

Effects of Jigsaw IV Instructional Strategy on Senior Secondary School Students' Interest and Achievement in Physics

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ABSTRACT

The study investigated the effects of Jigsaw IV instructional strategy on senior secondary school students' interest and achievement in physics. Four research questions and four hypotheses guided the study. The study adopted a quasi-experimental non-equivalent pretest posttest group design. A sample size of 186 Senior Secondary two (SS 2) students from six schools in Abakaliki Education Zone were used as research subjects in the study. Two research instruments; Physics Interest Scale (PIS) and Physics Achievement Test (PAT) developed by the researcher were used for data collection. The Physics Interest Scale (PIS) is made of 27 items while the Physics Achievement Test (PAT) is made of 30 items (multiple choice objective tests). The instruments were face and content validated by three subject specialists; one from measurement and evaluation and two from physics education. The reliability coefficient of PIS using the Cronbach Alpha was 0.6 while the reliability coefficient of PAT using Kuder-Richardson-20 was 0.9. The research questions were answered using mean and standard deviations while Analysis of covariance, ANCOVA was used for the hypotheses testing at 0.05 levels of significance. The results indicated that Jigsaw IV instructional strategy improved students' interest and achievement in physics than the lecture method. There was no significant difference in mean achievement as a result of gender. The researcher therefore concluded that Jigsaw IV instructional strategy is effective in improving interest and achievement in physics. Based on the findings, it was recommended among other things that physics teachers should be trained on how to use Jigsaw instructional strategy in teaching to make learners active for effectiveness and quality learning to be achieved in science education particularly in physics. The study recorded educational implications of Jigsaw IV instructional strategy to include enhancing students' interest and achievement in physics, close the gap between male and female students' interest and increase inclusiveness, do not record any discrimination in achievement based on gender, and enhances teachers teaching profession when used.

Keywords: physics, interest, achievement, gender, and instructional strategy.

INTRODUCTION

To study physics is to unlock the secrets of the universe, as physics takes a thrilling journey through the fundamental laws and principles that govern everything from the smallest particle to the vast expanse of cosmic creation. Physics is a science subject that deals with matter, energy and force. In Nigeria, physics is offered by students at the senior school level, which is the last three years of senior secondary school (SSS1-SSS3). Young and Freedman (2023) define physics as essential scientific subject, which studies the universe. Physics is also seen as the bedrock to engineering and technology as no engineer could make a design without first understanding the fundamental laws of physics. Scientists including chemists, paleontologists, and climatologists make use of the knowledge of physics.

Despite the importance of physics in scientific discipline, the interest and achievement of students in the subject in Ebonyi state have not been encouraging over the years (Damoeroem, 2022). Interest is a central factor on the choice of a given endeavor. Udoh and Akpan (2024) defined interest as a feeling of like or dislike towards activity or something. Interest is also defined as the feeling one has in the course or process of wanting to know or learn about something or someone (Okorie, 2022). Achievement on the other hand refers to performance outcomes that indicate the extent to which a person has attained specific goals that were the

focus of activities in instruction (Steinmayr, Meibner, Weidinger & Wirthwein 2023). Levin (2022) defined achievement as an individuals' academic level of accomplishment or proficiency across subject areas. Achievement is measured in terms of test scores, grades and overall academic ability.

The Jigsaw instructional strategy is a method of organizing classroom activity that makes students to depend on each other to succeed. It breaks a class into groups and breaks assignments into pieces that the group assembles to complete. Jigsaw instructional strategy, one of the cooperative learning strategies, is based on group dynamics and social interactions. It is one of the pure cooperative learning strategies. According to Sahin (2022), this technique includes two different treatments with different small groups in order to help learning and improve cooperation among students. It was originally designed by Aronson (2023) to help weaken racial cliques in integrated schools. Jigsaw is an instructional strategy in which the members of a class are organized into home groups; the students are then reorganized into expert groups containing one member from each home group. The members of the expert group work together to learn concepts or solve problems and then return to their home groups to share their learning or what they learnt in the expert group one after the other, based on the topic or sub-topic assigned to them in the expert group. In this way, the work of the expert groups circulates throughout the class.

Generally, the main purpose of this study is to determine the effects of Jigsaw IV instructional strategy on the mean interest score of secondary school physics students.

Statement of the Problem

The consistent decline in the interest and achievement of physics students in most secondary schools in Nigeria is the major problem that prompted this investigation. Therefore, if Nigeria is to attain science and technological development, the problem of decline in physics enrollment, interest and achievement must be addressed (House of Lords, 2023). Research evidence revealed that students' interest and achievement in physics in public examinations particularly in Ebonyi state have been very poor over the years (Ugwu, 2024). Various factors have been suggested that contribute to the poor achievement of students in physics. Most of the speculations point directly to pedagogy. Research reports have linked the low interest and achievement to predominant use of teacher centered methods like the lecture method by physics teachers. Specially, lack of active involvement of students and linear mediation of information from teacher to students seem to be responsible for the low interest and poor achievement of students taught using the lecture method.

Student-centered approach like Jigsaw IV instructional strategy has been advocated for teaching and learning of physics to enhance interest and achievement. The argument of its efficacy when infused into classroom instruction lacks empirical data to the knowledge of the researcher. The quest for this study therefore, was to establish the effects of Jigsaw IV instructional strategy on senior secondary school students' interest and achievement in physics.

Research Questions

The following research questions guided the study:

1. What is the effect of Jigsaw IV instructional strategy on secondary school physics students' mean interest score in physics?
2. What is the effect of Jigsaw IV instructional strategy on male and female secondary school students' mean interest score in physics?
3. What is the effect of Jigsaw IV instructional strategy on secondary school physics students' mean achievement score in physics?
4. What is the effect of Jigsaw IV instructional strategy on male and female secondary school students' mean achievement score in physics?

Hypotheses

The following null hypotheses were formulated for the study and were tested at 0.05 level of significance:

H01: There is no significant difference in mean interest rating scores of students taught physics using Jigsaw IV instructional strategy and those taught using lecture method.

H02: There is no significant difference between the mean interest rating scores of male and female secondary school students taught physics using Jigsaw IV instructional strategy.

H03: There is no significant difference in mean achievement scores of students taught physics using Jigsaw IV instructional strategy and those taught using the lecture method.

H04: There is no significant difference between the mean achievement scores of male and female secondary school students taught physics using Jigsaw IV instructional strategy.

METHODOLOGY

The researcher adopted quasi-experimental design. In a quasi-experimental study, there is no random assignment of subjects. Intact classes were used for the study. The specific design the researcher used for the study is pre-test post-test non-equivalent control group design. The choice of this design is because it offers maximum control over extraneous variables. According to Abonyi, Okereke, Omebe, Anugwo and Nnachi (2022), this design helps a researcher to establish control over internal factors or variables capable of invalidating the findings of the study.

The study was carried out within the Abakaliki Education Zone of Ebonyi State. Ebonyi State is divided into three Education zones; Abakaliki Education Zone, Onueke Education Zone and Afikpo Education Zone. Abakaliki Education Zone was chosen.

The population of the study consist all the SS2 physics students totaling 1,831 students (1,270 males and 561 females) from 80 co-education schools in Abakaliki Education Zone (Ebonyi State Secondary Education Board, 2025).

Sample size of 186 students from the intact classes of six co-education schools was used for the study. This comprise of 92 male and 94 female students. The total number of students in the experimental group is 91 students (32 males and 59 females) and the total number of students in the control group is 95 (43 males and 52 females) given a total number of 186 students. The six secondary schools were drawn using simple random sampling technique after stratifying all the secondary schools in the zone according to their Local Government Area. This is to ensure that schools selected are not close to each other. Three secondary schools were assigned to the treatment group while the other three were assigned to the control group through a simple toss of coin.

Two instruments which include Physics Interest Scale (PIS) and Physics Achievement Test (PAT) were face validated by three experts; two from the Physics Education and one from Measurement and Evaluation in Ebonyi State University, Abakaliki. The corrections, recommendations and suggestions of these experts were incorporated in the final production of the PIS and PAT.

Both instruments PIS and PAT were administered to 30 students in Afikpo Education zone outside the researcher's area of study, to ascertain their reliability index. The Physics Interest Scale was subjected to test of reliability using the Cronbach Alpha approach. The reliability yielded a coefficient index of 0.66 showing high reliability while the Physics Achievement Test PAT was subjected to test-retest method of determining reliability using Pearson Product Moment Correlation. T

his analysis gave a reliability coefficient of 0.83 indicating that the instrument is highly stable. The same instrument was also subjected to test of internal consistency using Kuder-Richardson-20 (KR₂₀), which gave a coefficient of 0.95 indicating a very high internal consistency.

From the data generated, mean and standard deviation were used to answer the research questions while ANCOVA was used to test the entire hypotheses at 95% confidence level.

RESULTS

Results are presented in tables according to individual research questions and hypotheses.

Research Question 1

What is the effect of Jigsaw IV instructional strategy on secondary school physics students' interest mean score in physics?

Table 1: Interest Mean of Students Based on Teaching Strategy

Teaching Method	N	Mean X	Standard Deviation
Jigsaw IV Instructional Strategy	91	97.13	4.89
Lecture Method	95	70.17	2.16

Researcher's Field Work, 2026

Summary of result presented in Table 1 indicates that the interest mean score of students taught physics using Jigsaw IV instructional strategy was 97.13 with standard deviation of 4.89. While, that of interest mean score and standard deviation of students taught using lecture method were 70.17 and 2.16 respectively. Therefore, the interest mean score of the students taught using Jigsaw IV instructional strategy (97.13) is greater than the interest mean score (70.17) of those taught using the lecture method. This implies that Jigsaw IV instructional strategy enhanced student's interest in physics more than the lecture method. Also, those in experimental group showed higher interest.

Research Question 2

What is the effect of Jigsaw IV instructional strategy on male and female secondary school students' interest mean score in physics?

Table 2: Interest Mean Score of Students Based on Gender

Gender	N	Mean X	Standard Deviation
Male	32	97.16	5.25
Female	59	97.12	4.74

Researcher's Field Work, 2026

Results presented in Table 2, indicates that the interest mean score and standard deviation of male students taught physics using Jigsaw IV instructional strategy were 97.16 and 5.25 respectively. While that of interest mean score and standard deviation of female students was 97.12 and 4.74 respectively. Based on the mean

values, male students had higher mean interest score than female students when taught physics using Jigsaw IV instructional strategy.

Research Question 3

What is the effect of Jigsaw IV instructional strategy on secondary school physics students' mean achievement score in physics?

Table 3: Achievement Mean Score of Physics Students Based on Teaching Method

Teaching Method	N	Adjusted Mean X	Standard Deviation
Jigsaw IV Instructional Strategy	91	44.91	4.22
Lecture Method	95	32.85	3.08

Researcher's Field Work, 2026

Table 3, reveals that the achievement mean score of students taught physics using Jigsaw IV instructional strategy was 44.91 with standard deviation of 4.22. The Table also revealed that achievement mean score for the students taught using lecture method was 32.85 with standard deviation of 3.08. This implies that Jigsaw IV instructional strategy yielded greater achievement mean score than the lecture method.

Research Question 4

What is the effect of Jigsaw IV instructional strategy on male and female secondary school students' mean achievement score in physics?

Table 4: Achievement Mean of Students Based on Gender

Gender	N	Adjusted Mean X	Standard Deviation
Male	32	46.13	4.64
Female	59	44.25	3.86

Researcher's Field Work, 2026

The results in Table 4 show that the mean achievement score and its standard deviation for male were 46.13 and 4.64 respectively. The Table also revealed that the mean achievement score for female students in the group was 44.25, with its standard deviation as 3.86. From the results, male students taught physics using Jigsaw IV instructional strategy had higher achievement mean score than the female students taught physics using the same method.

Test of Hypotheses

The null hypotheses were tested at 0.05 level of significance and the results presented as shown below:

H₀₁: There is no significant difference in interests mean scores of students taught physics using Jigsaw IV instructional strategy and those taught using lecture method.

Data collected using interest scale for both treatment and control groups for male and female students were used to test this hypothesis. Summary of the results are shown in Table 7.

Table 7: ANCOVA Results of Interest Mean Scores on Teaching Method

Sources of Variance	Sum of Squares	DF	Mean Square	F	Sig. of F	Decision
Corrected Model	33808.647 ^a	4	8452.162	593.371	.000	
Intercept	1639.116	1	1639.116	115.072	.000	
PRETEST	17.449	1	17.449	1.225	.270	
METHOD	5039.674	1	5039.674	353.803	.000	S
GENDER	.063	1	.063	.004	.947	
METHOD * GENDER	.176	1	.176	.012	.912	
Error	2578.219	181	14.244			
Total	1328887.000	186				
Corrected Total	36386.866	185				
Corrected Model	33808.647 ^a	4	8452.162	593.371	.000	

S: Significant at $p < 0.05$ (Researcher's Field Work, 2026)

Results presented in Table 7 revealed that the F-ratio for method was 353.803 with significance of F-value of 0.000. The significance of F-value 0.000) is less than the alpha level (0.05). Therefore, H₀₁ was rejected. This means that there is significant difference in interests mean scores of students taught physics using Jigsaw IV instructional strategy and those taught using lecture method. Jigsaw IV instructional strategy is more effective to lecture method in enhancing students' interest in physics.

H₀₂: There is no significant difference between the interests mean scores of male and female secondary school students taught physics using Jigsaw IV instructional strategy.

Data collected using the interest scale for the treatment group only was used to test this hypothesis. Summary of results is shown in Table 8.

Table 8: ANCOVA Results on Student's Interest Based on Gender

Source of Variance	Sum of Squares	DF	Mean Square	F	Sig. of F	Decision
Corrected Model	7.732 ^a	2	3.866	.158	.854	
Intercept	306.826	1	306.826	12.554	.001	

PRESTEST	7.702	1	7.702	.315	.576	
GENDER	.415	1	.415	.017	.897	NS
Error	2150.686	88	24.440			
Total	860707.000	91				
Corrected Total	2158.418	90				

NS: Not Significant at $p > 0.05$. (Researcher's Field Work, 2026)

Table 8 shows that F-ratio for gender is 0.017 and the significance of F to be 0.897. Since, the significance of F (0.897) is greater than the alpha level (0.05). Therefore, there is no significant difference between the interests mean scores of male and female secondary school students taught physics using Jigsaw IV instructional strategy.

H₀₃: There is no significant difference in achievement mean scores of students taught physics using Jigsaw IV instructional strategy and those taught using the lecture method.

Data collected using the achievement test for both treatment and control groups for male and female students were used to test this hypothesis. Summary of the result are shown in Table 9.

Table 9: ANCOVA Results of Achievement Mean Scores Based on Teaching Method

Sources of Variance	Sum of Squares	DF	Mean Square	F	Sig. of F	Decision
Corrected Model	6984.664 ^a	4	1746.166	139.112	.000	
Intercept	1785.949	1	1785.949	142.281	.000	
PRESTEST	152.486	1	152.486	12.148	.001	
METHODS	6012.396	1	6012.396	478.989	.000	S
GENDER	43.503	1	43.503	3.466	.064	
METHODS * GENDER	34.271	1	34.271	2.730	.748	
Error	2271.959	181	12.552			
Total	288586.000	186				
Corrected Total	9256.624	185				
Corrected Model	6984.664 ^a	4	1746.166	139.112	.000	

Method: Significant at $p < 0.05$; Interaction: Not Significant at $p > 0.05$. (Researcher's Field Work, 2026)

Table 9 showed that the F-Ratio for method was 478.989 with significance of F as 0.000. H₀₁ was rejected since significance of F (0.000) is less than 0.05. This implies that there is significant difference at $p < 0.05$ between achievements mean scores of students taught physics using Jigsaw IV instructional strategy and those taught using lecture method. The difference can be rightly attributed to the effects of the treatment.

H04: There is no significant difference between the achievements mean scores of male and female secondary school students taught physics using Jigsaw instructional strategy.

Data collected using the achievement test for the treatment group only was used to test this hypothesis. Summary of results is shown in Table 10.

Table 10: ANCOVA Results of Student's Achievement in Physics Based on Gender

Source of Variance	Sum of Squares	DF	Mean Square	F	Sig. of F	Decision
Corrected Model	96.333 ^a	2	48.167	2.809	.066	
Intercept	1970.378	1	1970.378	114.909	.000	
PRESTEST	23.723	1	23.723	1.383	.243	
GENDER	76.019	1	76.019	4.433	.738	NS
Error	1508.964	88	17.147			
Total	185161.000	91				
Corrected Total	1605.297	90				

Gender: Not Significant at $p > 0.05$. (Researcher's Field Work, 2026)

Table 10 revealed that F-ratio with regard to gender was 4.433, with significance of F as 0.638. The significance of F (0.638) is greater than the alpha level (0.05). Therefore, H_0 was accepted implying that there was no significant difference between the mean achievements score of male and female secondary school students who were taught physics using Jigsaw IV instructional strategy. Achievement of students when Jigsaw IV strategy is used does not depend on gender.

DISCUSSION OF FINDINGS

The result from this study as shown in Table 1, indicated that students taught physics using Jigsaw IV instructional strategy had higher interest mean score than those taught using the lecture method. Test of hypothesis 1 showed that there was statistically significant difference between the interests mean scores of the treatment and control groups. This finding implies that the difference between the interest mean scores were systematic and not due to chance occurrence. The mean interest scores were not equivalent, statistically.

The findings agree with some studies by Gilbert (2024), Hence (2024) Nam (2024), that cooperative learning strategies like the Jigsaw IV instructional strategy is associated with and enhances the development of general interest of the learner. Studies by Udo and Akpan (2024) as well as Abbas (2021), found that Jigsaw technique enhance interest of students in geometry.

Findings on Effect of Jigsaw IV instructional strategy on male and female secondary school students' mean interest score in physic revealed that male students had higher interest mean score than female students. This finding implies that when physics is taught using the Jigsaw IV instructional strategy, male students will have greater interest in physics than female students.

The higher mean interest score of male students seemed to support to the assertion of Fakoredo in Nworgu et al., (2022) that girls have less interest in in science subjects, such as physics. The findings agreed with the findings of Sule, (2023) and Bacon (2024); that male students had higher interest score than the female students in physics, Integrated Science and Biology respectively and that there was no significant difference in

the mean interest scores of male and female students. On the contrary, Okeke (2024) found that female students' interest mean score was higher than that of male students.

The findings on Effects of Jigsaw IV instructional strategy on Students' Achievement Mean Score in Physics showed that students who were taught physics using the Jigsaw IV instructional strategy had higher mean achievement score than those taught using the lecture method. This implies that the difference between the mean physics achievement scores of students taught using Jigsaw IV instructional strategy and those taught using lecture method was statistically significant at $p < 0.05$. This shows that the disparity in the achievement means scores was systematic rather than chance occurrence. The findings of this study agree with Kajuru (2022) and Okeke (2023) that Jigsaw instructional strategy improved mean achievement scores and the difference was significant in each case.

Investigation on Effect of Jigsaw IV instructional Strategy on Male and Female Secondary School Students' Mean Achievement in Physics revealed that the male students had slightly higher achievement mean score than the female students. The finding apparently supports the view of researchers such as Nworgu, 2022; Okorie and Eze, 2023, that male students achieved higher in physics and other science subjects, than female students. On the contrary, Adigun, Onihunwa, Irunokhai, Sada & Adasina 2023 reported that the mean achievement of female students in thermodynamics was greater than those of male students. Similarly, Shaibu and Mani in Nworgu et al., (2022) found that female students achieved higher in science processes.

CONCLUSION

The difference in the interest mean score of the treatment groups was not by chance but due to effects of the treatment. Therefore, Jigsaw IV enhances students' interest in physics than the lecture method. The difference between the mean scores are due to chance occurrence and not systematic. Also, the strategy favored female and male students based on interest and achievement. Therefore, interest and achievement mean scores were free from gender bias.

RECOMMENDATIONS

Based on the findings, the researcher made the following recommendations:

1. Science teachers should utilize the Jigsaw instructional strategy during instructional delivery.
2. Teachers should be trained effectively so that they can master constructivist learning strategies for improvement in instructional delivery.

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