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# Comparative Effects of Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies on University Science Students' Achievement and Retention in Nasarawa State, Nigeria

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**ABSTRACT**
This study investigated the comparative effect of individualized jigsaw, jigsaw ii and jigsaw iv learning strategies on University Science students' achievement and retention in Nasarawa State, Nigeria. Quasi-experimental, non-equivalent pretest, posttest, post-posttest design was employed for the study. The sample for study comprised fifty 400 level university science students purposely selected from Nasarawa University, Keffi, Nasarawa State, Nigeria. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. Students' Achievement in Science Test (SAST) was used as instrument for data collection. The reliability of SAST was determined using Kuder-Richardson formula 21 ($K\text{-}R_{21}$) and the reliability coefficient was found to be 0.85 implying that the instruments was reliable enough for the study. Descriptive statistics of Mean and Standard Deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance. Findings from the study revealed a significant difference between the achievement of university science students exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies in favor of Jigsaw II. In relation to retention, Findings from the study revealed a significant difference between the achievement of university science students exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies in favor of Jigsaw IV. Based on the findings of this study, it was recommended that; Students should always be encouraged to work together in groups so as to enable them imbibe the culture of working together cooperatively in order to promote their understanding of science.
**Keywords:** Achievement, Jigsaw, Learning Strategies, Science Students and Retention

## INTRODUCTION

The role of science and technology in the development of a nation is not in dispute. It is evident that the current development in science and technology has greatly affected the life of human beings so much that to be ignorant of the basic knowledge of this development is to live an empty, meaningless and probably unrealistic life. It will also be difficult for a nation with a scientifically and technologically illiterate citizenry to make any reasonable political decision on issues of everyday life such as the environment, agriculture, health, transport and communication or population growth. This is so because such a nation lacks the rudimentary tools to grasp the various arguments that are necessary for taking such decisions.

Science and Technology therefore, have a privileged function of exerting a domineering influence on the development of a nation (Kabutu, Oloyede & Bandele, 2015).

The vital role played by science in contemporary society is indispensable in recognition of the important role of science for national development, the Federal Republic of Nigeria in the National Policy on Education (FRN, 2014) gave a special place to science, technology and mathematics education and the promotion of scientific and technological literacy to her citizenry. In addition, the government put in place some reforms and measures aimed at harnessing the human and material resources in the country. Prominent among these is the National Policy on Science and Technology that has spelt out objectives and direction of science and technology education in Nigeria. Some of the objectives are;

a. Producing world class scientists, engineers and technologists who are well grounded in theory, practice of basic science and the needs of entrepreneurship.
b. Providing adequate support for continuous training of academic staff in tertiary and research institutions.
c. Strengthening the curricula in technological entrepreneurship and management of technology for science and engineering students.
d. Mainstreaming students in arts and social sciences to appreciate the relevance of science and technology and invention (STI) to profitability in business as well as natural development.
e. Encouraging and providing opportunities for the products of informal training schemes in STI for further formal training.
f. Strengthen capacity building institutions within the military, public and private sectors of the economy.
g. Facilitate on-the-job standardized training for professionals in STI organizations.
h. Promoting academic industry exchange programs to enhance knowledge sharing (FRN, 2011:4).

Despite all the aforementioned which are aimed at improving the production of scientists and the subsequent development and use of scientific products among the citizenry, students' achievement has remained largely not encouraging (Oni, 2014). The persistent underachievement in science and technology if not checked, will continue to jeopardize the placement chances of students in post-secondary institutions. This has serious implications for national development, security, economy, and manpower for a country with a vision of becoming one of the leading nations in science and technology (Gambari & Yusuf, 2017).

Researchers (Alabi, 2014; Bukunola & Idowu, 2012; Osokoya, 2013; Oni, 2014; Kabutu, Oloyede & Bandele, 2015; Samuel, 2017 and Eriba & Samuel 2018) observed that poor instructional strategies employed in the teaching of the subjects by teachers contribute to students under achievement. Students find it difficult to understand the basic concepts taught.

Individualised jigsaw learning strategy requires each student to work independently with the information given to which no one else has access, thereby making the student an expert on the section of the subject matter. Thereafter, students take turn to teach other members of the class what they have learnt.

Jigsaw II cooperative learning strategies was first developed by Aroson in 1978 (Gocer, 2010; Karacop & Doymus, 2013). Jigsaw II requires students to work in group of five to six members. Each student in a group is given information to which no one else in the group has access, thus making each student expert on his or her section of the subject matter. After receiving their assignments, each team member reads a section. Next, members of different teams who have studied the same sections meet in 'expert groups' to discuss their sections. Then the students return to their original teams and take turn teaching their team mates what they have learnt. All students in a group are expected to learn all the subject matter assigned to members of their group.

In Jigsaw, students are assigned to three member teams to work on academic materials. Initially, all students are assigned to study and understand the basic concept of the materials. Later, each student is given a section/topic on which to become an expert. Students with the same section/topic meet in expert groups to discuss their topic, after which they return to their original teams to teach what they have learnt

to their team mates. The students take group and individual quizzes that result in a team score based on the improvement score system (Slavin, 1986). The Jigsaw IV includes three new features: an introduction, quizzes and re-teaching of material after individual assessment (Janson, Somsook & Coll, 2008)

Achievement is the action of accomplishing an academic task successfully. Its purpose is to find out the stand of a student at a given moment (Akani, 2017). It has to do with testing the knowledge acquired by the student which helps the teacher and the student to evaluate and predict the degree of learning attained. It is useful in testing the retention of information and skill. It is also a determinant of the efficacy and efficiency of a given instruction (Kabutu, Oloyede & Bandele, 2015).

Learning is said to have occurred when what is learnt remains relatively permanent in the mind of the learner. Hence, it is pertinent for students to retain what is learnt. Retention is the capability to replicate the concept learnt when need arises. It is the ability to reproduce a learned behaviour by the learner in due time. Therefore, a learner who repeats an acquired knowledge with less error is said to have retained the material learnt. Similarly, when what is not retained or fades with time, learning becomes incomplete. Exploring mode of lesson delivery which could help students retain materials learnt becomes absolutely important (Asogwa, Muhammed, Asogwa & Ofoegbu, 2016).

This study therefore, sought to investigate the comparative effect of individualized jigsaw, jigsaw ii and jigsaw iv learning strategies as viable options that teachers can employ to make university students achieve better in science. Specifically, the study sought to:

1. Compare the effect of individualized jigsaw, jigsaw ii and jigsaw learning strategies on university science students' achievement.
2. Compare the effect of individualized jigsaw, jigsaw ii and jigsaw learning strategies on university science students' retention.

**Research Questions**

1. What is the effect of individualized jigsaw, jigsaw ii and jigsaw learning strategies on university science students' achievement?
2. What is the effect of individualized jigsaw, jigsaw ii and jigsaw learning strategies on university science students' retention?

**Research Hypotheses**

**$Ho_1$**: There is no significant difference in the mean achievement scores of university students taught Science using individualized jigsaw, jigsaw ii and jigsaw learning strategies.

**$Ho_2$**: There is no significant difference in the mean achievement scores of university students taught Science using individualized jigsaw, jigsaw ii and jigsaw learning strategies.

## METHODOLOGY

Quasi-experimental, non-equivalent pretest, posttest, post-posttest design was employed for the study. The sample for study comprised fifty 400 level university science students purposely selected from Nasarawa University, Keffi, Nasarawa State, Nigeria. The experimental groups I (n=10), II (n=16) and III (n=24) were taught using individualized jigsaw, jigsaw ii and jigsaw learning strategies.

Students' Achievement in Science Test (SAST) was used as instrument for data collection. SAST contained 50 itemed instrument with options A – E that tested the students' knowledge, comprehension, application of selected topics in Science namely; Ecology, Hydrology and Science and environment. The items were allotted one mark each, culminating to the total score of 50marks. The test was validated by experts in Science and was trial tested. The reliability of SAST was determined using Kuder-Richardson formula 21 ($K\text{-}R_{21}$) and the reliability coefficient was found to be 0.85 implying that the instruments was reliable enough for the study. Descriptive statistics of Mean and Standard Deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance.

## RESULTS

### Research Question One

*What is the effect of individualized jigsaw, jigsaw ii and jigsaw learning strategies on university science students' achievement?*

The data used to answer this research question is presented in Table 1.

**Table 1. Means and Standard Deviation of University Science Students' Achievement Scores Exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies**

| Group | Type of Test | N | Mean | SD | Mean gain |
|---|---|---|---|---|---|
| Individualized Jigsaw Strategy | Pretest | 10 | 23.84 | 3.44 | 27.55 |
| | Posttest | 10 | 51.39 | 3.51 | |
| Jigsaw II Strategy | Pretest | 16 | 24.76 | 3.35 | 41.11 |
| | Posttest | 16 | 65.87 | 2.88 | |
| Jigsaw IV Strategy | Pretest | 24 | 23.74 | 3.57 | 30.92 |
| | Posttest | 24 | 54.66 | 3.33 | |

Table 1 shows that mean gain of the achievement scores of university science students exposed to Jigsaw II Learning Strategy is the highest (41.11) followed by those exposed to Jigsaw IV Learning Strategy (30.92) and those exposed to the Individualized Jigsaw Learning Strategy had the least (27.55).

### Research Question Two

*What is the effect of individualized jigsaw, jigsaw ii and jigsaw learning strategies on university science students' retention?*

The data used to answer this research question is presented in Table 2.

**Table 2**

**Means and Standard Deviation of University Science Students' Retention Scores Exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies**

| Group | Type of Test | N | Mean | SD | Mean loss |
|---|---|---|---|---|---|
| Individualized Jigsaw Strategy | Posttest | 10 | 51.39 | 3.51 | 13.38 |
| | Post-posttest | 10 | 38.01 | 2.99 | |
| Jigsaw II Strategy | Posttest | 16 | 65.87 | 2.88 | 10.91 |
| | Post-posttest | 16 | 57.96 | 3.23 | |
| Jigsaw IV Strategy | Posttest | 24 | 54.66 | 3.33 | 09.12 |
| | Post-posttest | 24 | 45.54 | 3.05 | |

Table 2 shows that the mean loss of the retention scores of university science students exposed to Jigsaw IV Learning Strategy is the highest (09.12) followed by those exposed to Jigsaw II Learning Strategy (10.91) and those exposed to the Individualized Jigsaw Learning Strategy had the least (13.38). The lower the mean loss, the higher the retention and the higher the mean loss, the lower the retention.

### Research Hypothesis One

There is no significant difference in the mean achievement scores of university students taught Science using individualized jigsaw, jigsaw ii and jigsaw learning strategies.

Data to test the hypothesis is presented in Table 3.

**Table 3. Result of Analysis of Covariance of Science Students' Achievement Using SAST**

| Source of Variation | Sum of Square | Df | Mean Square | F | Sig |
|---|---|---|---|---|---|
| Corrected Model | 912.085 | 2 | 44.002 | 9.712 | .000 |
| Intercept | 281.245 | 1 | 281.245 | 44.241 | .000 |
| Pretest | 16.284 | 1 | 16.284 | 3.524 | .000 |
| Group | 54.432 | 1 | 54.432 | 10.057 | .000 |
| Error | 409.519 | 45 | | | |
| Total | 1673.565 | 50 | | | |

Table 3 shows that the ANCOVA test is $F = 10.057$, $p < 0.05$. This implies that there is a significant difference in the mean achievement scores of university science students exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies in favor of Jigsaw II. Therefore, the hypothesis was rejected

**Research Hypothesis Two**

There is no significant difference in the mean achievement scores of university students taught Science using individualized jigsaw, jigsaw ii and jigsaw learning strategies.

Data to test the hypothesis is presented in Table 4.

**Table 4. Result of Analysis of Covariance of Science Students' Retention Using SAST**

| Source of Variation | Sum of Square | Df | Mean Square | F | Sig |
|---|---|---|---|---|---|
| Corrected Model | 85.007 | 2 | 40.112 | 7. 412 | .000 |
| Intercept | 240.221 | 1 | 240.221 | 24. 411 | .000 |
| Posttest | 28.162 | 1 | 28.162 | 5. 324 | .000 |
| Group | 43.254 | 1 | 43.254 | 17.521 | .000 |
| Error | 519.010 | 45 | | | |
| Total | 1673.565 | 50 | | | |

Table 3 shows that the ANCOVA test is $F = 17.521$, $p < 0.05$. This implies that there is a significant difference in the mean achievement scores of university science students exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies in favor of Jigsaw IV. Therefore, the hypothesis was rejected

## DISCUSSION

Findings from the study revealed a significant difference between the achievement of university science students exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies in favor of Jigsaw II. This result indicates that the Jigsaw II learning strategies is effective in enhancing achievement. The reason for the enhanced achievement in the Jigsaw II group was because the students were allowed to work together in groups on a common task, supporting and encouraging one another to improve their learning through inter-dependence and cooperation with one another. The findings of the study are consistent with the findings of (Keramati, 2010; Ajaja & Eravwoke, 2010; Anowar & Rohanni, 2012;

Bukunola & Idowu, 2012; Gull & Shehzad, 2015; Odagboyi, Otuka & Uzoechi, 2015; Kabutu, Oloyede & Bandele, 2015; Gambari & Yusuf, 2017; and Eriba & Samuel, 2018), who in their various researches reported that, students taught using Jigsaw learning strategies achieve better academically than those taught using the conventional method.

In relation to retention, Findings from the study revealed a significant difference between the achievement of university science students exposed to Individualized Jigsaw, Jigsaw II and Jigsaw IV Learning Strategies in favor of Jigsaw IV. The reason for the enhanced retention in the Jigsaw IV group was because the students were allowed to work together in groups on a common task, supporting and encouraging one another to improve their learning through inter-dependence and cooperation with one another. This is in line with the findings of Samuel (2018) who found Jigsaw learning strategies have positive effect on students' retention in Science.

## CONCLUSION

The findings of the study, among others has shown that; Jigsaw II and Jigsaw IV cooperative learning strategies are a way of improving achievement in Science at the tertiary level of education in Nigeria

## RECOMMENDATIONS

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

1. Students should always be encouraged to work together in groups so as to enable them imbibe the culture of working together cooperatively in order to promote their understanding of science.
2. The present conventional lecture method employed by lecturers should drastically be minimized and only used in concert with more student-centered approaches.

## REFERENCES

Akani, O. (2017). Effect of guided discovery method of instruction and students' achievement in chemistry at the secondary school level in Nigeria. *International Journal of Scientific Research and Education,* 5(2), 6226-6234.

Ajaja, O.P. & Eravwoke, O.U. (2010). Effects of cooperative learning strategies on junior secondary school students' achievement in integrated science. *Electronic Journal of science Education,* 14(1), 24-33.

Alabi, O.A. (2014). Effect of activity based teaching strategy on students' achievement on secondary school students in Chemistry. *Journal of Education and Policy review*; 6(2), 119-128.

Anowar, H.I. & Rohanni, A.T. (2013). Effects of cooperative learning on students' achievement and attitude in secondary mathematics. 3rd World Conference learning, teaching and educational leadership. Procedia-Social and Behavioural Science. 93, 473-477.

Bukunola, B.A.J. & Idowu, O.D. (2012). Effectiveness of cooperative learning strategies on Nigerian junior secondary students' academic achievement in Basic Science. *British Journal of Education, Society and Behavioural Science.* 2(3), 307-325.

Eriba, J. O., & Samuel, R.I. (2018). Effect of stad and jigsaw iv cooperative learning strategies on students' interest and achievement in basic science. *Case Study International Journal*, 7(4), 6-14.

Federal Republic of Nigeria (2014). National policy on education. Lagos: NERDC Press.

Gambari, I.A. & Yusuf, O.M. (2017). Relative effectiveness of computer-supported Jigsaw II, STAD and TAI cooperative learning strategies on performance, attitude and retention of secondary school students in Physics. *Journal of Peer Learning* 10:76-94.

Gocer, A. (2010). A comparative research on the effectiveness of cooperative learning method and jigsaw technique on teaching literacy genres. *Educational research and reviews*, 5(8), 439-445.

Gull, F. & Shehzad, S. (2015). Effects of cooperative learning on students' academic achievement. *Journal of Education and Learning*, 9(3), 246-255.

Karacop, A. & Doymus, K. (2013). Effects of jigsaw cooperative learning and animation techniques on students' understanding of chemical bonding and their concepts of the particulate nature of matter. *Journal of science Education and Technology*, 22(2), 186-203.

Janson, N., Somsook, E., & Coll, R. (2008). The undergaraduate chemistry practical learning experiences using Jigsaw IV method. Journal of Science and Mathematics Education in Southeast Asia. 31(2), 178-200.

Kabutu, F.R., Oloyede, O.I. & Bandele, M.F. (2015). An investigation into the achievement of junior secondary school students taught integrate science using the cooperative learning strategy in Nigeria. *European Journal of Physics and Chemistry,* 7(2), 63-73.

Kerammati, M. (2010). Effect of cooperative learning on academic achievement of physics course. *Journal of Computers in Mathematics and Science Teaching*, 29(2), 155-173.

Odagboyi, I.A., Otuka, J.O.E & Uzoechi, B.C. (2015). Effect of the Jigsaw cooperative learning approach on Biology students' achievement and conceptual change. *Journal of Science Teachers Association of Nigeria.* 50(1), 163-173.

Oni, J.O. (2014). Teacher method of teaching and student academic achievement in Basic Science and Technology in junior secondary schools in South-West, Nigeria. *Journal of Education and Social Research,* 4(3), 397-402.

Osokoya, M.M. (2013). Teaching methodology in Basic science and Technology in South-West, Nigeria. *Asian Journal of Education.* 1(4), 206-214.

Samuel, I. R. (2018). Effects of jigsaw iv, group investigation and reversed jigsaw cooperative instructional strategies on basic science students' achievement and retention. *International Journal of Education Research*, 6(2), 54-62.

Samuel, I.R. (2017). Assessment of Basic Science and teachers' pedagogical practices and students' achievement in Keffi Educational Zone, Nasarawa State, Nigeria. An Unpublished Masters Dissertation, Faculty of Education, Nasarawa State University, Keffi.

Slavin, R.E. (1986). Using student team learning. Baltimore, MD: John Hopkins University.