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EFFECT OF JIGSAW-III COOPERATIVE LEARNING STRATEGY ON PHYSICS STUDENTS ACADEMIC PERFORMANCE AND ANXIETY OF SECONDARY SCHOOLS STUDENTS IN KATSINA STATE.

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Abstract: This study examined the Effects of Jigsaw-III cooperative learning strategy on physics student's academic performance and anxiety of secondary school students in Katsina State. The study was guided by two research objectives, two research questions and two hypotheses. The quasi experimental research design involving two groups (one experimental and one control) were used. The population of the study comprised 5,389 Physics students from nineteen public senior Secondary School in Rimi Zonal Education Quality Assurance. The sample of students for the study comprised of 128 students from two intact classes selected from two public secondary schools. Two instruments: Physics Performance Test (PPT) and Physics Anxiety Questionnaire (PAQ) were used for data collection. The reliability coefficient of the PPT and PAQ were obtained using PPMC and Cronbach alpha which were 0.855 and 0.915 respectively. The research questions were answered using mean, mean rank and standard deviation, while the null hypotheses were tested at $P \leq 0.05$ level of significance using independent samples t-test and Mann Whitney U-test sample by the aid of SPSS version 23. The results obtained shows that there is a significant difference in the mean academic performance and anxiety level between experimental and control group. The study concluded that Jigsaw III is effective teaching methods that can be explored as alternatives to the lecture method in teaching Physics among SSS Students. Moreover, Jigsaw-III is a gender friendly teaching strategy. Based on the findings, it is recommended that Teachers should employ the use of Jigsaw III as alternative to lecture method in the teaching physics at SSS level to enhance students‟ performance and reduces anxiety level.

Keys: Jigsaw-III Cooperative Learning Strategy, Academic Performance, and Anxiety.

Introduction

Science and technology are considered by many scientists, scholars and educators as inevitable requirement for National development (Usman, 2012). As observed by (Kabir, 2019) that we are living in a world where science and technology have become an integral part of the world

culture and country that overlooks this significant truism, does so it its own perish. Pliphs (2012) see science as the foundation upon which the bulk of present day technological breakthrough is built. These days' nation all over the world including Nigeria are striving hard to develop scientifically and technologically, since the world is becoming scientific and all proper functioning of lives depend greatly on science, therefore its relevance as a requirement for technological development of a nation cannot be underrated.

Science has also made it possible for man to acquire his desired benefits easily, it has rendered human needs to be barest minimum (Ogunlaye, 2020) physics is one of the core science subjects taught at senior secondary school in Nigeria as stipulated in the Nation Policy on Education; a vital document of Federal Republic of Nigeria (N.P.E. 2014)

Physics is seen as one of the core science subjects in Nigeria at secondary school level. Because of its importance, more students enrolled for physics in the senior secondary schools' certificate examination (SSCE). Physics is introduced to students at senior secondary school level as a preparatory grand for human development where carrier abilities are groomed as well as potentials and talents discovered and energized (Federal Republic of Nigeria, 2019). Physics as a subject discipline is guide popular at all levels of Nigeria education even though it is not the subject with large student enrolment among the science subjects especially at the upper basic levels of the Nigeria education (Ofoegbu, 2013)

However; physics education has been undergoing crisis. This is because the enrolment in physics courses at all levels is low in many African countries. Reasons for this range from: inadequate lower level preparation, weak Physics background, lack of job opportunities outside the teaching profession, inadequate teacher qualification as well as possession of below standard pedagogical content knowledge (Semela, 2020) many students consider physics as lit abstract and theoretical (House of Lords, 2016). The subject is considering devoid of application in the day life where many students find the subject boring unenjoyable (Hirschfeld, 2012)

Despite the important role Physics plays in society, there has been persistent poor performance in the subject globally. The United States of America (U.S.A), for example which is viewed as a global leader in many aspects, including finance, medical research, higher education, sports and scientific fields has lagged behind other countries of the world in learners' Physics achievement as indicated by Trends in International Physics and Science Study (TIPSS, 2018). In Nigeria, the performance in Physics has continued to be very poor at the senior school certificate examinations (SSCE) (WAEC, 2018).

In this recent time, students' performance in Physics in secondary schools has become worrisome as expressed by WAEC Chief Examiner (2019) for which he stated that among the weakness exhibited in WAEC Physics examination, include inability of the students apply mathematical principles correctly, or identify principle/concepts for solving problems among other weaknesses. WAEC chief examiner therefore recommended that, teachers should rise up to their responsibilities and make learning interactive.

There are various teaching strategies that could make learning interactive and foster students) positive interdependence. Cooperative learning strategy is an interactive learning strategy in which learners are grouped in a heterogeneous mixture and are to collectively learn together. It is one of the most common and successful areas of theory, research, and practice in education (Johnson, Johnson & Stanne, 2015). The method fosters students' active participation, self-learning responsibility and collective achievement. Jigsaw-III cooperative learning strategy are supported by social constructivist theories and positive interdependence theory. These theories proposed that learning is a joint intellectual effort which occurs at social level; and later, on the individual level. As such, students could learn effectively when they are grouped heterogeneously and encouraged to learn together as a team. However, various models used for implementing cooperative learning. For instance, Learning Together (LT) Student-Team Achievement-Divisions (STAD), Teams-Games-Tournaments (TGT), Group Investigation (GI), Jigsaw, Teams-Assisted-Individualization (TAI), Critical Debate (CD) and Cooperative

Integrated Reading and Composition (CIRC) are all cooperative learning models which foster interaction among learners.

Therefore, Jigsaw is one of the cooperative learning models which is very applicable in teaching science and Physics. Jigsaw is a strategy that involves students working in groups to become experts on specific topics. Jigsaws cooperative learning strategies have been found to improve students' performance enhance social learning as well as increase capacity for self-actualization by students (Turacoglu, 2016). In Jigsaw-III method of cooperative learning, students are heterogeneously divided into groups consisting of 5- or 6 student's jigsaw groups. A student in each group is appointed as the leader while the lesson is also divided into 5-6 segments. One of the advantages which Jigsaw-III has over other jigsaw models is that enables students to become expert and teach other members the topics assigned to them (Sahin, 2017). Based on this reason, Jigsaw III was used as a cooperative learning model in this study.

The search for effective learning strategy to help improve students' academic performance in Physics an as well restore students' confidence, lower anxiety levels during examination has been a matter of serious research. It has been asserted that, cooperative learning by Jigsaw-III strategy might be a good alternative to the traditional teaching methods in classrooms. A cross utilization of varieties of students' abilities in heterogeneous group may help the so-called weak students achieve better. Based on this background, this study investigates the effect of Jigsaw-III cooperative learning strategies on academic performance and anxiety among Physics students of Senior Secondary Schools in Katsina state.

Statement of the Problem

The issue of anxiety and poor performance among Physics students in secondary schools has continued to affect Physics Education despite the usefulness attached to it in the society. Learners' achievement in the subject at the end of Secondary School National Examinations has remained low. Scholars such as (Iji, Atobijba, Vershima, Okwu, 2014 & Charles-Ogan, 2014) asserted that secondary school Students performance is less than Fifty percent in Physics external examinations for the past decade with is below average. Also, the Chief Examiners

Reports for WAEC and NECO (2019) expressed worries over the low performance of students in Physics which they attributed to weakness and difficulty in understanding mathematical concepts, lack of confidence, poor teaching methods, poor retention and anxiety in Physics.

The persistent poor performance in Physics is also recorded in Katsina state where the study will be carried out. The underachievement and gender differences in learners' Physics performance is attributed to ineffective teaching methods employed in Physics classrooms, among other factors. It is based on these problem that the researcher is motivated to investigate the effect of Jigsaw-III cooperative learning strategy on academic performance and anxiety of secondary school students in Physics in Rimi Zonal Education Quality Assurance, Katsina State Nigeria, to see whether it will improve the performance or otherwise.

Objectives of the Study

The main objective of the study is to find out the effect of Jigsaw-III cooperative learning strategies on secondary school students' performance and anxiety levels in Physics as subject. Specifically, the study seeks to:

i. Determine the effect of Jigsaw-III cooperative learning strategy on academic performances in Physics among senior secondary school students in Rimi Zonal Education Quality Assurance;

ii. Determine the effect of Jigsaw-III cooperative learning strategy on students' anxiety in Physics among senior secondary school students in Rimi Zonal Education Quality Assurance;

Research Questions

The following research questions are formulated to guide the study:

i. What is the difference between the mean academic performance scores of students taught Physics using Jigsaw-III strategy and those taught Physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance?

ii. What is the difference between the mean anxiety scores of students taught physics using Jigsaw-III strategy and those taught Physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance?

Research Hypotheses

The following null hypotheses will be tested at 0.05 level of significance:

H_{03}: There is no significant difference between the mean academic performance scores of students taught Physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance.

H_{04}: There is no significant difference between the mean anxiety scores of students taught physics using Jigsaw-III strategy and those taught Physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance

Methodology

The research design for the study is quasi-experimental research design, which comprises of an experimental and control groups. Both experimental and control groups were pre-tested (O_1) using Physics Performance Test (PPT) and Physics Anxiety Questionnaire (PAQ) to determine the students' academic performance and students' anxiety in Physics as a subject. The essence is to ensure uniformity and equivalence in performance and anxiety level of the students before experiment start. The treatment is administered to students in the experimental group only; while students in the control group are taught with Lecture method (X_1). A Post-test (O_2) is administered after treatment to both groups of students to determine their Physics performance and anxiety level.

Fig. 1: Research Design is illustrated in Figure 3.1:

EG	**→**	**O_1**	**→**	**X_1**	**→**	**O_2**
CG	**→**	**O_1**	**→**	**X_0**	**→**	**O_2**

Where

EG	Experimental Group	X_2	Treatment (Jigsaw-III Cooperative Learning Strategy)
CG	Control Group	X_0	No treatment (Lecture method)
O_1	Pre-test		
O_2	Posttest		

A total of 128 SS Il Physics students were used for the study from the population of 5,389 Physics students in all 19 public Senior Secondary Schools in Rimi Zonal Education Quality Assurance using intact class. Two instruments: Physics Performance Test (PPT) and Physics Anxiety Questionnaire (PAQ) were used for data collection. The reliability coefficient of the PPT and PAQ were obtained using Pearson Product Moment Correlation (PPMC) and Cronbach alpha which were 0.855 and 0.915 respectively. The research questions were answered using mean and standard deviation, while the null hypotheses were tested at $P \leq 0.05$ level of significance using t-test independent sample by the aid of SPSS version 23.

Results and Discussion.

In order to be able to answer the research questions, the researcher made use of descriptive statistics (mean, mean rank, and standard deviation).

Research Question One: What is the difference between the mean academic performance scores of students taught Physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance?

Table 1: Differences in the Mean performance score of Experimental group and Control group

Groups	N	Mean	Std. Dev.	Mean difference
Experimental Group	55	45.71	5.31	13.02
Control	73	32.68	4.88	

Table 1, shows the difference between the mean academic performance scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method is 13.02 with the Experimental group recording a mean of 45.71 and standard deviation of 5.31 and the Control group recording a mean of 32.68 and standard deviation of 4.88. This indicates that the difference is in favour of Experimental group.

Research Question Two: What is the difference between the mean anxiety scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance?

Table 2: Differences in the Mean Rank of students' Anxiety in Experimental Group and Control Group

Groups	N	Mean Rank	Sum of Ranks	Mean Rank difference
Experimental Group	55	100.06	5503.50	
Control Group	73	37.71	2752.50	62.39

Table 2, indicated that the difference in the mean rank of anxiety scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method is 62.39 with the Experimental Group recording a mean rank of 100.06 and sum of ranks of 5503.50 and the control Group recording a mean rank of 37.71 and sum of ranks of 2752.50. This indicates that the difference is in favour of Experimental Group.

Hypotheses Testing

In order to be able to test the stated hypotheses, the researcher used inferential statistics Independent samples t-test and Mann Whitney U-test statistics to be specific. The use of this statistics was based on the nature of the data collected. Moreover, and all the hypotheses were tested at 5% level of significance.

H_{01}: There is no significant difference between the mean academic performance scores of students taught physics using Jigsaw-III strategy and those taught Physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance.

Table 3: t-test Analysis of students' Academic Performance between Experimental Group and Control group

Groups	N	Mean	Std. Dev.	df	t value	P value	Remark
Experimental Group	55	45.71	5.31	126	14.39	0.00	Significant
Control Group	73	32.68	4.88				

Significant at $P \leq 0.05$

Table 3, shows that the t-value obtained for the difference between the mean academic performance scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality

Assurance is 14.39, the P value is 0.00 at degree of freedom 126. Since the p-value of 0.00 is less than the alpha value 0.05, the null hypothesis which states that there is no significant difference between the mean academic performance scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance is hereby rejected. Consequently, there is significant difference between the mean academic performance scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance.

H_{02}: There is no significant difference between the mean anxiety scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance.

Table 4: U-test Analysis of Anxiety Score between Experimental Group and Control Group

Groups	N	Mean Rank	Sum of Ranks	Z	U value	P value	Remark
Experimental Group	55	100.06	5503.50	-9.44	51.50	0.00	Significant
Control Group	73	37.71	2752.50				

Table 4, shows that the U-value obtained for the difference between the mean anxiety scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance is 51.50, the P value is 0.00 and the Z value is -9.44. Since the P-value of 0.00 is less than the alpha value 0.05, the null hypothesis which states that there is no significant difference between the mean anxiety scores of students taught Physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance is hereby rejected. Consequently, there is significant difference between the mean anxiety

scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method in senior secondary schools of Rimi Zonal Education Quality Assurance.

Discussion

Finding to Research Hypothesis one shows that there is significant difference between the mean academic performance scores of students taught physics using Jigsaw-III strategy and those taught physics using lecture method. In line with this finding Fini, Zainlipour and Jamri (2012) reported that Jigsaw-Il Cooperative Learning Strategy has significant effect on students' academic performance evidenced by the higher mean scores of students as compared to the other students taught same concepts by the traditional method. This shows Jigsaws cooperative learning strategies have been found to improve students' performance enhance social learning as well as increase capacity for self- actualization by students as noted by Turacoglu (2016).

In addition, the finding to Research Hypothesis two indicated that there is significant difference between the mean anxiety scores of students taught physics using Jigsaw-III strategy and those taught Physics using lecture method. This shows that Jigsaw-III improves students' psychological readiness by lowering their fear, nervousness and/or anxiousness at the time of test or exams. The level of students' anxiety often determines the level of performance. High level of anxiety negatively correlates with academic performance as Siti & Rohani, (2017) rightly puts it.

Conclusion

The study was on effects of Jigsaw-III methods on academic performance and anxiety in Physics among senior secondary school students in Rimi Zonal education quality Assurance. From the findings of the study, the following conclusions were arrived at Jigsaw-III is more effective at improving students' performance in Physics compared to the lecture method. This is evident in the higher mean performance scores obtained by students who were taught using the methods. The Jigsaw-III was observed to reduces students' anxiety level in Physics better

than the lecture method. Hence; Jigsaw-III can be used as alternative teaching methods for Physics pedagogy at the senior secondary school level as shown by the findings of the study.

Recommendations

Based on the findings in chapter four and the conclusions of the study, the following recommendations are made:

i. Teachers should employ the use Jigsaw-III as alternative to lecture method in teaching physics at senior secondary school level to enhance students' performance and reduces the anxiety level.

ii. Students should be encouraged by their teachers to participate in the Jigsaw-III because they are result oriented strategy that have the potential of improving their performance and reduces the anxiety level in Physics.

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