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EFFECT OF JIGSAW INSTRUCTIONAL STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN DATA PROCESSING IN BAYELSA STATE, NIGERIA

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Abstract: The study investigated the effect of Jigsaw instructional strategy on senior secondary school students' academic achievement in data processing in Bayelsa State, Nigeria. Two research questions guided the study while three null hypotheses were tested at .05 level of significance. Quasi experimental research design was adopted for the study. The population for the study was 1076 Senior Secondary School 11 (SS 11) data processing students. Purposive random sampling technique was used to draw a sample size of 265 SS 11 data processing students. The instrument used for data collection was Data Processing Achievement Test (DPAT) which was developed by the researchers and validated by three research experts. Kuder-Richardson 20 (K-20) formula was used to estimate the reliability of the instrument and a reliability index of 0.81 was obtained. Mean and standard deviation were used for answering the research questions while Analysis of Covariance was used to test the null hypotheses. The findings of the study revealed that students who were taught data processing using jigsaw instructional strategy recorded better achievement than their counterparts who were taught with the lecture teaching method. The test of hypotheses also showed that the mean difference in achievement was significant, in favour of the students in the experimental group. In view of the findings, the study recommended among others that non-governmental organizations should encourage ongoing professional development for teachers to refine their skills in implementing the Jigsaw strategy effectively.

Keywords: Jigsaw Instructional Strategy, Academic Achievement, Data Processing, Lecture Method

Introduction

The advancement of any nation hinges predominantly on its educational system. Education stands as a fundamental requirement for each person, with a focus on the techniques and strategies employed in the process of teaching and learning. As highlighted by Onyali and Akinfolarin (2017), education serves a crucial role in arming individuals with the essential abilities and wisdom to engage actively and make contributions to a country's economic, social, and political progress. As per the definition provided by the Federal Republic of Nigeria (FRN, 2013), education is the means by which individuals gain knowledge, skills, values, convictions, and behaviours. The implementers of educational curriculum are the teachers.

Teachers play a pivotal role in executing a nation's educational agenda, and it is imperative for them to acquire knowledge and essential skills to make meaningful contributions, especially in the face of the ongoing information explosion and technological advancements. This is particularly crucial given the

central role that education plays in national progress (Adeniyi, 2015). A teacher's conduct in the classroom, including his teaching approaches, profoundly impacts the learning outcomes of students. Teaching and learning are fundamental aspects of education, with teachers employing various approaches and methods to facilitate active learning.

Currently, the learning approach in Nigerian education largely relies on traditional chalk-and-talk methods. Aladejana in Bamidele and Yoade (2017), stated that teachers still adheres to the outdated conservative model, where they are seen as knowledge holders and students as passive recipients. According to Abimbola (2013), the Nigerian educational system offers limited opportunities for self-instruction as students are consistently taught by teachers in school or coaching classes. As educators continue to explore innovative methods to enhance student learning, the jigsaw instructional strategy emerges as a valuable tool for promoting meaningful engagement and profound comprehension.

The Jigsaw instructional strategy is a cooperative learning technique that was developed by social psychologist Elliot Aronson in the early 1970s. According to Juweto (2015), Jigsaw instructional strategy is a teaching and learning strategy that promotes motivation in learning, positive attitudes and develops interpersonal skills and increase student's achievement. It is designed to promote collaboration, interdependence among students, and active engagement in the learning process. The Jigsaw method is particularly effective in diverse classrooms and can be applied in various educational settings, from primary to tertiary education. The jigsaw method involves learners taking responsibility for comprehending the material and subsequently teaching it to their peers. In educational settings, jigsaw can be applied to group data analysis projects, where students collaboratively work on data sets, apply analytical techniques, and present their findings. This directly connects the strategy to data processing.

Data processing refers to the manipulation, organization, transformation, and analysis of data to extract meaningful information and insights from it. Data processing entails a series of operations that utilize information to generate a desired outcome. In Nigeria, data processing is regarded as an essential subject in secondary schools (Anderson, 2014). It involves a series of operations and techniques performed on raw data to convert it into a more useful and structured form for various purposes, such as decision-making, reporting, and automation. Data processing can include tasks like data entry, validation, cleaning, aggregation, analysis, and visualization. It is a crucial step in the data lifecycle, enabling businesses and individuals to make informed decisions and derive value from their data. Data processing can be done manually by individuals or automatically through computer programs and algorithms. Over time, data processing allows educators to track trends in student achievement.

Academic achievement is the outcome of education, denoting the degree to which a learner, educator, or institution has achieved their educational objectives. Typically, it is evaluated through tests or continuous assessment (Ikwuka & Samuel, 2017). Ademola (2013), defined academic achievement as a measure of a student's progress in accomplishing specific tasks within a subject or field of study after engaging in a learning experience. According to Njoku and Eze-Odurukwe (2015), when students are instructed using the appropriate teaching strategies, their academic achievement experiences significant improvement.

Multiple studies have explored the effect of the Jigsaw instructional strategy on students' academic

achievement, consistently finding that it enhances their educational outcomes. Lawan (2016), demonstrated that the effectiveness of the Jigsaw instructional strategy is notably higher in various subjects like mathematics and economics compared to traditional teaching methods. Huang (2013) conducted a study revealing that the Jigsaw Cooperative Learning method not only positively influences students' attitudes towards learning but also enhances the efficiency of their learning process. Chu (2014), conducted a research on the application of the Jigsaw cooperative method in an economics course, with results indicating that this approach benefits students by improving their academic achievement. Nwankwo and Okigbo (2021), demonstrated that the jigsaw instructional strategy significantly improves achievement and retention scores among SS2 chemistry students more than the traditional teaching method. Yemi, Azid and Ali's (2018), findings indicated that the jigsaw strategy for teaching mathematics is more effective than traditional methods at enhancing academic achievement. Furthermore, students' gender has been linked to their academic achievement when exposed to innovative instructional strategies such as the Jigsaw method.

Gender involves classifying individuals as either masculine or feminine based on their biological sex and the societal roles assigned to them. Gender encompasses a wide range of physical, biological, mental, and behavioural traits that distinguish between females and males (Adigun, Onihunwa, Irunokhai, Sada, & Adesina, 2015). Various studies have explored the impact of gender on cooperative learning styles. For example, Omeje (2021) and Ukeh and Nwankwo (2023), discovered that male students achieved higher results than their female counterparts when exposed to cooperative learning strategies, indicating that gender played a role. In contrast, a study conducted by Ajaja and Eravwoke (2010), suggested that gender did not affect students' academic performance when they were exposed to cooperative learning. Given the differing findings from previous research, the current group of researchers felt it was important to investigate how gender differences might influence students' academic achievement in computer studies when they are exposed to the jigsaw instructional strategy. This motivation led the researchers to explore the impact of the jigsaw instructional strategy on the academic performance of senior secondary school students in data processing.

The rationale for this study stems from the need to enhance the quality of education and improve students' academic performance in Data Processing in Bayelsa State. The Jigsaw instructional strategy has been proven effective in various educational contexts worldwide, but its application in the Nigerian educational system, specifically in Data Processing at the senior secondary level in Bayelsa State, is not well-documented. The absence of such research leaves educators without evidence to support the implementation of this strategy in the classroom. It is based on the above background that the present study investigated the effect of Jigsaw instructional strategy on senior secondary school students' academic achievement in data processing in Bayelsa State.

Statement of the Problem

In recent years, the educational landscape in Bayelsa State, Nigeria, has witnessed a growing concern regarding the academic achievement of senior secondary school students in the subject of Data Processing. Despite the importance of this subject in preparing students for a technologically driven world, the performance of students has not consistently met the desired standards. This decline in academic

achievement raises concerns about the effectiveness of traditional teaching methods employed in Data Processing classrooms. One potential solution to address this issue is the implementation of innovative instructional strategies such as the Jigsaw method. The Jigsaw instructional strategy is a cooperative learning approach that encourages active student participation, collaboration, and critical thinking. However, its effect on the academic achievement of senior secondary school students in Data Processing in Bayelsa State remains largely unexplored. Therefore, this study aims to investigate the effect of the Jigsaw instructional strategy on senior secondary school students' academic achievement in Data Processing in Bayelsa State. The problem of this study when posed in question form is, therefore, "What is the effect of Jigsaw instructional strategy on the senior secondary students' academic achievement in data processing in Bayelsa State"? If effective, would both gender benefit equally?

Purpose of the Study

The purpose of the study was to investigate the effect of Jigsaw instructional strategy on senior secondary school students' academic achievement in data processing in Bayelsa State. The study specifically investigated the:

- effect of Jigsaw instructional strategy on SS II students' academic achievement when taught data processing and those taught the same topic using lecture method;
- Influence of gender (male and female) on SS II students' academic achievement when taught data processing using Jigsaw instructional strategy.

Research Questions

The following research questions guided the study:

- What are the mean achievement scores and standard deviations of SS II students' academic achievement when taught data processing using Jigsaw instructional strategy and those taught the same topic using lecture method?
- What are the mean achievement scores and standard deviations of male and female SS II students' academic achievement when taught data processing using Jigsaw instructional strategy?

Hypotheses

The following null hypotheses were tested at .05 level of significance:

Ho_1: There is no significant difference between the mean achievement scores and standard deviations of SS II students' academic achievement when taught data processing using Jigsaw instructional strategy and those taught the same topic using lecture method in both pre-test and post-test.

Ho_2: There is no significant difference between the mean achievement scores and standard deviations of male and female SS II students' academic achievement when taught data processing using Jigsaw instructional strategy.

Ho_3: There is no significant interaction effect of gender and Jigsaw instructional strategy on students' academic achievement in data processing.

Research Method

The researchers adopted a quasi experimental research design. Nworgu (2015), defined quasi-experimental research design as one which random assignment of subjects to experiment and control groups is not possible. The population for the study was 1076 Senior Secondary School II (SS II) data processing students. Purposive random sampling technique was used to draw a sample size of 265 SS II data processing students. It comprised 142 SS II students in the experimental group (65 males and 77 females) and 123 SS II students in the control group. The instrument used for data collection was Data

Processing Achievement Test (DPAT) which was developed by the researchers and validated by three research experts. DPAT was a multiple choice question designed to measure students' knowledge, skills, or proficiency in a computer programming course. Kuder-Richardson 20 (K-20) formula was used to estimate the reliability of the instrument and a reliability index of .81 was obtained. A two-week training session was organized within the sampled schools by the researchers for the regular data processing teachers. The teachers for the experimental group used Jigsaw instructional strategy while the teachers for the control group used the lecture method. The treatment spanned a duration of six weeks, and the instructional sessions adhered to the standard school schedule. The weekly timetable designated one 80-minute double period and one 40-minute single period for data processing. These time slots were employed for teaching the students over a four-week period, with each topic spanning one week. Research questions were addressed using mean and standard deviation, while the null hypotheses were tested through Analysis of Covariance (ANCOVA). ANCOVA was chosen because intact classes were utilized, and it was impossible to ensure initial homogeneity. The null hypothesis was only rejected if the probability value was less than or equal to the significance level of .05 ($P \leq .05$); otherwise, it was retained.

Data Analysis and Results Presentation

Research Question 1: What are the mean achievement scores and standard deviations of SS II students' academic achievement when taught data processing using Jigsaw instructional strategy and those taught the same topic using lecture method?

Table 1: Mean achievement scores and standard deviations of students taught data processing using Jigsaw instructional strategy and those taught using lecture method

Groups	Number	Pre-test		Post-test		Mean Gain
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	
Experimental	142	36.68	4.89	42.10	6.53	5.42
Control	123	32.72	4.08	35.48	5.33	2.76
Mean Diff.						**2.66**

Table 1 presents data comparing students' academic achievement in data processing instruction using the Jigsaw instructional strategy and the lecture method. The results showed that students in the Jigsaw group had initial (pre-DPAT) and final (post-DPAT) scores of 36.68 and 42.10, respectively, with standard deviations of 4.89 and 5.42. On the other hand, students in the lecture group had initial and final scores of 32.72 and 35.48, respectively, with standard deviations of 4.08 and 5.33. The average improvement (mean gain) in the experimental group was 5.42, while it was 2.76 in the control group, resulting in a mean difference of 2.66. This significant difference in mean achievement scores between the experimental and control groups indicates that learning indeed occurred. Notably, both groups

achieved higher mean scores in both pretests and posttests, demonstrating that students taught data processing using the Jigsaw instructional strategy outperformed those taught using the lecture method in terms of academic achievement.

Research Question 2: What are the mean achievement scores and standard deviations of male and female SS II students' academic achievement when taught data processing using Jigsaw instructional strategy?

Table 2: Mean achievement scores and standard deviations of male and female students taught data processing using Jigsaw instructional strategy

Gender	Number	Pre-test		Post-test		
		Mean ($\bar{x}$)	Standard Deviation (s)	Mean ($\bar{x}$)	Standard Deviation (s)	Mean Gain
Male	65	31.58	4.03	34.89	5.11	3.31
Female	77	30.44	3.86	32.03	4.09	1.59
Mean Diff.						**1.72**

Table 2 presents data indicating that male students who were instructed in data processing using the Jigsaw teaching method achieved pre-DPAT and post-DPAT scores of 31.58 and 34.89 along with standard deviations of 4.03 and 5.11 respectively. Female students taught data processing using the same Jigsaw instructional strategy achieved pre-DPAT and post-DPAT scores of 30.44 and 32.03 with standard deviations of 3.86 and 4.09 respectively. The mean gain for male students was 3.31, while female students showed a mean gain of 1.59. The mean difference between the two groups was 1.72, indicating a disparity in academic achievement scores between male and female students in the experimental group. These findings suggest that male students who were taught data processing using the Jigsaw instructional strategy outperformed their female counterparts in terms of academic achievement.

Hypotheses

Ho_1: There is no significant difference between the mean achievement scores and standard deviations of SS II students' academic achievement when taught data processing using Jigsaw instructional strategy and those taught the same topic using lecture method in both pre-test and post-test.

Table 3: Analysis of Covariance on the mean achievement scores of students taught data processing using Jigsaw instructional strategy and those taught using lecture method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	431.46	2	215.73	12.55	.000	Rejected
Intercept	788.78	1	788.78	351.04	.000	
GROUP	939.91	1	939.91	12.55	.000	
Error	8642.71	267	21.90			
Total	10802.86	269				
Corrected Total	10611.91	268				

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Table 3 demonstrates that the computed F statistic of 12.55 holds significance at a level of less than .000, which is below the predetermined .05 significance threshold established for this study. Consequently, the null hypothesis is rejected which suggests that there is a significant difference between the mean scores of students who were taught data processing through the Jigsaw instructional approach and those who were taught using the lecture method.

Ho_2: There is no significant difference between the mean achievement scores and standard deviations of male and female SS II students' academic achievement when taught data processing using Jigsaw instructional strategy.

Table 4: Analysis of Covariance on the mean achievement scores of male and female students taught data processing using Jigsaw instructional strategy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	379.78	2	189.89	7.81	.000	Rejected
Intercept	186.42	1	186.42	5.33	.000	
Pretest	291.32	1	291.32			
Gender	142.83	1	142.83	9.42	.000	
Error	891.12	152				
Total	1891.47	154				
Corrected Total	1544.46	153				

Table 4 shows that the calculated F value is 9.42 which is found to be significant at .000. Since this significant level (.000) is less than the .05 significant level set for the study, the null hypothesis is rejected. This means that there is a significant difference between the mean scores of male and female students taught data processing using Jigsaw instructional strategy.

Ho_3: There is no significant interaction effect of gender and Jigsaw instructional strategy on students' academic achievement in data processing.

Table 5: Analysis of Covariance on the interaction effect of gender and method (Jigsaw instructional strategy) on students' achievement in data processing

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	262.18	2	131.09	9.56	.000	
Intercept	111.91	1	111.91	5.90	.000	
Method*Gender	201.44	1	201.44	9.56	.000	Rejected
Error	289.09	267	19.11			
Total	864.62	269				
Corrected Total	798.41	268				

Table 5 shows that the calculated F value is 9.56 which is found to be significant at .000. Since this significant level (.000) is less than the .05 significant level set for the study, the null hypothesis is, accordingly, rejected. This means that there is a significant interaction effect between method and gender in students' academic achievement scores.

Discussion

The findings of the study showed that students who were taught data processing using Jigsaw instructional strategy recorded increased achievement than their counterparts who were taught with the lecture method. The findings of the study is in line with Lawan (2016), who indicated that there is a high level of effectiveness of jigsaw instructional strategy in many subjects like mathematics and economics when compared to the conventional teaching strategy. The finding is in line with Huang (2013), who found that the Jigsaw method of Cooperative Learning improved the students' learning attitudes and improved the efficiency of learning. The finding is in line with Nwankwo and Okigbo (2021), who posited that the jigsaw instructional strategy significantly improves achievement of students more than the traditional teaching method. The finding also agrees with Yemi, Azid and Ali's (2018), who posited that the jigsaw strategy for teaching is more effective than traditional method at enhancing academic achievement.

The findings also showed that male students achieved higher results than their female counterparts when taught data processing using Jigsaw instructional strategy. The finding is in line with Omeje (2021), who stated that male students achieved higher results than their female counterparts when exposed to cooperative learning strategies, indicating that gender played a role. The finding is in disagreement with Ajaja and Eravwoke (2010), who stated that gender did not affect students' academic performance when they were exposed to cooperative learning.

Furthermore, the test of hypotheses also showed that the mean difference in achievement was significant, in favour of the students in the experimental group. There was an interaction effect between method and gender in the academic achievement scores of students.

Conclusion

The study on the effect of the Jigsaw instructional strategy on senior secondary school students' academic achievement in Data Processing in Bayelsa State, Nigeria, has provided valuable insights into the potential benefits of innovative teaching methods in enhancing learning outcomes. The findings of this research have demonstrated that the Jigsaw instructional strategy can significantly improve students' academic achievement in Data Processing. By fostering collaboration, active participation, and a deeper understanding of the subject matter, this teaching approach has shown promise in addressing the unique challenges faced by students in the Nigerian education system.

Recommendations

Based on the findings, the following recommendations were proffered:

- Non-governmental organizations should encourage ongoing professional development for teachers to refine their skills in implementing the Jigsaw strategy effectively.
- Teachers should collaborate with other educators who have successfully implemented the jigsaw instructional strategy to exchange best practices and strategies for improving outcomes for all students, regardless of gender.

REFERENCES

Abimbola, I.O. (2013). The misunderstood word in science: Towards a technology of perfect understanding for all. *The one hundred and twenty-third (123 rd) inaugural lecture. Ilorin: Unilorin Press.*

Adeniyi, C.O. (2015). Effects of personalized system of instruction on senior school students' achievement in mathematics in Kwara South Nigeria. *ABACUS, Journal of the mathematical Association of Nigeria.40* (1).122- 132.

Adigun, J., Onihunwa J., Irunokhai, E., Sada, Y. & Adesina, O. (2015). Effect of gender on students' academic achievement in computer studies in secondary schools in New Bussa, Borgu Local Government of Niger State. *Journal of Education and Practice,* 6(33), 1-7

Ajaja, O.P. & Eravwoke, O.U. (2010). Effects of cooperative learning strategy on junior secondary school students' achievement in integrated science. *Electronic Journal of Science Education, 14(1),* Retrieved from http://ejse.southwestern.edu 13th March, 2017

Anderson, T. (2014). Theory and practice of online learning. Canada: AU Press, Athabasca University. J.B. Arbaugh (2010). How classroom environment and student engagement affect learning in internet-based MBA courses. *Business Communication Quarterly*, 63(4), 9-18.

Bamidele, E.F. & Yoade, F. B. (2017). Effects of modes of computer animation instructional packages on students' achievement in OSUN state secondary schools' biology. *International Journal of Innovation and Research in Educational Sciences, 4*(4); 496-501

Chu, S. (2014). Application of the Jigsaw Cooperative Learning Method in Economics Course *International Journal of Managerial Studies and Research*, 2(10): 166-172

Huang, Y.M. (2013). A Jigsaw-based Cooperative Learning Approach to Improve Learning Outcomes for Mobile Situated Learning. *Educational Technology & Society*, 17(1), 128-140

Ikwuka, O.I., & Samuel, N.N.C. (2017). Effect of computer animation on chemistry academic achievement of secondary school students in Anambra State, Nigeria. *Journal of Emerging Trends in Educational Research and Policy Studies*, 8(2), 98-102.

Juweto, G.A. (2015). Effects of Jigsaw co-operative teaching/learning strategy and school location on students' achievement and attitude towards Biology in secondary school in Delta State. *International Journal of Education and Research*, 3(8): 31-40

Lawan, Y. (2016). Impacts of Jigsaw co-operative learning strategy on academic performance and retention in mensuration among senior secondary school students in Kano State, Nigeria. *An Unpublished Dissertation*. Ahmadu Bello University, Zaria.

Njoku, Z.C. & Eze-Odurukwe, P.I. (2015). Resolving Nigerian secondary school students' learning difficulties in nuclear Chemistry using

animation solutions. *Procedia- Social and Behavioral Sciences,* 176, 1034-1040.

Nwankwo, M.U. & Okigbo, E.C. (2021). Effect of Jigsaw teaching strategy on academic achievement and retention of Anambra State secondary school students in chemistry. *Unizik Journal of Educational Research and Policy Studies;* 7(1); 375-386.

Nworgu, B.G. (2015). *Educational research: Basic issues and methodology (Third Edition).* Nsukka, Enugu: University Trust Publishers.

Omeje, C.O. (2021). Effect of learning activity package on senior secondary school students' achievement, interest and retention in chemistry. *Unpublished Thesis,* Enugu State University of Science and Technology.

Onyali, L.C. & Akinfolarin, A.V. (2017). Principals' provision of incentives practices for secondary schools improvement in Oyo State. *Unizik Journal of Education Graduates, 4*(1), 24-36.

Ukeh, B.O. & Nwankwo, E.D. (2023). Integrating Blended Learning Method in teaching of computer programming course: Effect on students' achievement in Tertiary institutions in Enugu State. *ESUT Journal of Education, 6*(1), 1-10.

Yemi, T.M., Azid, N.B.H. & Ali, M.R. (2018). Effect of jigsaw strategy of cooperative learning on mathematics achievement among secondary School students. *European Journal of Education Studies*, 4(2); 51-61.