UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.7;
https://unijerps.org
2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355. January-June, 2021
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363

ACADEMIC JOURNALS
expand your knowledge
http://www.academicjournals.org

EFFECT OF JIGSAW TEACHING STRATEGY ON ACADEMIC ACHIEVEMENT AND RETENTION OF ANAMBRA STATE SECONDARY SCHOOL STUDENTS IN CHEMISTRY

1. Nwankwo, MaryJane Uche
2. Okigbo, Ebele Chinelo
1,2 Department of Science Education,
Nnamdi Azikiwe University Awka Anambra State, Nigeria
1. Email:mu.nwankwo@unizik.edu.ng (+234 7069553344)
2. Email: ec.okigbo@unizik.edu.ng (+234 8037715662)

Abstract
The study assessed the effect of jigsaw teaching strategy (JTS) on academic achievement and retention of senior secondary two (ss2) students in chemistry. Two research questions and two hypotheses and pretestposttestnon equivalent control group design was adopted to guide the study. The population of the study is made up of 1,129 SS 2 chemistry students from the 49 secondary schools in Aguata Education Zone of Anambra State. Using multi stage sampling, sample size of 71 was selected for the study. Descriptive statistics of mean was used to answer the research questions while standard deviation was adopted to ascertain the homogeneity or otherwise of the respondents' achievement scores. Inferential statistics of Analysis of Covariance (ANCOVA) was used to test the formulated hypotheses at 0.05 alpha level. Findings of the study revealed that JTS strategy significantly enhanced achievement and retention scores of SS2 students in chemistry more than the conventional teaching method. Based on this finding, the study recommended amongst others that the Anambra state ministry of education should organize seminars, workshops and conferences for teachers, most especially, chemistry teachers on how to use JTS in teaching chemistry.

Keywords: Chemistry; Academic Achievement, Retention, Jigsaw teaching strategy

INTRODUCTION

Chemistry is a subject of universal interest in human development with

regards to the utility of its knowledge in real-life situations to be faced by many students someday (Jegede,2012).The objectives of chemistry education at the senior secondary school level include: to show chemistry and its link with industry, everyday life benefits and hazards, and to provide a course which is complete for individuals not proceeding to higher education (Federal Ministry of Education, 2012).Therefore, Chemistry Education is a imedat developing both the individual and the entire society.

The importance of chemistry to national development cannot be over emphasized. Despite this importance, Nigerian Senior School Certificate Examination (SSCE) has continued to record poor performance in chemistry over the years. For instance, the WAEC Chief Examiners' report revealed that the performance of candidates in Chemistry paper 2 as at 2018 with mean score of 29 and standard deviation of 13.78 was worse than candidates' performance in 2017 with mean score of 47 and standard deviation of 13.78. Similarly, they further reported that the performance of candidates in Chemistry paper 3 as at 2018 with mean score of 24 and standard deviation of 9.95 was worse than candidates' performance in 2017 with mean scores of 26 and standard deviation of 8. These result analyses denote a decrease in the performance of students in Chemistry for those years. These analyses agreed with the research of Kozma and Russelin Pekdag (2010) and Ikwuka and Samuel (2017) that chemistry is seen as an abstract subject that is difficult to understand.This is because the basic concepts in chemistry have to be mentally visualized by the students to understand the chemical phenomena.

The quality of instruction received by the students depends on the knowledge of the teacher. There is a strong positive relationship between teachers' level of knowledge of subjects and levels of subject knowledge achieved by their students (Sophia, 2016). Therefore, for any subject to be effectively taught, there should be trained and qualified teachers employing appropriate instructional strategy. This implies that for the effective study of chemistry, teachers have to select appropriate instructional methods that will appeal to both the students, arouse their interest and enable them achieve excellent performance. Sophia (2016) stated that reliance on the conventional teaching method has been criticized as molding students into passive recipient to information transmitted by the teacher and making them highly dependent on the teachers for much of their learning

needs. Personal observation by the researcher shows that the predominant method of teaching chemistry in secondary schools in Aguata Education zone is the conventional method. Chemistry, being a practically inclined subject, is hierarchically organized and failure to comprehend prerequisite is likely to interfere with students' further learning. This deficiency, calls for a corresponding change in chemistry less on delivery method that could engender more funand interactive class sessions like jigsaw teaching strategy.

The Jigsaw teaching strategy (JTS) is a method of organizing classroom activity that makes students depend on each other to succeed. It breaks a class into groups and breaks assignments into pieces that the group assembles to complete the puzzle. Jigsaw, one of the cooperative learning techniques, is based on group dynamics and social interactions. It is one of the pure cooperative learning techniques (Sahin, 2010). This technique includes two different treatments with different small groups in order to help learning and improve cooperation among students.

Several empirical studies have demonstrated the effectiveness of jigsaw teaching strategy in many subjects like mathematics and economics when compared to the conventional teaching strategy (Garonia, 2009; Lawan, 2016). However, no study has relatively assessed the effect of JTS on student's achievement and retention in chemistry, hence, the need for this study.

Statement of the problem

The consistent decline in the achievement and retention of chemistry students in most secondary schools in Nigeria is the major problem that prompted this investigation. Chemistry is one of the key subjects required to meet up with increase in demand for science and technology. Therefore, if Nigeria is to attain science and technological development, the problem of consistent decline in chemistry must be addressed.

For any meaningful learning to occur, there should be trained and qualified teachers employing appropriate instructional method. This implies that for effective study of chemistry, teachers have to select appropriate instructional methods that will appeal to the students, arouse their interest and enable them achieve excellent performance.

Available research findings showed that chemistry teachers in Nigerian secondary schools adopt conventional teaching method in teaching chemistry concepts. This conventional teaching

method lack students' cooperation and interaction required for effective learning and transfer of learning in chemistry concepts, which are mainly abstract and difficult. Such cooperation and interaction are found in jigsaw teaching strategy. Therefore, the problem of this study is what are the effects of jigsaw teaching strategy on academic achievement and retention of secondary school students in chemistry in Aguata education zone? Thus, this forms the gap the study intends to fill.

Research Questions

The following research questions guided this study:

1. What is the difference between the mean achievement scores of SS 2 students taught chemistry using Jigsaw teaching strategy (JTS) and those taught using Conventional Teaching Method (CTM)?
2. What is the difference between the mean retention scores of SS 2 students taught chemistry using JTS and those taught using CTM?

Hypotheses

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

1. There is no significant difference between the mean achievement scores of SS 2 students taught chemistry using jigsaw teaching strategy (JTS) and those taught using the Conventional Teaching Method (CTM).
2. There is no significant difference between the mean retention scores of SS 2 students taught chemistry using JTS and those taught using the CTM.

Method

Quasi-experimental design was adopted for the study. Specifically, the pre-test post test non-equivalent control group design was used. This research design is considered suitable because it allows the researcher to observe the achievement and retention of students before and after manipulations of the independent variable. Also, there was randomization of the research participants into experimental and control groups. The study was conducted in Aguata Education zone of Anambra state. The choice of this zone is because of students' poor academic performance in the internal and external examinations in chemistry. The population of this study comprises 1,129 SS2 chemistry students in the zone.

The sample size for this study is 71 SS 2 chemistry students. Multi-stage sampling procedure was used to compose the sample which involves purposive and simple random sampling technique (tossing of a coin). From the experimental school, the intact class of 39 (24 males and 15 females) was used and from the control school, an intact class of 32 (22 males and 10 females) was used.

The instrument used for data collection is Chemistry Achievement Test (CAT). This was composed by the researcher using WAEC past question papers for 4 years (2017, 2016, 2015 and 2014). The instrument is divided into two parts. Part A elicited the bio-data of the students while part B is made up of 40 multiple choice objective test items with four options, which covers one content area in SS II chemistry syllabus namely electrolysis. The researcher used the question during the pre-test and the same questions was reshuffled and used as post-test. This instrument was reshuffled again and used as retention test. The CAT was validated by three experts; two from the Department of ScienceEducation and one from measurement and Evaluation Unit of Educational foundations Department in Nnamdi Azikiwe University, Awka. To establish the validity of the CAT, the lesson plans, title, purpose, scope, research questions and hypotheses with the CAT were given to the three experts. The experts were asked to check whether the items were relevant, adequately covered the contents, had acceptable level of difficulty, whether the language was ambiguous and ideas were not repeated. The corrections, recommendations and suggestions of these experts were incorporated in the final production of CAT. The content validity of the CAT was ensured by the use of the test blueprint. The test blueprint was constructed by considering the period to be covered in the concept.

Reliability of CAT was established by administering it on intact class of 23 SSII chemistry students in Community secondary school, Amawbia outside the research area but has a homogenous culture as the research area. The scores obtained from trial testing exercise were used to estimate the reliability coefficient of CAT using Kudar Richardson Formula (KR-20) which yielded a reliability index of 0.82 (computed using SPSS). This value was considered acceptable by the researcher as this was in agreement with Ogundare (2008) that any value above 0.70 is an acceptable reliability value.

Before the experiment, pre-test was administered to all the SS II chemistry

students in both the experimental and control group. Also, post-test was administered to both control and experimental group. Answer sheets was distributed to the students along with the question papers (containing 40 items) for their responses. The test lasted for 1 hour (60 minutes) after which the answer sheets were retrieved for marking and scoring. Each item on the question carries one mark to make a total of 40 marks. After a minimum of 3 weeks for retention test, the researcher re-administers the post-test called delayed post-test in order to check the retention level of the students in both experimental and control groups. Data obtained were analyzed with the descriptive statistics of mean to answer the research questions while standard deviation was be used to ascertain the homogeneity or otherwise of the respondents' achievement scores. Inferential statistics of Analysis of Covariance (ANCOVA) was used to test the null hypothesis at 0.05 alpha level. The null hypothesis was rejected if probability value is less than or equal to the significant value of 0.05 ($P \leq 0.05$) and if otherwise ($P > 0.05$), it was accepted.

Table 1: Difference between the Mean achievement scores of SS 2 students taught chemistry using Jigsaw teaching strategy (JTS) and Conventional Teaching Method (CTM)

Group	N	Pre-test $\bar{X}$	Post-test $\bar{X}$	Mean gain
Experimental (jigsaw teaching strategy)	39	35.45	71.07	32.67
Control (conventional teaching method)	32	21.51	50.89	29.38
Mean difference 13.94	20.18		3.29	

Table 1 shows that the mean achievement scores of students taught with jigsaw teaching strategy is higher than those taught using the conventional teaching method because the gain in mean of 32.67 for the experimental group is greater than 29.38 gain in mean for the control group. The mean

difference is 3.29 in favour of experimental group.

Table 2: Difference between the mean retention scores of SS 2 students taught chemistry using JTS and those taught using CTM

Group	N	Post-test $\overline{X}$	Retention test $\overline{X}$	Mean loss
Experimental (jigsaw teaching strategy)	39	71.07	68.12	-2.95
Control (conventional teaching method)	32	50.89	47.64	-3.25
Mean difference		**20.18**	**20.48**	**0.30**

Table 2 indicates a mean loss of 2.95 for students taught using jigsaw teaching strategy and 3.25 for those taught using conventional teaching method. This proves that students in the experimental group retained slightly higher than those in the control group. These differences in mean was tested for significance.

Table 3: ANCOVA test of significant difference between the mean achievement scores of SS 2 students taught chemistry using JTS and CTM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1445.007[a]	2	722.504	100.473	.000
Intercept	4369.875	1	4369.875	607.685	.000
Achievement	.397	1	.397	.055	.815
Treatment	1308.402	1	1308.402	181.949	.000
Error	826.968	70	7.191		
Total	164629.000	71			
Corrected Total	2271.975	69			

a. R Squared = .636 (Adjusted R Squared = .630)

Table 4 reveal that the difference in the mean achievement scores of SS 2 students taught chemistry using JTS and those taught using the CTM is significant because the p-value of 0.000 is less than the alpha level of 0.05 at 70 degree of freedom. Therefore, the null hypothesis is rejected, thus, there is

UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.7;
https://unijerps.org
2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355. January-June, 2021
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363
ACADEMIC JOURNALS
expand your knowledge
http://www.academicjournals.org

significant difference between the mean achievement scores of SS 2 students taught chemistry using JTS and CTM. This was in favour of JTS group.

Table 4: ANCOVA test on significant difference between the mean retention scores of SS 2 students taught chemistry using JTS and CTM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1268.389[a]	2	634.194	40.306	.000
Intercept	1528.879	1	1528.879	97.167	.000
Retention	107.460	1	107.460	6.830	.011
Treatment	618.797	1	618.797	39.327	.000
Error	1038.481	69	15.735		
Total	45582.000	71			
Corrected Total	2306.870	70			

Table 4 shows that the p-value of 0.000 is less than that the alpha level of 0.05 with 70 degree of freedom (0.00 < 0.05, df 70). This means that the null hypothesis is rejected. Therefore, there is a significant difference in the mean retention scores of SS 2 taught chemistry using JTS and CTM in favour of JTS group.

Results and Discussion

The findings revealed that the mean achievement scores of students taught with jigsaw teaching strategy achieved higher than those taught using the conventional teaching method. This finding agreed with that of Maxwell (2009) that jigsaw instructional strategy significantly improved students' academic achievement in government. Similarly, the study was in line with the study of Danladi (2010) that jigsaw instructional strategy has significant effect on students' achievement in senior secondary school biology contents. This means that students achieved meaningfully in chemistry as a result of the Jigsaw teaching method and that the method was adequate for the instruction process.

The finding of this study agreed with the finding of Mari and Sani (2015) that the use of cooperative learning strategy has significant effect on the academic achievement of formal 'reasoners' more than that of the concrete 'reasoners'. Also, the finding of this study was in support with the finding of Adejoh (2015) that Jigsaw Instructional Technique has more effect onstudents' achievement and transferability in Economics than the

Group Investigation. The difference in mean was further tested for significance.

The result from hypothesis testing revealed that there is significant difference in the mean achievement scores of SS 2 students taught chemistry using jigsaw teaching strategy (JTS) and those taught using the Conventional Teaching Method (CTM).This was in favour of JTS group. This finding was in line with the finding of Danladi (2010) that there is a significant difference in the mean achievement scores of biology teachers taught using jigsaw instructional strategy and those taught using the conventional teaching method. This finding also supported the finding of Onuocha, Eneogu, Asogwa and Ngwuchukwu (2016) that the use of jigsaw instructional strategy and conventional teaching method for teaching social studies in junior secondary schools when compared to the conventional teaching method is significantly different. Invariably, these findingsshows the effectiveness of jigsaw teaching strategy as a method for enhancing academic achievement regardless of the subject matter and level of class.

The findings from results revealed that the mean retention scores of students taught with jigsaw teaching strategy is higher than those taught using the conventional teaching method. This finding supported the finding of Gubbad (2010) that co-operative learning on students' retention of 6th grade primary school pupils in mathematics concept is higher than those taught using conventional teaching method. The finding agreed with the finding of Isa (2014) that students taught by co-operative learning had a higher performance score and higher retention scores more than the control group taught by lecture method.

The findings from the study also revealed that there is a significant difference between the mean retention scores of SS 2 taught chemistry using jigsaw teaching strategy and those taught using conventional teaching method. This was in favour of JTS group. This finding supported the finding of Gubbad (2010) that there is a significant difference in the mean retention scores of 6th grade primary school pupils in mathematics concept using co-operative learning and those using conventional teaching method. Similarly, this finding agreed with the finding of Lawan (2016) that there was significant difference between the mean retention scores of students taught mensuration concepts using jigsaw II co-operative learning strategy and those taught using

conventional lecture method in favour of the Jigsaw II co-operative learning strategy group. However, it disagreed with the earlier findings of Abdulrahim and Al-shakili (2005) and Igbal (2004) that cooperative learning strategy and traditional lecture method produce similar effect in terms of retention of mathematical concepts. This difference in findings about retention could be attributed to the difference in location.

Conclusion

This study showed that jigsaw teaching strategy helped to improve students' academic achievement and retention in electrolysis than students taught using the conventional method. In fact, jigsaw teaching strategy has demonstrated its effectiveness in increasing meaningful learning in chemistry because it is an activity-oriented method which involved checking and assessing individual academic confidence level at every new stage or units in knowledge without leaving a stone unturned. It is therefore recommended that all levels of education should adopt jigsaw teaching strategy because it boosts the participation of students in chemistry thereby improving the academic achievement and retention of students in chemistry.

REFERENCES

Abdullahi, S. M., &Salisu, M. (2017).Effect of Jigsaw teaching method on the perfroamcne of senior secondary school students in Arabic language in Ilorin Metropolis, Nigeria.*Asia Pacific of Education, Arts and Sciences, 4*(1), 48 – 52.

AbdulRahim, A.Y & Al-shakili, B.N. (2005) The effectiveness of the strategy of collaborative learning in the Omani schools. *The educational magazine.* Kuwait 19 (75), 114-148

Adejoh, I. S. (2015).*Effects of group investigation and Jigsaw instructional techniques on secondary school students' achievement and transferability in Economics in Kogi State, Nigeria.*An Unpublished Masters' Thesis.Department of Social Sicence Education, University of Nigeria.

Adeyemi, S.A. (2003). *Study of the effects of aptitude instructional leadership styles and learning environment on students*

*achievement in physics.*UnpublishedPh.D dissertation. University of Lagos, Nigeria.

Bichi, S.S. (2000). *Effects of problems solving strategy and enriched curriculum on secondary school students achievement in evolution concepts.* Unpublished Ph.DThesis.ABU Zaria.

Bitrus, Z. (2014). Causes of poor achievement in WAEC mathematics examination in River State secondary schools Nigeria.*International Journal of Mathematics Education, 21*(3), 110-120.

Danladi, G. (2010). The effect of Jigsaw strategy on students' achievement in contents in senior secondary school biology.*International Journal EducationReview 14*(3), 361-384.

Federal Ministry of Education (2012).*Nigeria education sector diagnosis: A framework for re-engineering the education sector.* Retrieved fromhttp://planipolis.iiep.unesco.org/upload/Nigeria/Nigeria%20Education%20Sector%20Diagnosis.pdf

Garonia, P. (2009). *A study comparing cooperative learning methods: Jigsaw and group discussion.*An unpublished Thesis.University of Uyo.

Grasha, A. &Yangarber, H. (2010).Integrating teaching styles and learning styles with instructional technology.*College Teaching, 48*(1), 2-11.

Hedeen, T. (2013). The reverse jigsaw: A process of cooperative learning and discussion. *Teaching socialization, 31*(3), 325-332.

Iqbal, M. (2004). Effects of co-operative learning on academic achievement of secondary school students in mathematics. Unpublished Thesis, *University of Arid Agriculture / Institute of Education and Research* . Pakistan. Retrieved from www.eprint.hecing. 31/10/2

James, T.O. &Taiwo, G.O. (2011).Rebranding Nigeria by improving the teaching of mathematics through diagnosing mathematics learning difficulties.A case study of SSS students in Sokoto.In J. S. Sadiku (Ed.).*proceedings of MAN annual conference. 138-157.*

Lawan, Y. (2016). *Impacts of Jigsaw co-operative learning strategy on academic performance and*

*retention in mensuration among senior secondary school students in Kano State, Nigeria.*An Unpublished Dissertation.Ahmadu Bello University, Zaria.

Maxwell, N. (2009). The effect of Jigsaw strategy on students' achievement in Government.*African Research Review, 7* (3), 156-167.

Obioma, U.A (2011). Re-branding the strategies for teaching mathematics.The case of scaffolding.*Proceedings of MAN Annual Conference.*

Ojokuku, G.O. (2010).*Understanding Chemistry for senior secondary school.* Zaria: MacChin Multimedia Designers.

Sagor, E. (2008).What is peer-to–peer learning? *Newsletter*.Retrieved from: *http// www.wonsagoonline.com.*

Sahin, A. (2010) Effects of jigsaw technique on academic achievement and attitudes to written expression course. *Educational Research and Reviews*, 5 (12), 777-787.

Samuel, N. N. C. (2008). *Effect of teaching relevant mathematical topics before and during the teaching of selected topics in Chemistry.*Unpublished MSc Thesis.Department of Science Education, NnamdiAzikiwe University, Awka.

Uyuota, U.E. (2006). Instructional strategies and retention of science concepts among primary school pupils..*Journal of Educational Studies.*12 (1), 189 – 194.