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EFFECTS OF COOPERATIVE STRATEGY ON SENIOR SECONDARY TWO STUDENTS' RETENTION IN STOICHIOMETRY IN JEMA'A LOCAL GOVERVMENT AREA, KADUNA STATE

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ABSTRACT

The study examined the effects of cooperative learning strategy on senior secondary two students' retention in stoichiometry in Jema'a, Kaduna State. It adopted quasi experimental research design involving pre-test-posttest nonequivalent control group design. The study answered three research questions and tested two hypotheses. The population of the study consisted of 543 students from public senior secondary schools in Jema'a. The sample of the study was 180 students drawn from four intact classes. The instrument used for the research was a Stoichiometry Retention Test (SRT). The validity of the instrument was established by judgment of three experts in relevant fields. The reliability coefficient of the instrument was determined through administering the research instrument on 30 respondents who were not part of the study. Results were calculated using Kuder Richardson (K-R-20) formula which gives reliability index of 0.70. Data were computed using mean, standard deviation and ANCOVA. The findings of the study showed that cooperative learning strategy was effective in improving the retention of secondary school students in stoichiometry. The study recommended that Chemistry teachers should adopt the use of cooperative learning strategy in the teaching of Chemistry at the secondary school level. The study further recommended that special training on the effective implementation of cooperative learning instructional strategy should be organized by Plateau State Government for teachers and students.

Keywords: Cooperative Learning, Strategy, Retention, Stoichiometry

INTRODUCTION

Science plays an important role in the society. Science is the systematic study of the universe around and within us. It is a natural solution to our daily problems. It helps students to explain events in nature, identifying those beliefs that are superstitions, teach students to develop their physical skills through the proper handling of objects and equipment, teach students how to solve simple problems they encounter every day, help students develop social skills establishing friendship while working cooperatively in groups. Chemistry occupies a special position in the senior secondary school curriculum in Nigerian schools in the National Policy on Education (FRN, 2014). Each student at the senior secondary school, irrespective of his/her stream is expected to study at least a science subject (Chemistry, Biology or Physics). Chemistry is a major science subject that deals with the scientific study of the composition, structure, properties and reactions of matter in different forms. House croft (2020) defines Chemistry as the art and science of transforming matter and understanding the transformation that occurs. In Nigeria, Chemistry is a compulsory subject for all senior secondary school science classes, as spelt out National Policy on Education (FRN, 2014). Chemistry has a profound impact on various aspects of society as it is a study that involves

exploration of relationship between theory and experiment. Within the chemistry curriculum, stoichiometry holds a central place as it is the relationship between the masses of reactants and products before, during and following chemical reactions. To calculate the stoichiometry by mass, the number of molecules required for each reactant is expressed in moles and multiplied by the molar mass

Jigsaw I cooperative learning requires students to engage in group activities that increase learning and add other important dimensions. (Agbo & Amaka, 2020). Jigsaw I cooperative learning strategy improved race relations and increase personal and social development as the student interact within the groups. Therefore, when jigsaw I cooperative method is used as part of instructional strategy it is potent at increasing students' interest, achievement, and knowledge and also has the potentials to enable students to engage in reflective thinking (Adodo, 2013). These strategies recognize individual differences in learners and encourage them to create their own knowledge at their own pace.

Gender refers to the personal sexual identity of an individual, regardless of the person's biological and outward sex (Ibitoye, 2018). Gender can also be seen as a socially ascribed attribute which differentiates male from female. (Mbonu & Okoli 2019). Review of studies show inconsistency on the results of male and female students' academic achievement in Chemistry and science at large. Alamri (2018) found that female students performed better than the male students. Nwachukwu (2014) and Amedu (2015) revealed that boys performed better than their female counterparts. Kingdom-Aaron, Etokeren and Okwelle (2019) showed that there was no significant difference between male and female students. Based on the inconsistency on the results of male and female students' academic achievement in science, it is pertinent to investigate whether the use of cooperative learning strategy would enhance academic achievement of both male and female students in chemistry.

Retention of learning is a repeat performance of the activity learned earlier, elicited after a time interval by the learner (Damire, 2014). Retention of learning is the ability to hold, keep or recall past experience and reproduce a learnt concept when the need arises (Bukunola & Idowu, 2012). It is an important variable in learning because only a learnt experience is recalled; learning cannot be said to have taken place if there is no proper retention. Retention is a crucial construct that most classroom teachers strive to maximize among their pupils. Whatever touches consciousness leaves trace or impression and is retained in the mind in the form of images. Whenever a stimulating situation occurs retained images are revived or reproduced to make memory possible. It means that Chemistry concepts should be presented to the students such that, it touches their consciousness. It then implies that any pedagogical approach used in education to improve Chemistry students' achievement should be able to improve students' retention ability. Bala (2010), reports that studies conducted in Chemistry in secondary schools in Nigeria showed that there is a definite loss varying from 12% during long-term vacation to 35.11%. It further revealed that, during a standardized Chemistry test, some students even showed a loss of 100%. To be able to measure retention, a test has to be conducted on the learner to know if the material learnt is retained and can be remembered and reproduced.

. There is a serious decline in learners becoming confident and efficient problem solvers. This is because Chemistry educators do not often implement the problem – solving pedagogical technique as means to minimize the occurrence of learners' difficulties in stoichiometry. This decline may be attributed to the fact that students have resorted to memorization of stoichiometry concept as a result of their passive involvement in the teaching and learning process due to the lecture method of teaching. It is very obvious that the lecture method of teaching has not truly yielded the required result in terms of students' retention

specifically in Chemistry. This calls for the adoption of other teaching methods that could ensure the active involvement of students in the teaching and learning process and also provide the opportunity for them to discover new knowledge on their own with little or no assistance from teachers. Consequently, the problem of the study is seen in the following broad question: What are the effects of co-operative learning strategy and gender on students' achievement and retention in chemistry in senior secondary schools in Jama'a Local Government Area, Kaduna State.

OBJECTIVES OF THE STUDY

The objectives of the study are to:

1. determine the difference in the mean retention scores of students taught stoichiometry using cooperative learning strategy and those taught using lecture method.
2. find out the difference in the mean retention scores of students in urban and rural schools taught stoichiometry using co-operative learning strategy.

RESEARCH QUESTIONS

The following research questions guided the study:

1. What is the difference in the mean retention scores of students taught stoichiometry using cooperative learning strategy and those taught using lecture method?
2. What is the difference in mean retention scores of students in urban and rural schools taught stoichiometry using co-operative learning strategy?

HYPOTHESES

The following null hypotheses are stated and shall be tested at 0.05 level of significance.

1. There is no significant difference in the mean retention scores of students taught stoichiometry using cooperative learning strategy and those taught using lecture method.
2. There is no significant difference in the mean retention scores of urban and rural secondary school students taught stoichiometry using co-operative learning strategy.

RESULT

Research Question One

What is the difference in the mean retention scores of students taught stoichiometry using cooperative learning strategy and those taught using lecture method?

Table 1

Retention Mean Scores of Students taught Chemistry using the Cooperative Learning Strategy and those taught using Lecture Method

Group		Pre-test		Post-test			
	N	Mean	SD	Mean	SD	Mean Gain	Mean difference
Experimental	90	5.78	3.24	17.54	3.57	10.77	3.94
Control	90	7.83	4.821	8.88	5.134	7.83	

Table 1 shows the pre-test and post-test retention mean score of students in the experimental and control groups. From the result, the experimental group has a post-test retention mean score of 17.54 and standard deviation of 3.57 higher than the pre-test mean score of 5.78 and standard deviation of 3.24 with a mean gain of 11.77, indicating that there

was improvement in the retention of students after treatment. Also, for the control group the mean score was 7.83 and a standard deviation of 4.82 at the pretest. At the post-test the mean score of students was 8.88 and standard deviation of 7.83. The finding shows that students in the experimental group had a higher mean score after treatment. It can be deduced that cooperative learning strategy does improve students' retention in Chemistry

Research Question Two
What is the difference in mean retention scores of students in urban and rural schools taught stoichiometry using co-operative learning strategy?

Table 2
Retention Mean Scores of Urban and Rural School Students after Exposure to Cooperative Learning Strategy

Location	Test	N	$\bar{x}$	SD	Mean difference
Urban	Post-test	44	19.84	4.297	
					2.57
Rural	Post-test	46	17.30	4.526	

Table 2 shows the retention mean scores of urban and rural school students after exposure to cooperative learning strategy. From the result, the post-test achievement mean score for urban school students was 19.84 and a standard deviation of 4.30, while the mean score of rural school students was 17.30 with a standard deviation of 4.53, indicating that there was increase in the retention of students at the post-test for both urban and rural school students after treatment, although urban school students had a higher achievement mean score than the rural school students with a mean difference of 2.57. This shows that the achievement mean score of urban school students was better than that of rural school students.

Hypothesis One
There is no significant difference in the mean retention scores of students taught stoichiometry using cooperative learning strategy and those taught using lecture method.

Table 3
ANCOVA Result on Retention Mean Scores of Students when taught Chemistry using Cooperative Learning Strategy and Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5465.364[a]	2	2732.682	163.663	.000	.649
Intercept	3770.449	1	3770.449	225.816	.000	.561
Covariate	1442.026	1	1442.026	86.365	.000	.328
Group	4599.778	1	4599.778	275.486	.000	.609
Error	2955.363	177	16.697			
Total	46063.000	180				
Corrected Total	8420.728	179				

a. R Squared = .649 (Adjusted R Squared = .645)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference existed in the posttest retention mean score of students taught Chemistry using

cooperative learning strategy and the lecture method**.** Table 3 shows that F (1,177) = 275.49, p < 0.05, since the p-value of 0.000 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant effect of cooperative learning strategy on retention of students in Chemistry. The result further reveals an adjusted R squared value of .690 which means that 69 percent of the variation in the dependent variable which is retention in Chemistry is explained by variation in the treatment of cooperative learning strategy, while the remaining is due to other factors not included in this study. It implies that cooperative learning strategy can help students retain what they have been taught in Chemistry.

Hypothesis Two

There is no significant difference in the mean retention scores of urban and rural secondary school students taught Chemistry using co-operative learning strategy.

Table 4

ANCOVA Result on Urban and Rural School Students Retention in Chemistry when Exposed to Co-operative Learning Strategy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	194.931[a]	2	97.465	5.092	.008	.105
Intercept	4608.842	1	4608.842	240.766	.000	.735
Ovariate	50.234	1	50.234	2.624	.109	.029
Urban	172.571	1	172.571	9.015	.003	.094
Rural	167.281	1	167.281	8.461	.001	.083
Error	1665.391	87	19.142			
Total	32811.000	90				
Corrected Total	1860.322	89				

a. R Squared = .105(Adjusted R Squared = .084)

Analysis of Covariance (ANCOVA) was conducted to determine if there was a significant effect of co-operative learning strategy on retention of urban and rural school students in Chemistry. Table 4 shows that the main effect of location yielded F(1,87) = 4.70, p < 0.05, since the p-value of 0.003 is less than 0.05 level of significance, the null hypothesis was rejected, indicating that there was a significant difference in the achievement mean scores of urban and rural school students exposed to co-operative learning strategy. It indicates that co-operative learning strategy can help improve the achievement of both urban and rural school students in favour of urban school students.

DISCUSSION

The study analyzed the effectiveness of cooperative learning strategies on senior secondary two student's retention in chemistry in Jema'a, Kaduna State. The results showed that exposure to cooperative learning strategy was found to be more effective in improving the achievement and retention of secondary school students in chemistry as indicated in the result that there is a significant difference between the posttest achievements of students taught chemistry with cooperative learning strategy and lecture method. The effectiveness of cooperative learning strategy could be because it is a strategy that centers on group interaction, discussions, and exchange of ideas in class. It gives opportunity for all to sit and listen, as well as talk and think, thus emphasizing the process of "coming to know" as

valuable as "knowing the right answer". In other words, students in a cooperative class are not passive listeners, neither is the teacher a sole performer. Students are allowed to develop critical thinking ability, learn to evaluate ideas, concepts and principles, procedure, programme

The findings on the retention mean score of students taught chemistry using cooperative learning strategy and those taught with lecture method revealed that the improvement in the achievement of students was retained after treatment. The findings show that students in the experimental group had a higher retention mean score after treatment using cooperative learning strategy than those in the control group who were taught using lecture method. This means that after the intervention the achievement of students taught using cooperative learning strategy was retained better than those who were not given the intervention. It can be deduced that cooperative learning strategy does increase students' retention mean score in chemistry. This finding concurs with the work of Adeniji (2018) who found that cooperative learning promotes students' retention in science in senior secondary schools. The finding also revealed that students in urban schools achieved better than those in rural schools.

CONCLUSION AND RECOMMENDATIONS

From the findings of the study, it can be concluded that the achievement level of both groups of students before treatments were low in chemistry. The result further showed that students taught using cooperative learning strategy performed significantly better than their counterparts taught with lecture method. Cooperative strategy was found to be more effective in improving the achievement and retention of secondary school students in chemistry when compared to lecture method. It was discovered that the students in urban schools performed better than their counterpart in rural schools when taught chemistry using cooperative learning strategy.

In view of the findings of the study, the following recommendations are made:

1. Special training on the effective implementation of cooperative learning instructional strategy should be organized by the Plateau State Government for teachers and students, so as to help them become competent in the use of cooperative learning strategy. .
2. The study recommended that Chemistry teachers should adopt the use of cooperative learning instructional strategy in the teaching of Chemistry at the secondary school level. The study further recommended that Special training on the effective implementation of cooperative learning instructional strategy should always

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