effective teaching method. The effectiveness of the strategy in improving students' academic performance in Biology is in agreement with the findings of Ogunleye & Ojekwu (2020) and Chukwu & Arakoyo (2019) who reported similar findings in different contexts. The findings further revealed that the Jigsaw learning Strategy was more effective than the lecture method in enhancing students' academic performance (Damoeroem & Siyelen .2021). This could have resulted based on the combination of individual, small group and whole-group activities involved in the learning processes of Jigsaw. The results of this study prove that the learning strategy used has an important role in the implementation of learning conducted by teachers. Therefore, in the implementation of learning teachers should pay attention and choose the learning strategy by the material presented. The findings of the study also revealed that the Jigsaw learning Strategy is gender-friendly. This might be argued to be a result of their active participation in the learning process. This particular finding is in agreement with the findings of Yaduvanshi & Singh, (2018) whose work demonstrated the Effect of Cooperative learning strategies on students' achievement in biology at the secondary level and its role to address gender issues.

### CONCLUSION

Based on the results of the analysis of research data, it can be put forward the following conclusions:

1. Jigsaw learning strategy affects students' learning outcomes. The influence of the Jigsaw learning Strategy on student learning outcomes as evidenced by the increase in student learning performance after the pretest and posttest.
2. It was concluded that the jigsaw learning strategy is gender-friendly. The male and female students performed equally, indicating that the treatment is not gendered biased, based on these, the following recommendations were made:

### RECOMMENDATIONS

1. That teachers of Biology should deploy cooperative learning strategies, especially the jigsaw learning strategy more often in the classroom to ensure more engagement and active participation of the students, thereby helping in the improvement of students' academic performance in Biology.
2. Biology teachers' emphasis should be shifted from a teacher-centred approach to teaching to active learning strategies such as the Jigsaw learning Strategy.
3. Professional bodies like the National Teachers' Institute (NTI), Science Teachers' Association of Nigeria (STAN), should organize seminars and workshops for teachers on how to use Jigsaw Learning Strategy for effective teaching and learning process.

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