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Effect of Jig - Saw Instructional Strategy on Chemistry Achievement among Secondary School Students in Ilorin West Local Government Area, Kwara State

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Abstract
This study investigated on effect of jig - saw instructional strategy on chemistry achievement among secondary school students in Ilorin west local government area, kwara state. The study employed quasi experimental research design using pretest posttest non randomized non control group design. Population consists of all senior secondary school (class II) chemistry students in Ilorin west government secondary schools, sample size of study consists of 167 students using an intact class randomly selected among government secondary schools in Ilorin west local government. The instruments used for data collection was Chemistry Students Achievement Test (CSAT). The CSAT was validated by experts from University of Ilorin, Ilorin kwara State. Thus, the CSAT gave a reliability Coefficient of 0.933 using Guttmann Split half reliability test. Mean and standard deviation was used to answer research questions raised and Analysis of Covariance (ANCOVA) to test the null hypotheses at 0.05 levels of significance. Findings from this study revealed that there was a significant difference between achievement of students exposed to jigsaw instructional strategy and those expose to conventional method. Based on research findings for this study, it was recommended that students should be exposed to jig-saw instructional strategy frequently by teachers during Chemistry instructions so as to aid better achievement in Chemistry among secondary school students.

Keywords: Jig-saw strategy, chemical reaction and achievement.

Introduction
Science education is a field of study which involves producing a scientifically enlightened individual in the area of science and technology development. The importance of science education in any society cannot be overemphasized that is why any society that aspires to be great must pay adequate attention to the quality of science education. Science education is taught in most senior secondary schools in Nigeria as Biology, Physics and Chemistry respectively.

Chemistry is one of the core science subjects' students are expected to pass before being admitted into higher institutions of learning in Nigeria to pursue science - based programs such as Medicine, Pharmacy, Engineering, Agriculture and Biochemistry (Bolaji, 2017). Despite the importance of Chemistry, West Africa Examination Council (WAEC) annual reports has shown that there is a decline in chemistry achievement over the years, which revealed failure rate increases from 27.28% to 77.99% while the pass rate decreases from 50.95% to 10.00% respectively.

Research findings shows that students perform poorly on the concept Electrolysis (Adeoye, 2016 and Ifeanyi, 2017). Some research findings attributed students' poor achievement in Chemistry to lack of adequate mastery of chemistry content knowledge by teachers in some selected areas in Chemistry (Agu, & Odu,

2016). This implies that some chemistry teachers are not well - versed and competent enough in teaching some aspects of Chemistry. Moreover, Okeke (2015) and (Odogu & Oduguisi, 2017) attributed the cause of students' poor achievement in chemistry to adequate use of teaching strategy. This implies that students' interest in the learning of chemistry may negatively influence the quality of learning outcome thereby lowering achievement.

Despite the importance of Chemistry, the WAEC chief examiners annual reports revealed a continued decline in Chemistry achievement as shown in Table 1 which revealed that from 2012 - 2018 failure rate increases from 27.28% to77.99% while the pass rate decreases from 50.95% to 10.00% respectively.

Table1:May /June, 2012 – 2018, West Africa Examination Council (WAEC) Results.

Year	Total Sat	Total Credit A1 – C6	Total Pass D7 – E8	Total Fail F9
2012	349,936	178,274 (50.95%)	66,423 (18.71%)	47,913 (27.28%)
2013	380,140	170,670 (44.50%)	86,423 (22.73%)	11,448 (30.11%)
2014	391,160	165,265 (42.25%)	74,751 (19.11%)	151,144 (38.64%)
2015	401,723	178,164 (34.35%)	93,642 (23.31%)	129,917 (42.34%)
2016	403,528	158,465 (34.27%)	94,990 (23.54%)	150,072 (47.19%)
2017	411,356	150,145 (25.20%)	91,444 (15.80%)	169,766 (60.90%)
2018	464,853	46,488 (10.00%)	55,780 (11.99%)	362,585 (77.99%)

Source: WAEC Headquarter Yaba, Lagos state (September,2018)

Also chemistry students do not perform well in the concept of Chemical reactions (Bolaji, 2017). Research findings attributed students' poor achievement in chemical reaction to the use of poor and inadequate instructional strategies (Odogwu & Oduguisi, 2017), lack of adequate mastery of the concept chemical reactions by teachers (Agu, & Odu, 2016), and (Okeke, 2015) and variations gender among students in chemistry achievement (Agu & Odu, 2016). However, traditional methods of instruction have been the most commonly used instructional strategies in most Nigerian secondary schools and have been found to be inadequate for chemistry instruction. Therefore, the need to seek for alternative teaching strategies becomes necessary.

The traditional methods of instruction have been the most commonly used instructional strategies in most Nigerian secondary schools and have been found to be inadequate for chemistry instruction (Okeke, 2015). Nevertheless, innovative teaching strategies such as collaborative or specifically jig-saw instructional strategy are being employed to mitigate the inadequacies of these traditional methods. Team teaching is an instructional strategy involving groups of teachers working together in a well structured platform for effective classroom delivery (Adai & Bayo, 2017). Jig - Saw instructional strategy is a collaborative instructional strategy which student centered involving students working together as a team by sharing ideas during problem solving with, little guide from the teacher (Okeke, 2015).

Thus, this research intends to investigate the effects of Jig-Saw instructional strategy on chemistry achievement among senior secondary school students in Ilorin west local government area, Kwara state.

Objectives of the Study

The objective of this study was to determine the effects of Jig - Saw instructional strategies on achievement in concept Chemical reactions among senior secondary school students in Ilorin west local government.

Research Question

What is the effect of Jig-Saw instructional strategy on achievement in concept Chemical reactions among senior secondary school students in Ilorin west local government?

Research Hypothesis

There is no significant difference between achievement of students exposed to concept chemical reactions using Jig-Saw instructional strategy and those exposed to conventional method in Ilorin west local government

Methodology

Quasi experimental research design, specifically, Pretest Posttest non randomized non equivalent control group design. The population of the study consists of all Senior Secondary School (Class II) chemistry students in Ilorin west government secondary schools in kwara state during the 2020/2021 academic session. Sample size of 167 class II Chemistry students using an intact class among government secondary schools randomly selected Ilorin west local government area of kwara state were used for the study.

Chemistry Students Achievement Test (CSAT), the CSAT was developed using blooms taxonomy of learning which covers the entire 4 sub - topics on the concept chemical kinetics as shown in table 3.

Table 2: Table of Specifications for Chemistry Students Achievement Test

Content Area	Remember	Understand	Apply	Analyze	Evaluate	Create	Total
Types of Reaction	13	11,12	16	20	-	-	5
Chemical Kinetics	1,14,25	23	9	-	2	-	6
Rate of Reaction	3,5,7	17	19,24	21	6	-	8
Calculations/theories	15	4	8	18	-	10,22	6
Total items	**8**	**5**	**5**	**3**	**2**	**2**	**25**

Source: Anderson and Krathworl in Bidemi, (2017).

The CSAT and marking schemes were validated by three experts from University of Ilorin, Ilorin Kwara State. The CSAT was pilot tested using an intact class of 63 class two 2020/21 Chemistry students from Omu Aran High School, Omu Aran, Kwara State. The same instrument was applied to the same group of students after an interval of two weeks (test-retest method). The reliability coefficient of 0.933 was gotten for CSAT using Guttman's Split half Correlation Coefficient reliability test. The CSAT was administered to the students in a normal class room setting for pretest scores. Experimental groups were taught the concept chemical reaction using jig-saw instructional strategy while control group were taught using convention method, respectively. A reshuffled version of the CSAT was then administered to the students to measure achievement. Mean and standard deviation was used to answer research questions raised, analysis of variance (ANOVA) to analyze if pretest result was significant or not. Thus, Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 levels of significance. The statistical package for social sciences (version 23.0) was used to analyze data. Thus, the research lasted for six (6) weeks.

Results

To determine the choice of statistical method of analysis, the pretest result was further analyzed and result presented in table 3.

Table: 3: Summary of ANOVA Pretest Results on Achievement Scores in Chemistry.

	Sum of Square	df	Mean square	F	Significance
Between Groups	2887.463	11	262.497	0.932	0.031
Within Groups	43936.822	156	281.646		
Total	46824.286	167			

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Pretest results presented in table 4 revealed that P value gives 0.031 at 0.05 levels of significance (0.031 < 0.05). Therefore, there was significant difference between experimental and control groups on pretest scores. This implies that both groups were found to be different before treatment commenced. Hence, the use of Analysis of Covariance (ANCOVA) to test the null hypotheses using pretest results as covariate justifies the choice of statistical analysis for this study.

Research Question 1

What is the effects of Jig-Saw instructional strategies on achievement in concept Chemical reactions among senior secondary school students in Ilorin west local government?

Table 4: Mean and Standard Deviation of Students achievement in Chemistry

Group	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Jig-Saw	94	27.45	3.12	42.04	4.61	14.59
Control	63	24.12	4.92	26.38	6.35	2.26

Table 5, revealed a pretest result for jig-saw group having a mean achievement score of 27.45 with standard deviation of 3.12, while posttest result shows a mean score of 42.04 with standard deviation score of 4.61. Hence, had a mean gain score of 14.59. Similarly, the control group pretest results revealed mean achievement score of 24.12 with standard deviation of 4.92, while posttest result gave mean achievement score of 26.38 with standard deviation of 6.35. Hence, mean gain of 2.263. These, results revealed that jig-saw instructional strategy had higher mean achievement score than control group, Thus, to find out how significant the difference was, analysis of covariance ANCOVA was used to test the null hypothesis from research question 1 raised as shown in table 5.

Hypothesis One (Ho_1)

There is no significant difference between achievement of students taught concept chemical reaction using Jig-Saw instructional strategy and those exposed to conventional teaching method in Ilorin west local government area.

Table 5: Summary of ANCOVA Test Results of Groups with Achievement

Source	Sum of Square	df	Mean Square	F_{cal}	P_{value}
Corrected Model	9958.241[a]	2	3319.414	14.685	0.000
Intercept	28667.327	1	28667.327	126.821	0.000
Pretest	536.457	1	536.457	2.373	0.125
Group	8248.057	1	4121.028	18.244	0.000
Error	46565.573	168	226.046		
Total	373365.000	167			
Corrected total	56523.814	166			

Significant at P > 0.000

Table 5 revealed that $F_{(2, 206)}$ = 18. 244 and P = 0.000 at 0.05 level of significance. This shows that p value is less than 0.05 (0.00 < 0.05) which is significant. Therefore, the null hypothesis one was rejected. There is significant difference between achievement of students taught concept chemical reaction using jig-saw instructional strategy and those exposed to conventional teaching method.

Discussion of finding

The findings for this study revealed that there is significant difference between achievement of students taught the concept chemical reaction using Jig-saw instructional strategy and those expose to conventional method. the finding is in agreement with the

findings of Okeke (2015) and Odogu & Oduguisi (2017) which revealed significant difference between jig-saw instructional strategy and achievement in Chemistry among secondary school students.

Conclusion

Jig - saw instructional strategy improves senior secondary school students' achievement in chemistry.

Recommendations

Based on research findings for this study, it was recommended that Jig-saw instructional strategy should be adequately used frequently by teachers during Chemistry instructions to aid better achievement in Chemistry among secondary school students.

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