Effect of Jigsaw II Cooperative Learning Strategy (J2CLS) on Academic Achievement of Senior Secondary School Students in Physics within Bauchi Metropolis

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Abstract

This study examined the effect of Jigsaw II cooperative learning strategy (J2CLS) on the academic achievement of Senior Secondary School Students in Physics within Bauchi Metropolis of Bauchi State, Nigeria. The study is an attempt to solve persistent low academic achievement in Physics concepts at the senior secondary school level. The study was guided by one research question and one hypothesis. The quasi-experimental research design involving two groups (one experimental and the other control) was adopted. The population of the study comprised of senior secondary school year two (SS 2) students of the public secondary schools in Bauchi educational zone of Bauchi state. Two coeducation schools out of the fifteen (15) coeducation schools within Bauchi metropolis were put into experimental and control groups by simple random sampling technique. The sample of students for the study comprised of 78 students. (One school 40 and the other 38) from two intact classes. The instrument used for data collection was a Physics Achievement Test on Work, Energy and Power (PATWEP) was used for data collection. Mean and Standard deviation was used in answering the research questions while the research hypotheses were analyzed using the t-test at $\propto$=0.05 level of significance. The results obtained showed a significant difference in mean academic achievement in favor of students exposed to the J2CLS. The results also revealed no significant difference in the mean academic achievement score of male and female students when exposed to J2CLS, hence, J2CLS is not gender sensitive. The study concludes that J2CLS is effective in teaching and learning of physics concepts work, energy and power and it is a gender friendly teaching method. Based on the findings, the researchers recommend that stake holders in Education should organize workshops and symposia where the use of J2CLS will be introduced and taught to physics teachers to increase their Pedagogical Content Knowledge in handling difficult concepts in physics.

Key words: Jigsaw II Cooperative Learning Strategy, Students' Achievement.

Introduction

Physics is one of the basic science subject taught at the senior secondary school level of education in Nigeria and its importance in science and technology cannot be overemphasized. Physics is applied to almost every human activity, because every science profession involves some elements of physics and this is evident in the National policy of Education (FRN, 2006). Therefore, physics is seen in every aspect of human endeavor and it is a determinant to the attainment of the goals and objectives of science and technology. The importance of physics made its inclusion in the Nigerian senior secondary school curriculum imperative (Gambari & Mudasiru, 2017). But despite the importance of physics as outlined in the national policy of education (FRN, 2006), the performance of senior secondary school students in both internal and external certificate examination has been very low (Mankilik, 2005). The performance of students has not been appreciable and this has been attributed to a number of key factors which

includes, poor learning environment and method of instruction (Adegoke, 2010), abstract nature of physics concepts (Haratua and Judyanto, 2016), poor and not fully equipped laboratories (Shawl, 2003), negative attitudes of students towards physics and lack of qualified teachers (Biodun, 2004) etc. In order to address the problem of low academic achievement of students in both internal and external examinations, several teaching/learning strategies have been advocated for use by instructors that will involve active student's participation in the classroom thereby promoting science learning outcomes. One of such strategies include cooperative learning strategy (CLS).

Cooperative learning strategy (CLS) refers to institutional methods in which teachers organize students into small groups who then work to help one another lean academic content. Johnson, Johnson & Smith, (2014). It is a mode of learning in which students of different levels of ability work together in small groups to achieve a purpose. In a cooperative setting, students work together to attain group goals that cannot be obtained by working individually or by working competitively.

In the literature, so many cooperative learning strategies have been identified to have improved students' related factors to learning in sciences and at various level. The strategies include; Round robin brain storming, think-pair share, think-pair solo, learning together, teams' games tournament TGT, group investigation, jigsaw, numbered heads together, constructive controversy, complex instruction, team accelerated instruction students' teams' achievement division, cooperative learning structures and cooperative integrated reading and composition. For the purpose of this study, Jigsaw cooperative strategy will be used.

Jigsaw cooperative learning strategy developed by Elliot Aronson (1978) is method of composing group classroom activities that will make students to be dependent on each other in order to succeed. It' a cooperative method of instruction made up of two groups i.e. the Home group and the Expert group (Doymus et al., 2004). Students are first assigned to a home group and then given numbers after which student with the same numbers from their respective home groups will come together to form an expert group. The contents of a lesson or topics are assigned numbers in line with the number of students in the home group and these contents, subtopics or topic are distributed to the aligned number in the home group. Experts are expected to research comprehensively on the subtopic or content allocate to them, teach themselves so that each and every one understands the content after which they are to return to their home groups. In their home group each expert will be held accountable for teaching the particular content and this will be done in turns based on the arrangement of the contents of the lesson.
Research suggest that there are six (6) different Jigsaw strategies that can be used by teachers for classroom instruction. They include Jigsaw developed by Aronson (1978), Jigsaw II developed by Slavin (1987), Jigsaw III developed by Stahl (1994). Jigsaw IV was developed by Holliday (2000), reverse jigsaw was developed by Hedeen (2003) and subject jigsaw was developed by Doymuş (2007). Jigsaw and Jigsaw II differ from each other only in that Jigsaw II allows group competition The same is valid for Jigsaw III too. However, it is different from Jigsaw I and II since the process in it is evaluated by forms. Its difference from Jigsaw I, II, and III is that some quizzes are given to students in order to check the learning in expert and home groups and the parts of the units which are not taught are added to the process of instruction adifference.

Several studies have been conducted on the positive effect of using jigsaw II cooperative learning strategy in enhancing students related factors such as achievement/performance, attitude, retention, interest etc. In a study by Sahin (2010), the effect of jigsaw II technique on the academic achievement and attitude to written expression course of preservice teachers was investigated, it was found that jigsaw II had a positive effect on the academic achievement and attitude of preservice teachers. The effect of

jigsaw cooperative learning technique and how it affects students' achievement was also investigated by Timayi, Bolaji and Kajuru (2015). Findings indicated that students exposed to jigsaw cooperative technique performed significantly better in geometry than those exposed to traditional method of instruction. The work of Musa and Bala (2019), Gambari and Yusuf (2016), Evcim and Ipek (2012), Chan (2004), Fidelis (2017), Qiao and Jin (2010) provides additional evidence regarding the positive effect of exposing students to Jigsaw cooperative learning Strategy.

While so much empirical evidence points to the positive effect on the use of jigsaw cooperative learning strategy on student related factors, the studies were conducted mostly for students in other subjects like mathematics, Biology, Chemistry, Basic science etc. Not much have been done in trying to solve the problem of teaching and learning of some conceptually difficult topics in physics through the use of Jigsaw cooperative learning strategy. Its in-line with this that the present study sought to find out whether jigsaw II cooperative learning strategy can be used to enhance senior secondary school physics students' achievement in Bauchi metropolis.

Research Objective

The study had the following objective: To

i. Determine the effect of Jigsaw II cooperative learning strategy on the mean academic achievement of physics students taught the concept of Work, Energy and Power.

Research Hypothesis

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

1.There is no significant difference in the mean academic achievement scores of students taught the concept of Work, Energy and Power using J2CLS and those taught using lecture methods.

Methodology

The research employed a quasi-experimental design, specifically non-equivalent control group design. The population of the study comprised of all the 3600 SSI Physics students in all the 15 co-Educational public senior secondary schools offering Physics in Bauchi Metropolis (Bauchi State Ministry of Education, 2019). Multi stage sampling was used in the study. First, 15 co-educational schools were purposively selected out of the 43 schools in Bauchi metropolis. Simple random sampling technique was used to select 2 schools out of the 15 public schools in Bauchi metropolis. The assignment of schools to either experimental and control was also done using a tossed coin. A pre-test on physics achievement test on work, energy and power was administered to the two schools to determine the equality of the two groups. The Experimental group had 40 students while the Control group had a total of 38 students making the sample size to be seventy eighty (78). The experimental group was taught the concepts of work, energy and power for 4 weeks after which the post test was then administered to both groups.

Instrumentation

The instrument that was used for data collection is a Physics Achievement Test on Work, Energy and Power (PATWEP). PATWEP comprised of two sections, the first section sought to elicit students' demographic information while the second section has 25 objective type questions and the questions were divided across the topic under consideration. The questions were used to measure students' achievement of the concept of work, energy and power before and after teaching intervention. The

questions for the PATWEP were adapted from the past Senior Secondary School Certificate Examinations (SSCE). The questions are also aligned to Blooms taxonomy of classifying questions into lower and higher order cognitive objective.

Procedure and Data Analysis

The data collected from the study was quantitatively analyzed. Mean and Standard deviation was used to answer the research question while t-test was used to test the hypothesis at 0.05 level of significance.

Results and Discussion

The data presented in the tables 1 and 2 are used to answer research questions and were used to test the hypothesis at 0.05 level of significance.

Research Question: What is the effect of J2CLS on the mean academic achievement of Students taught the concept of Work, Energy and Power?

Table 1: Mean Achievement and Standard Deviation of Students taught with J2CLS and Conventional Method

	Groups	N	$\bar{X}$	SD	Mean difference
Pretest	Experimental	40	11.25	2.24	
	Control	38	11.19	2.35	0.06
Posttest	Experimental	40	26.80	4.39	
	Control	38	22.69	4.63	4.11

The data in table 1 shows the pretest and posttest mean scores of students taught Work, Energy and Power using J2CLS and those taught using conventional methods. For the pretest, the experimental group had a mean and standard deviation score of 11.25 and 2.24 while the control group had 11.19 and 2.35 establishing a mean difference score (between) of 0.06. For the pretest, the experimental group had a mean and standard deviation score of 26.80 and 4.39 while the control group had 22.69 and 4.63 establishing a mean difference score (between) of 4.11. The data shows that the mean difference score of students taught work, energy and power using J2CLS is higher than those taught using conventional method indicating that J2CLS was found to be effective in improving students' achievement in work, energy and powe

Hypothesis Testing

HO_1: There is no significant difference in the mean academic achievement scores of students taught the concept of work, energy and power using J2CLS and those taught using conventional methods.

Table 2: Summary of t-test Analysis of Students' Achievement Scores on work, energy and power.

	Groups	N		SD	T	P
Pretest	Experimental	40	11.25	2.24	1.35	0.430
	Control	38	11.19	2.35		
Posttest	Experimental	40	26.80	4.39	2.91	0.00
	Control	38	22.69	4.63		

The data in table 2 indicates that a t value (t = 1.35) related to the differences between pretest scores on PATWEP of the experimental and control group was found to be non-significant (P>0.05). This also indicates that there is no difference between the pretest scores of students in the experimental and control group.

Further analysis on table 2 indicates that a t value (t = 2.91) related to the difference between pretest scores on PATWEP of the experimental and control group was found to be significant (P<0.05) which indicates that a significant difference exists between the posttest scores on PATWEP between the experimental and control group in favour of students in the experimental group exposed to instruction using J2CLS. This finding also reveals that J2CLS was found to be effective in enhancing senior secondary school students' achievement on work, energy and power.

Discussion of Findings

The findings of the study as shown in table 1 and 2 indicates that a significant difference existed between students taught the concept of work, energy and power using J2CLS and students taught using conventional method which implies that students exposed to J2CLS performed better than students exposed to Conventional method. This shows that J2CLS is effective in enhancing students' achievement in physics. The finding is in agreement with the findings of Sahin (2010) who found out that there was an improvement in pre-service teachers' achievement and attitude in written expression. This result is also in agreement with the work of Suroto (2019) who investigated the effectiveness of Jigsaw II model and found out that it was more effective in improving students' understanding of course material of citizenship education in higher education.

Conclusion

Based on the findings and discussions, it can be concluded that J2LCS is an effective strategy for enhancing senior secondary school academic achievement in Physics.

Recommendations

Based on the findings of this study, the researchers recommended that, Physics teachers should be encouraged to use J2CLS as an effective instructional strategy for enhancing senior secondary school physics students' academic achievement

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