

EFFECTS OF JIGSAW IV STRATEGY ON SENIOR SECONDARY TWO STUDENTS' ACHIEVEMENT IN NUTRITION IN JOS NORTH LOCAL GOVERNMENT AREA, PLATEAU STATE, NIGERIA

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ABSTRACT

This study investigated the effects of Jigsaw IV teaching strategy on the Achievement of Senior secondary two students in Biology within Jos North Local Government Area, Plateau State, Nigeria. The study population comprised of 2985 SS two students with a sample size of 85 students, divided into two groups: an experimental group, which received instruction through a Jigsaw IV strategy, and a control group, which was taught using the traditional lecture method. A quasi-experimental design with a non-equivalent control group pre-test-post-test approach was employed, utilizing the Nutrition Achievement Test (NAT), a researcher-designed instrument with a reliability coefficient of 0.81. The study aimed to answer three (3) research questions and three (3) hypotheses at a 0.05 level significance. The data collected was analyze using mean and standard deviation for research questions and independent t-test was utilized for the hypothesis. The findings revealed that there is significant difference between the pre-test mean scores of the control and experimental group in Nutrition Achievement Test (NAT). Moreover, there is a significant difference between the post-test mean scores of the control and experimental group in Nutrition Achievement Test (NAT). The difference is in favour of the experimental group. Furthermore, there is a significant difference between the pre-test and post-test scores of the experimental group in Nutrition Achievement Test (NAT). The difference is in favour of the post-test scores. Lastly, there is no significant difference between the post-test scores of the male and female students in the treatment group after exposure to Jigsaw IV strategy. Based on the findings, it was concluded that the Jigsaw IV strategy has the capacity to enhance students' achievement in Nutrition. Moreover, the strategy is both gender and environment-friendly. The study therefore, recommended among others that Biology teachers should integrate the Jigsaw IV strategy into their instructional practices, as it offers students an opportunity to actively engage and collaborate, leading to improved academic performance.

Keywords: Achievement, Jigsaw IV Strategy, Nutrition

INTRODUCTION

Biology is a fundamental science discipline which deals with the study of life. It gives a clear understanding of how living and non-living things relate to each other, providing a profound scientific understanding of both living and non-living organisms, shedding light on the diverse forms of life and their interactions with the environment. Biology has made substantial contributions to national development in areas such as agriculture, medicine, biochemistry, health and disease management, pharmaceuticals, nursing science, and more (Adegboye, Bello & Isaac, 2017). At the senior secondary level in Nigeria, the study of biology plays a crucial role in shaping the career ambitions of students, influencing their choices in fields such as medicine, chemistry, pharmaceuticals, nursing, environmental science, psychology, nutrition, and biology teaching, among others. Nutrition, as a core aspect of biology, involves the process by which organisms obtain and utilize essential nutrients for growth, repair, and overall health maintenance (German & Rose, 2021).

Despite the importance of Biology to human life and the technological advancement of the nation, students' achievement in the subject has consistently been unsatisfactory (Yilshik, Ezekiel, & Umar, 2020; Adebajo, 2020; Piwuna, 2023). Various factors have been linked to this poor

achievement, including the use of ineffective teaching methods in biology classrooms, a shortage of qualified teachers, and the abstract and complex nature of certain biology topics, such as ecology, genetics, and Nutrition (WAEC Chief Examiners' report, 2023).

In addressing these challenges, it is essential to explore effective instructional approaches in teaching biology, moving away from the traditional teacher-centered methods (Salami, Isah and Ogedengbe, 2023). To overcome the limitations of teacher-centered teaching, scholars have suggested employing active strategies, such as the discussion method, discovery or inquiry-based approaches and Jigsaw strategy (Fasuyi, Oladipo & Udeani, 2022). The Jigsaw strategy, specifically Jigsaw IV, stands out due to its evaluation features, allowing students to explore cause-and-effect relationships while engaging with their peers. Research has shown that the Jigsaw method promotes active engagement, enhances critical thinking, and improves communication skills among biology students (Karacop, 2017). Moreover, Jigsaw IV fosters a sense of shared responsibility and cooperation, which can positively impact the overall learning experience. This method encourages student-centered methods, which allow students to share ideas, take risks, question each other's perspectives, and collaborate until a consensus is reached among both the genders (Obafemi, Fajonyomi & Ola-Alani, 2023). This method of teaching can promote high academic achievement in both boys and girls.

Gender-related disparities in academic achievement persist, partly due to teaching methods that encourage gender stereotypes. According to Nasution, Al-Muhdhar and Sari, (2023) opined that the matter of gender remains a significant and pertinent topic, particularly within the realm of education due to its correlation with academic success and the engagement of individuals in specific professions. This relationship can be influenced by a range of factors, including societal expectations, stereotypes, access to educational resources, and teaching methods. However, research findings show inconclusiveness with regard to these variables. For instance, findings from studies conducted by Animasaun and Abegunrin (2017) and El-Emadi, Said and Friesen (2019) showed no gender disparities between achievement of male and female students when active and innovative strategies were used in science instruction. On the contrary, these findings are at variance with those of Njoku and Nwagbo (2020) and Almasri (2022) which revealed that the achievement mean scores of female students were higher than those of male students in biology. Hence, the need for more empirical studies due to the conflicting findings. These highlighted the importance of addressing gender-based educational inequalities, ensuring equitable opportunities for all students, and promoting teaching strategies that support diverse learning needs. Thus, the foregoing underscores the need to examine the effect of the Jigsaw IV strategy on the achievement of Senior Secondary Two students in nutrition in Jos North Local Government Area, Plateau State.

RESEARCH QUESTIONS

1. What are the differences between the post-test mean scores of the control and experimental group in Nutrition Achievement Test (NAT)?
2. What are the differences between the pre-test and post-test scores of the experimental group in Nutrition Achievement Test (NAT)?
3. What is the difference in the post-test achievement means scores between the male and female students in Nutrition using Jigsaw IV strategy in the experimental group?

HYPOTHESES

1. There is no significant difference between the post-test achievements mean scores of students taught Nutrition in the experimental and control groups.
2. There is no significant difference between the pre-test and post-test scores of the experimental group in Nutrition Achievement Test (NAT)?
3. There is no significant difference between the post-test achievement means scores of male and female students in Nutrition using Jigsaw IV strategy in the experimental group.

METHOD

The study adopted a non-randomized pre-test, post-test quasi-experimental control group design. A total sample of 85 Senior Secondary Two Biology students from two public schools in Jos North Local Government Area, Plateau State, was selected using stratified sampling, comprising 46 males and 39 females. The Nutrition Achievement Test (NAT), a 20-item multiple-choice instrument, was developed by the researcher to collect data. The instrument was validated by experts from the University of Jos in the Departments of Science and Technology Education and Research, Measurement, and Evaluation, with a reliability coefficient of 0.81 determined through trial testing using the Kuder-Richardson formula (K-R21). The experimental group was taught using the Jigsaw IV strategy for two weeks, while the control group received traditional lecture-based instruction. Data was collected after the treatment period and analyzed using IBM SPSS Statistics. The mean and standard deviation were calculated to answer the research questions, and paired t-tests were used to test the hypotheses at a 0.05 level of significance.

RESULTS

Research Question One

What are the differences between the post-test mean scores of the control and experimental group in Nutrition Achievement Test (NAT)?

Table 1: The Mean and Standard Deviation scores of the post-test mean scores of the Control and Experimental Groups

Group	N	Mean(x)	SD
Control	45	42.556	9.572
Experimental	40	66.750	12.224

Table 1 reveals the post-test mean scores of two groups of students: one serving as the control group, while the other was the experimental group. The control group, recorded a mean score of 42.556 with a standard deviation of 9.572. On the other hand, the experimental group, achieved a notably higher mean score of 66.750 with a standard deviation of 12.224.

Research Question Two

What are the differences between the pre-test and post-test scores of the experimental group in Nutrition Achievement Test (NAT)?

Table 2: The Mean and Standard Deviation of the pre-test and post-test scores of the Experimental Group

Test	N	Mean (X)	SD
Pre-test	40	39.623	9.699
Post- test	40	66.75	12.224

Table 2 reveal the pre-test and post-test assessments of the experimental group in the Nutrition Achievement Test (NAT). The pre-test results show a mean score of 39.63 with a standard deviation of 9.699, indicating the students' initial performance before the intervention. Following the intervention, the post-test results reveal a significant increase in the mean score to 66.75, with a standard deviation of 12.224.

Research Question Three

What is the difference in the post-test achievement means scores between the male and female students in Nutrition using Jigsaw IV strategy in the experimental group?

Table 3: The Mean and Standard deviation of the post-test scores of the male and female students in the experimental group.

Gender	N	Mean (x)	SD
Male	16	65.625	11.673
Female	24	66.500	12.768

Table 3 presents the post-test achievement mean scores of male and female students in the experimental group who were taught using the Jigsaw IV strategy. The data reveals a slight difference in performance between the genders. The female students achieved a slightly higher mean score ($M = 66.500$, $SD = 12.768$) compared to the male students, who had a mean score of 65.625 ($SD = 11.673$).

Hypothesis One (H_{01})

There is no significant difference between the post-test achievements mean scores of students taught Nutrition in the experimental and control groups.

Table 4: t-test results of Sample Analysis for post-test mean differences of Experimental and Control Groups in NAT

Group	N	Mean (x)	SD	t-cal	Df	P-value	Decision
Control	45	42.556	9.571	-3.467	39	0.001	Reject H_{01}
Experimental	40	66.750	12.223				

$P < 0.05$

Table 4 above show that there is significant difference between the post-test mean scores of students taught Nutrition in the experimental and control groups. The results revealed that the experimental group, which was taught using the Jigsaw IV strategy, achieved a mean score of 66.750 with a standard deviation of 12.223, while the control group, taught using a traditional method, had a mean score of 42.556 with a standard deviation of 9.571. The calculated t-value is -3.467 with 39 degrees of freedom, and the p-value is 0.001. Since the p-value is less than 0.05, the null hypothesis (H_{01}) is rejected.

Hypothesis Two (H_{02})

There is no significant difference between the pre-test and post-test scores of the experimental group in Nutrition Achievement Test (NAT)?

Table 5: t-test Result of Sample Analysis of pre-test and post-test scores of the Experimental Group in Nutrition Achievement Test (NAT).

Test	N	Mean(x)	SD	t-cal	Df	P-value	Decision
Pre-test	40	39.6250	9.699	-10.994	78	0.000	Reject H_{02}
Post-test	40	66.7500	12.223				

$P < 0.05$

Table 5 reveals that the pre-test mean score is 39.625 with a standard deviation of 9.699, while the post-test scores show a significantly higher mean of 66.750 with a standard deviation of 12.223. The calculated t-value is -10.994, with 78 degrees of freedom, and the p-value is 0.000. Since the p-value is well below the 0.05 significance level, the null hypothesis (H_{02}) is rejected.

Hypothesis Three (H_{03})

There is no significant difference between the post-test scores of the male and female students in the treatment group after exposure to Jigsaw IV strategy.

Table 6: t-test Result of Sample Analysis of post-test scores of the male and female students in the Experimental Group.

Gender	N	Mean(x)	SD	t-cal	df	P-value	Decision
Male	16	65.6250	11.672	-0.470	38	0.642	Accept H_{03}
Female	24	67.5000	12.768				

$P < 0.05$

Table 6 reveals that the male students had a mean score of 65.625 with a standard deviation of 11.672, while the female students achieved a mean score of 67.500 with a standard deviation of 12.768. The calculated t-value is -0.470, with 38 degrees of freedom, and the p-value is 0.642. Since the p-value is greater than 0.05, the null hypothesis (H_{03}) is accepted. This indicates that

there is no significant difference in the post-test scores between male and female students in the experimental group, suggesting that the Jigsaw IV strategy had a similar effect on both genders.

DISCUSSION

The findings of the study revealed that the Jigsaw IV strategy was effective in improving the achievement of SS2 students in Biology. Students in the experimental group who were taught using the Jigsaw IV strategy scored significantly higher on the post-test compared to their counterparts in the control group. This can be attributed to the engaging and student-centered nature of the strategy, which allowed students to explore concepts critically and actively, leading to a better understanding of the topic. The results showed a significant difference in the achievement mean scores of the experimental and control groups, indicating the positive effect of the Jigsaw IV strategy. Thus, the null hypothesis was rejected. This finding aligns with the works of Akudo (2021) and Obafemi, Fajonyomi and Ola-Alani (2023), which highlighted the effectiveness of Jigsaw IV instructional approaches in improving students' academic performance in science subjects.

The study also revealed that there was a significant improvement in the mean scores of students in the experimental group from the pre-test to the post-test. This improvement demonstrated the substantial impact of the Jigsaw IV strategy on students' understanding and retention of concepts. The result supports the findings of Cashata, Seyoum and Gashaw (2023), who documented significant gains in students' academic achievement after being exposed to Jigsaw IV strategies. However, it contrasts with the findings of Azmin (2016), who suggested that some teaching methods might not always yield significant improvements.

Regarding gender, the results showed no significant difference in the post-test achievement scores of male and female students in the experimental group. Both male and female students benefited equally from the Jigsaw IV strategy, suggesting that the approach was inclusive and effective regardless of gender. This finding aligns with the studies of Karacop (2017) and Akudo (2021), which reported minimal gender differences when innovative teaching strategies were employed. However, it differs from some studies, such as those by Pepple, Danladi and Okoro (2024), that observed slight variations in achievement based on gender.

CONCLUSION

Based on the findings of the study, it is concluded that the use of Jigsaw IV teaching strategy significantly improved students' achievement in Biology, particularly in the topic of Reproduction. The persistent challenges in students' performance in Biology could be mitigated if Biology teachers adopt effective and innovative instructional methods such as Jigsaw IV strategy in their teaching. Furthermore, the Jigsaw IV strategy proved beneficial to students in terms of achievement, regardless of gender, highlighting its potential to create equitable learning opportunities for all students.

RECOMMENDATIONS

From the findings of the study, the following recommendations were made:

- i. Biology teachers should integrate the Jigsaw IV strategy into their instructional practices, as it offers students an opportunity to actively engage and collaborate, leading to improved academic performance.
- ii. The jigsaw IV approach should be adopted as a gender-inclusive and environmentally supportive strategy to enhance students' achievement in Biology, particularly in Nutrition.

REFERENCES

- Adebanjo, A. A. (2020). Improving students' academic achievement in Biology using information and communication technology-aided instruction. *NIU Journal of Social Sciences*, 5(4), 317–326.

- Adegboye, M. C., Bello, G., & Isaac, O. A. (2018). Conceptions of the nature of Biology held by senior secondary school Biology teachers in Ilorin, Kwara State, Nigeria. *MOJES: Malaysian Online Journal of Educational Sciences*, 5(3), 1–12.
- Akudo, O. K. (2021). Effects of Jigsaw-IV instructional strategy on students' attitude towards coordinate geometry. *Nigerian Online Journal of Educational Sciences and Technology*, 3(2), 109–119.
- Almasri, F. (2022). The impact of e-learning, gender-groupings, and learning pedagogies in Biology undergraduate female and male students' attitudes and achievement. *Education and Information Technologies*, 27(6), 8329–8380.
- Animasaun, I. L., & Abegunrin, O. A. (2017). Gender difference, self-efficacy, active learning strategies, and academic achievement of undergraduate students in the Department of Mathematical Sciences, Federal University of Technology, Akure, Nigeria. *International Journal of Teaching and Case Studies*, 8(4), 255–280.
- Azmin, N. H. (2016). Effect of the jigsaw-based cooperative learning method on student performance in the General Certificate of Education advanced-level Psychology: An exploratory Brunei case study. *International Education Studies*, 9(1), 91–106.
- Cashata, Z. A., Seyoum, D. G., & Gashaw, F. E. (2023). Enhancing college students' procedural knowledge of Physics using blended Jigsaw-IV problem-solving instruction. *International Journal of Research in Education and Science*, 9(1), 148–164.
- El-Emadi, A. A., Said, Z., & Friesen, H. L. (2019). Teaching style differences between male and female science teachers in Qatari schools: Possible impact on student achievement. *EURASIA Journal of Mathematics, Science and Technology Education*, 15(12), em1800.
- Ezekiel, D. P., Yilshik, O. M., & Joseph, M. (2021). Biology students' questioning behaviour in relation to their achievement in Biology in Barkin Ladi, Local Government Area, Plateau State. *Kashere Journal of Education*, 2(2), 106–112. <https://doi.org/10.4314/kje.v2i2.13>
- Fasuyi, O. A., Oladipo, A. J., & Udeani, U. U. (2022). Effects of two instructional strategies on students' engagement in Biology classes. *NIU Journal of Humanities*, 7(1), 79–89.
- F.R.N (2014). National policy on education. N.E.R.D.C. Press Yaba Lagos Nigeria.
- Karacop, A. (2017). The effects of using the Jigsaw method based on cooperative learning model in the undergraduate science laboratory practices. *Universal Journal of Educational Research*, 5(3), 420–434.
- Nasution, N. E. A., Al Muhdhar, M. H. I., & Sari, M. S. (2023). Relationship between critical and creative thinking skills and learning achievement in Biology with reference to educational level and gender. *Journal of Turkish Science Education*, 20(1), 66–83.
- Njoku, M. I. A., & Nwagbo, C. R. (2020). Enhancing students' attitude and achievement in Biology through innovative strategies. *PEOPLE: International Journal of Social Sciences*, 6(2), 134–152.

- Obafemi, K. E., Fajonyomi, A. A., & Ola-Alani, E. K. (2023). Effect of Jigsaw-IV instructional strategy on pupils' academic achievement in Mathematics in Kwara State, Nigeria. *International Journal of Academic Pedagogical Research*, 7(1), 48–52.
- Odo, E. E., & Nwachukwu, J. N. (2020). Effect of two peer instructional strategies on secondary school students' achievement in science. *American Journal of Educational Research*, 8(2), 80–89.
- Pepple, B. G., Danladi, S. A., & Okoro, C. A. (2024). Impact of Jigsaw and graphic organizers instructional strategies on students' retentions and academic performance in secondary school Biology students in Rivers State. *International Journal of Innovative Psychology & Social Development*, 12(3), 82–98.
- Piwuna, C. (2023). The effect of the implementation of WAEC and NECO chief examiners' reports on senior secondary II Biology students' motivation in Jos South, Plateau State, Nigeria. *BW Academic Journal*, 10, 10.
- Salami, F. O., Isah, A., & Ogedengbe, O. G. (2023). Effect of cooperative learning method on the achievement of Biology II students in animal nutrition in Jos North Local Government Area, Plateau State. *BW Academic Journal*, 9, 9.
- WAEC Chief Examiners' Report. (2023). WAEC revealed a decline in pass rate. Retrieved from <https://www.waeconline.org.ng/e-learning/Biology/Biomain.html>
- Yilshik, O. M., Ezekiel, D. P., & Umar, S. A. (2020). Relationship between secondary school students' self-concept and academic achievement in Biology in Plateau State central senatorial zone, Nigeria. *Journal of Science, Technology, Mathematics and Education*, 16(2), 176–185.