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CONTENTS

EFFECTS OF GUIDED-REVERSE JIGSAW INSTRUCTIONAL STRATEGY ON SENIOR SECONDARY SCHOOL PHYSICS STUDENTS' ACHIEVEMENT IN OYO STATE, NIGERIA

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Abstract

The study determined the effects of guided-reverse instructional strategy on Physics Students' achievement in Senior Secondary Schools in Oyo State, Nigeria. Four hypotheses were tested at 0.05 level of significance. 73 students selected from two schools took part in the study. The instruments for data collection were twenty items Physics Achievement Test while Mean, standard deviation and t-test were used for the analysis of the data. A statistically significant difference exists in the mean academic achievement scores of students taught physics using guided-reverse jigsaw instructional strategy and those taught using conventional lecture method in favor of guided-reverse instructional strategy. Gender differences are of no statistically significant difference in the mean academic achievement scores for both experimental and control groups. The study recommends that physics teachers should adopt guided-reverse jigsaw instructional strategy.

Keywords: Guided–reverse jigsaw strategy, Physics students' achievement and cooperative teaching

Background to the Study

The role of physics as a vehicle for technological, social and economic development of all nations cannot be overemphasized. Through its principles and laws, it helps in the inventions of different gadgets that make lives easy and convenient for mankind amongst which are washing machines, computers, air conditioners, refrigerators, etc. Not only does our means of transport and communications majorly depends on its methodology, it also unifies most disciplines in life such that no candidate could be offered admission to study courses such as Medicine, Pharmacy, Engineering, Agriculture and Environmental sciences among others at higher level of education without a credit pass in physics at School Certificate Examination organized by National Examination Council (NECO) or West African Senior School Certificate Examination (WASSCE). Perhaps, this explains why it is described as the language of science or the most fundamental of all sciences by Babajide and Togbe, (2016). Realizing its importance, Igbokwe in Graduate Projects, (2022) contends that without physics there will be no science and without science there will be no technology, and without technology there will be no modern society. For this reason and many more, its inclusion in the Nigerian senior secondary school curriculum seems justified.

Taking cue from the aforementioned, it is obvious that for any meaningful national development, there is need for a solid foundation for an effective and efficient physics education

at the secondary school level. Achieving this goal calls for nothing other than the adoption of instructional strategies that will boost the academic performance of students in the subject. Such strategies will involve them in doing things and thinking about what they are doing which according to Eison (2015) is termed Active Learning Strategies. One of such interactive teaching strategies is the Jigsaw Learning Strategy (JLS). The strategy organizes students into group work in such a way that they have no choice than to collaborate and rely on one another in the task of learning a concept, as individual in a group has something unique to contribute to their group's outcome. The strategy according to Catapano (2018) is characterized with the steps such as organizing students into a group of 4-6 students; dividing the day's lesson into 4-6 parts, and assigning one student in each group to be responsible for a different segment; giving students time to learn and process their assigned segment independently; putting students who completed the same segment together into an "Expert group" to talk about and process the details of their segment; having students return to their original "Jigsaw" groups and take turns, sharing the segments they have become experts on and having students complete a task or a quiz that depends on students having a better understanding of the material from the contributions of all their group members.

Five types of Jigsaw strategies have however been identified. These according to Maden, (2011) are the original Jigsaw developed by Aronson (1978); Jig-saw II developed by Slavin (1987); Jigsaw III developed by Stahl (1994); Jigsaw IV developed by Holliday (2000) and Reverse Jig-saw strategy by Hedeen (2003). The Reverse jigsaw was purposely designed to cater for higher students. Besides this, in the reverse jigsaw, students in the expert groups teach the whole class rather than return to their home groups to teach the content. Thus, it differs from the original jigsaw during the teaching portion of the activity.

In an investigation carried out by Timayi, Bolaji and Kajuru (2016) on the effects of jigsaw IV cooperative learning strategy (J4CLS) on interest and academic performance of secondary school students in geometry in Kaduna State, Nigeria, a significant difference in performance in favour of students exposed to jigsaw IV cooperative learning strategy (J4CLS) was obtained. The results also revealed no significant difference in the performance of male and female students when exposed to jigsaw IV strategy. The result further revealed a significant difference in interest level in favour of student exposed to jigsaw IV. It is obvious from the above that few attempts have been undertaken for younger students especially, in secondary schools to improve their academic achievement in physics using this strategy.

Equally worthy of mention is the divergent opinions of scholars on the effect of gender on the academic achievement of students in physics. While Cheema and Mirza (2013) reported gender differences in favor of male students, Usman and Mankilik (2019) observed that gender had no effect on academic achievement of students. These contradictory views about gender prompted its insertion as a moderating variable for this study. It is against this background that this study sought to investigate the effects of reverse jigsaw teaching strategy on students' achievement in secondary school physics. This study chose the reverse jigsaw being one of the newest methods recently created under cooperative learning strategies. Beside this, it is noted that the strategy was originally created to cater for students in higher classes hence, its veracity need be tested on senior secondary school physics students. It would however be modified with teacher's guide to make it become guided-reverse jigsaw.

Statement of the Problem

In spite of the important role of physics in helping students to comprehend the world around them and in preparing them to improve on it, the subject is still afflicted with a number of observable teething troubles especially at the post primary school level. One of the hitches is the consistent use of conventional lecture method of teaching which could lead to a surface learning thereby, making the objective of achieving an all-round development of physics students a mirage. To curb this problem, several strategies have been suggested. One of them is the reverse-jigsaw instructional strategy. Earlier studies on it regarding its effect on students' achievement were carried out outside the shore of Nigeria and mostly concentrated on students of higher learning with relatively fewer attempts for younger students especially at the secondary school level. It is against this background that this study sought to investigate the effect of reversed-jigsaw instructional strategy and gender on students' academic achievement in secondary school physics. The strategy would however be modified with teacher's guide to make it become guided-reverse jigsaw.

Objectives of the Study

This study primarily aimed at examining the effect of reverse-jigsaw instructional strategy on the academic achievement of senior secondary school physics students. Specifically, the study sought to:

1. Determine the difference in the pretest mean achievement scores of physics students taught using guided-reverse jigsaw strategy and those taught using conventional lecture strategy.
2. Examine the difference in the post-test achievement mean scores of physics students taught with guided-reverse jigsaw instructional strategy and those taught with conventional lecture method.
3. Investigate the difference in the post-test achievement mean scores of male and female students taught with conventional lecture strategy.
4. Find out the difference in the achievement mean scores of male and female physics students taught with guided-reverse jigsaw instructional strategy.

Hypotheses

The following null hypothesis were formulated and tested at level of significance $p < 0.05$

Ho1: There is no statistically significant difference between the pretest mean achievement scores of physics students taught using guided-reverse jigsaw strategy and those taught using conventional lecture strategy.

Ho2: There is no statistically significant difference in the post-test achievement mean scores of physics students taught with guided-reverse jigsaw instructional strategy and those taught with conventional lecture method.

Ho3: There is no statistically significant difference in the achievement mean scores of male and female physics students taught with conventional lecture strategy.

Ho4: There is no significant difference in the achievement mean scores of male and female physics students taught with guided-reverse jigsaw instructional strategy.

Methodology

The pretest-posttest control group quasi-experimental design was adopted for this study. An intact class of 73 SSII physics students participated in the study (36 male and 37 females). A pretest measure was administered to both groups in term of Physics Achievement Test to determine the initial disparity among the students before mounting up the treatment to the

experimental group. Those intact classes of Senior Secondary School II Physics students from the two schools were randomly assigned to treatment (experimental) and conventional (control) group. Thereafter, a posttest measure on Physics Achievement was administered to the participants after the treatment duration of four weeks. The conventional group was left out without any intervention. The pretest and posttest measures were parallel in the sense that they were almost the same. It was the items therein that were reshuffled.

Research Instruments

The study adopted Physics Achievement Test (PAT) developed by the researchers. It consisted of a 20-multiple choice item with options labeled A – D and drawn from Senior Certificate Examination physics past questions. It was validated by experts in science education for both face and content validity. The reliability index of the instrument was determined through a test-retest method and the reliability index was of 0.73 was obtained. The instructional guide was validated by three experienced physics teachers and adjudged suitable for teaching the selected light-related physics concepts.

Results

There is no statistically significant difference between the pretest mean achievement scores of students taught using guided-reverse jigsaw instructional strategy and those taught using conventional lecture strategy.

Table I: Means and Standard Deviations of Achievement Scores of Students in the Experimental and Control Groups during the Pretest

Pretest **Treatment**	**N**	**Mean**	**SD**	**Std Error**
Experimental	39	8.67	3.958	0.29775
Control	34	8.95	3.964	0.31246

Table 1 shows the difference between the mean achievement scores as well as standard deviation of the experimental and control groups in the pretest. It could be seen that the mean scores of students is 8.67 for those in the experimental group and 8.95 for those in the control group. Though, there appears a little difference of 0.28 in favor of those in the control group but the difference is not statistically significant. The two groups appear to be equal in pretest achievement scores. In consequence, the null hypothesis I is not rejected.

Table 2: Means, Standard Deviations and t-test Comparisons of Post-test Achievement Scores of Students in the Experimental and Control Groups

Group	N	Mean	SD	df	t calc.	tcrit	P
Experimental	39	11.82	4.659	71	2.19	1.96	S
Control	34	9.47	4.515				

Table 2 indicated that students in the experimental group had a higher mean score in their post achievement test (11.82) than their counterparts in the control group (9.47). This is further corroborated with the t-calculated being greater than the t-critical. The null hypothesis is therefore rejected. Consequently, the two groups were found to be different in post-test achievement scores, the difference is highly in favor of the experimental group.

Table 3: Means, Standard Deviations and t-test Comparisons of Post-test Achievement Scores of Male and Female Students in the Conventional Lecture (Control) Group

Group	N	Mean	SD	df	t calc.	tcrit	P
Male	15	9.67	3.966	32	0.154	1.96	NS
Female	19	9.45	4.335				

With the t-calculated (0.154) being less than the t-table (1.96) in Table 3, the null hypothesis which states that there is no statistically significant difference in the achievement mean scores of male and female physics students taught with conventional lecture strategy is not rejected rather, it is upheld.

Table 4: Means, Standard Deviations and t-test Comparisons of Post-test Achievement Scores of Male and Female Students in the Reverse-Jigsaw (Experimental) Group

Group	N	Mean	SD	df	t calc.	t critic	P
Male	21	11.96	4.180	37	0.179	1.96	NS
Female	18	11.72	4.172				

Table 4 shows that t-calculated 0.179 is less than t-value 1.96. Therefore there is no significant difference in the achievement mean scores of male and female physics students taught with guided reverse jigsaw instructional strategy.

Discussions

Mean Achievement Scores of Students in the Pretest

Findings of the study showed low mean scores of 8.67 and 8.95 at the pretest stage. With this, one is tempted to assert that general performance of the students was a bit low. This could be partly attributed to the students' unexpectedness of the test at the time it was conducted and partly due to the inability of the students' physics teacher to cover the content areas in the unit under review before the pretest. Other factors may be students' lack of interest and poor attitude

to physics. The assertion is in view of the submissions of Wikina, (2016) and Business Dictionary (2018) that the development of right attitude to learning is crucial to the attainment of good performance in any endeavor.

Effect of Guided-Reverse Jigsaw Instructional Strategy on Physics Students Achievement
The result revealed that students taught Physics using guided-reverse jigsaw instructional strategy performed better than those taught with conventional lecture method. The implication of this is that the difference in the mean scores from 8.67 (pretest) to 11.82 in the post-test was significant in favor of the treatment group. The finding is in line with Agu and Samuel, (2018) whose investigation on the effect of reversed-jigsaw, team-assisted instruction and guided discovery instructional strategies on the interest and achievement of Basic Science students showed that there were significant differences in the interest and achievement of students in favor of those from the reversed-jigsaw instructional strategy.

Effect of Gender on the Achievement on the Achievement of Students in Physics
According to the results of the study from tables 3 and 4, guided-reverse jigsaw instructional strategy is not gender bias in teaching physics. With mean achievement scores of male and female students not significantly different in both strategies, it then proves that the era of male supremacy in science learning is gone. The finding is similar to that of Usman and Mankilik (2019) who affirmed that there was no significant difference between male and female students' achievement. With guided-reverse jigsaw instructional strategy, students are free to interact freely with each other irrespective of gender.

Conclusion
It is concluded that students performed brilliantly when they are taught with guided-reverse jigsaw learning strategy than when they are taught with conventional lecture method. This is attributed to the interesting nature of the guided reverse-jigsaw strategy to connect different facts and concepts in classes with their practical applications. It thus makes the content relevant to the students by connecting them with everyday life and the society in which they live. The study also reported gender difference on students' achievement in physics.

Recommendations
Based on the findings of this study, it was recommended that:

- Efforts should be made to shift the in-class activities from the teacher in front of the class to interactions among students through the use of guided-reverse jigsaw learning strategy.
- Government should organize workshops, trainings and conferences for physics teachers on how the to use the strategy in class in order to bring about a conceptual change in physics.

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