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JIG-SAW, BUZZ GROUP LEARNING STRATEGIES AND STUDENTS' ACHIEVEMENT IN BASIC SCIENCE IN ATIBA LOCAL GOVERNMENT AREA, OYO STATE, NIGERIA

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Abstract
This study investigated firstly, the effect of jig-saw, buzz group, conventional learning strategies and students' achievement, secondly, the moderating effect of gender of students on achievement in basic science. The study adopted a pretest-posttest, control group, quasi-experimental design. The participants consisted of 208 junior secondary school II students from Atiba local government area in Oyo State, Nigeria. Five instruments were validated for the study. Three hypotheses were tested at $p \leq 0.05$ level of significance. Data collected were analyzed using inferential statistics of Analysis of Covariance (ANCOVA) and Bonferroni Post-hoc. The result revealed there was a significant main effect of treatment on students' achievement in basic science, no significant main effect of gender on students' achievement and that the interaction effect of treatment and gender on students' achievement was not significant. It was therefore recommended that teachers should use the strategies above to improve the achievement in basic science teaching.

Keywords: Jigsaw learning strategy, Buzz group learning strategy, achievement in basic science

Introduction

Nigeria is running a 9-3-4 system of education which segregates between basic, secondary and tertiary levels. At all these levels, science is taught but in different forms and depth. Basic Science is the first form of science a student encounters at the Basic school level, hence, it prepares students at the Junior Secondary school level for the study of

core science subjects at the Senior Secondary school level. This implies that for a student to study science subjects at the Senior Secondary school level successfully, such a student should have been well grounded in Basic Science at the basic school level (Samuel, 2017). Basic Science is an approach to science in which the fundamental unity of science is stressed, while the traditional boundaries between science subjects are eliminated. Basic Science subject has enjoyed a wide range of acceptance among science educators since it is expected to lay foundation for progress and success in the various disciplines in science such as Biology, Physics and Chemistry amongst others. Implying that the teaching of Basic Science in Nigerian Junior Secondary Schools needs to be properly handed.

It is evident that the current development in science and technology has greatly affected the lives 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 puts in place some reforms and measures aimed at harnessing the human and material resources in the country.

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 in the subject is not as good as expected (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; Idowu, 2011; Bukunola & Idowu, 2012; Osokoya, 2013; Oni, 2014; Kabutu, Oloyede & Bandele, 2015 & Samuel, 2017) observed that poor instructional strategies employed in the teaching of the subject by teachers contribute to student's underachievement. Students find it difficult to understand the basic concepts taught. Hence a child that is not well grounded in basic science at this level will not show interest in offering core science subjects at the senior school level.

Learning strategies used by teachers to teach and drive home their subject points at the junior secondary school level is important because the strategies used determined the type of interaction pattern that could take place during lessons and if learning would occur. The quality of teaching at this stage will not only influence the child's rate of learning, but will to a large extend determine the quality and direction of his/her academic career later in life. This underscores the need to make teaching and learning very interesting, stimulating and meaningful to the learner. One of the ways of achieving this is through the use of appropriate instructional strategies by the teacher. Thus, the strategy that will help the students to familiarize with the contents of instruction, increase their interest, empower them with sufficient level of knowledge of Basic Science, science process skills and enhance their active participation in the subject and also efficacious in improving their interaction with the environment are highly needed. Hence, this study focused on improving students' achievement in basic science through cooperative strategies that promote class interaction and participation. Examples of such strategies are the Jigsaw and Buzz Group.

In Jigsaw, students are assigned to four-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/top icon 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 learned to their teammates. The students take a group and individual quizzes that result in a team score based on the improvement score system (Slavin, 1986). It is a cooperative learning technique in which

students work in small groups of four to six (Aronson 2008, Lestik & Plous 2012 & Hakkarainen, 2012). It is used to develop the skills and expertise needed to participate effectively in group activities which also focuses on listening, speaking, co-operation, reflection, and problem solving skills in the students (Bratt, 2008; Hakkarainen, 2012). Jigsaw strategy, according to Gregory (2013) can be used for students by giving them different materials and content to match different levels of readiness.

According to Aronson (2000), jigsaw is a cooperative learning strategy that enables each students of a group to specialize in one aspect of a learning unit. Students meet with members from other groups who are assigned the same aspect and after mastering the material, return to main group and teach this material to the group member. Jigsaw learning strategy can be used whenever teaching materials that are segmented into separate components.

Buzz Group was also used in this study and it is usually used with small groups of 2-3 participants discuss a specific question or issue in order to come up with many ideas in a short time. It is a useful way of encouraging everyone to participate within a group session by dividing the learners into small groups for a short time to discuss ideas or share information. Buzz group learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught, but also for helping team mates to learn, thus creating an atmosphere of achievement (Ronsini, 2000). Buzz group learning is a mode of learning in which students work in small groups to achieve a purpose. Here there is an emphasis on the importance of group work, students in a group help each other in learning the content, but achievement is judged individually. According to Odili (2000), the class in Buzz groups learning is divided into groups, and each group has specific work to do. Also, group rewards and individual accountability within the group are essential.

In addition to differences in how buzz groups instruction is implemented, researchers have also differed in how they attempt to measure the effectiveness of this instruction. Decades of research from meta-analyses (almost all from pre-college instruction) suggest that buzz groups results in improved student learning (Schneider, Krajcik,

Marx, and Soloway, 2002; Shymansky, 2000).Most studies on the effectiveness of buzz groups have measured student achievement through acquisition of content knowledge, conceptual understanding, and overcoming misconceptions. Buzz group learning is a powerful educational tool and an effective way of enhancing student learning. It promotes social contact with peers and faculty as a way of learning with and from each other.

The basic science curriculum is child-centred and emphasis is laid more on learning science as a process than as a body of knowledge (Olarewaju, 1994). Hence, teachers should actively engage students in the process of learning of basic science which Jigsaw and Buzz Group learning strategies allow more active involvement of students in the teaching and learning process than other cooperative learning teaching strategies which is in line with the design of basic science curriculum as stated earlier (Johnson and Johnson, 2000).Educators understand that changes in student outcomes must be supported by parallel changes in curriculum and instruction. However, it is apparent that some teachers are not adopting these students' centred strategies to facilitate the learning of basic probably they are ignorant of these strategies as many teachers were educated in the class rooms where the role of the students was to memorize information, conduct well-regulated experiments and were then tested on their ability to repeat these tasks or remember specific facts (Dogru & Kalender, 2007). The present study, therefore, is aimed at determining the extent to which classroom exposures of students to Jigsaw and Buzz Group learning strategies will enhance basic science students' achievement in the subject.

Gender remains an important factor to be considered in the determination of effects of cooperative instructional strategies on the academic achievement of students. Gender has been identified as a major factor that affects students' achievement in Basic Science and Technology examinations and science and technology as endeavour (Omiko, 2017). Oni 2014 posited that in Nigeria, women are marginalized while men are given greater opportunities to advance based on their science background. In the Nigerian setting, this factor has been found to offer males an unfair advantage over their female counterparts. Alabi (2014) reported that women are hindered from progressing through discrimination on the basis of gender, early marriage, and childbearing and as a result, they have deprived sound

education, job opportunities and incapacitated and rendered passive generally in the society. Whether this assertion is correct or faulty, this study determined it.

Nigerian government's efforts towards making sure that there is improvement in students' achievement in basic science cannot be said to have yielded much fruit. This is due to the fact that the students' achievement in recent years is low, especially in Basic Education Certificate Examination (B.E.C.E). The problem stemmed from the conventional-lecture method being used by the basic science teachers at the J.S.S. level. Although some teaching methods have been tried out to explore their effects on students learning outcome, not much research attention has been given to jigsaw and buzz group learning strategies. Thus, this study therefore determined the effect of Jigsaw, Buzz Group, Conventional Learning strategies and students' achievement in basic science in Atiba Local Government Area of Oyo State, Nigeria.

Hypotheses

Three null hypotheses where tested at 0.05 level of significance and they are as follows;

$H_0$1: There is no significant main effect of treatment on students' achievement in basic science.

$H_0$2: There is no significant main effect of gender on students' achievement in basic science.

$H_0$3: There is no significant interaction effect of treatment and gender on students' achievement in basic science.

Methodology

The research design that was adopted for this study was the pretest, posttest, control group, qausi experimental design involving a 3x2 factional matrix. The targeted population for this study comprises all junior secondary school II students in Oyo zone. Multi-Stage sampling technique was used in constructing the sample. Multi-stage sampling technique was chosen because it enabled the researchers to sample the students along the four local government areas in the Oyo zone. The breakdown included: Simple random sampling technique which was used in selecting one local government out of the four local government areas in Oyo zone. Following this method, Atiba L.G.A. was

selected. Purposive sampling technique was used in selecting 6 out of 16 co-educational schools in the area. The reason for the choice of purposive sampling technique was because the researchers needed schools with experienced basic science teachers and at least three streams of JS11 classes. The reason for choice of co-educational school was because gender is a variable of the study. Five research instruments were used in the collection of data for the study and they are; Basic Science Achievement Test (BSAT), Teachers' Instructional Guide on Jigsaw Learning Strategy (TIGJLS), Teachers' Instructional Guide on Buzz Group Learning Strategy (TIGBGLS), Teachers' Instructional Guide on Conventional Learning Strategy (TIGCLS), and Evaluating Sheet for Assessing Instructor's Performance (ESAIP). The time duration for the test was estimated using the average time taken by the first and last subject to complete the test. The reliability coefficient (r) of Basic Science Achievement Test was computed using Kuder-Richardson (K-R20) for the test administration and yielding an average coefficient of 0.92. Data for this study was collected through pre-test and post-test of Basic Science Achievement Test. data collected from both tests was recorded separately. Analysis of data collected in relation to this study was done using descriptive statistics (mean and standard deviation) to explain the mean sources of the various groups (Treatment and Gender). The data was also analyzed using inferential statistics of Analysis of Covariance (ANCOVA) of the posttest scores with the pretest scores as the covariates.

Results

Table 1: Distribution of the Participants by Treatment and Gender

Variables	Frequency (N)	Percentage (%)
Treatment groups		
Jigsaw Strategy (JS)	71	34.1
Buzz Group Strategy (BGS)	65	31.3
Conventional Strategy (CS)	72	34.6
Total	208	100.0

Gender			
Male	95	45.7	
Female	113	54.3	39.6
Total	208	100.0	

Testing of null hypotheses

$H_0$1: There is no significant main effect of treatment on students' achievement

Table 2: Analysis of Covariance (ANCOVA) of Post-Achievement by Treatment and Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1787.318	6	297.886	76.940	0.000	0.697
Intercept	417.339	1	417.339	107.794	0.000	0.349
Pre Achievement	923.400	1	923.400	238.503	0.000	0.543
Treatment	710.430	2	355.215	91.748	0.000*	0.477
Gender	0.564	1	0.564	0.146	0.703	0.001
Treatment x Gender	12.642	2	6.321	1.633	0.198	0.016
Error	778.201	201	3.872			
Total	77274.000	208				
Corrected Total	2565.519	207				

R Squared = 0.70 (Adjusted R Squared = 0.69) * denotes significant p<0.05

Table 4.2 indicated that the main effect of treatment on students' achievement ($F_{(2, 206)}$ =91.748; p<0.05, partial η^2 = 0.48) was significant. This implies that treatment had effect on students' achievement. Table 2 further indicated the effect of48.0%. This implies that 48.0% out of the total variation (Adjusted R^2 = 0.69) in students' post-achievement mean scores is due to the significant main effect of the treatment on students' achievement. Therefore, hypothesis 1 was rejected. In order

to explore the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups were carried out and the result was presented.

Table 3: Estimated Marginal Means for Post-Achievement by Treatment and Control Group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Jigsaw Strategy (JS)	20.93	0.23	20.47	21.39
Buzz Group Strategy (BGS)	19.46	0.25	18.97	19.94
Conventional Strategy (CS)	16.53	0.23	16.07	16.99

Table 3 showed that students exposed to Jigsaw Strategy (JS) treatment group 1 had highest adjusted post-achievement mean score (20.93), followed by students exposed to the Buzz Group Strategy (BGS) treatment group 2 (19.46), while their counterparts in the Conventional Strategy (CS) control group (16.53) had the lowest adjusted post-achievement mean score. This order is represented as JS >BGS > CS. In order to determine which of the group causes this significant main effect of treatment on students' achievement, the Bonferroni post-hoc test was carried out on treatment groups.

Table 4: Bonferroni Post-hoc Analysis of Post-Achievement by Treatment and Control group

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Sig.
Jigsaw Strategy	Buzz Group Strategy	1.475*	0.000
	Conventional Strategy	4.402*	0.000
Buzz Group Strategy	Jigsaw Strategy	-1.475*	0.000
	Conventional Strategy	2.926*	0.000
Conventional Strategy	Jigsaw Strategy	-4.402*	0.000
	Buzz Group Strategy	-2.926*	0.000

Table 4 indicated that the post-achievement mean score of students exposed to Jigsaw Strategy (JS) was significantly different from those taught with Buzz Group Strategy (BGS) and Conventional Strategy (CS). Furthermore, Table 4 indicated that the difference in the post-achievement mean score of students exposed to buzz group strategy and their counterparts in the conventional strategy was significant. This implied that the significant difference indicated by the ANCOVA result was due to the difference observed between the treatment groups (jigsaw and buzz group strategies) and also between the treatment groups and the control group as students' post-achievement scores is concerned.

$H_0$2: There is no significant main effect of gender on students' achievement

The table showed that there was no significant main effect of gender on students' achievement ($F_{(1,\ 207)}$ = 0.15 p>0.05). This means that gender had no significant effect on students' achievement. Thus, hypothesis 2 was rejected. Although, Table 5 presented the estimated marginal means of gender. It was revealed that male students had the higher adjusted post-achievement mean score (10.03), while their female counterparts had the lowest adjusted post-achievement mean score (19.92). This difference in their mean score was not statistically significant.

Table 5: Estimated Marginal Means Post-Achievement by Gender

			95% Confidence Interval	
Gender	Mean	Std. Error	Lower Bound	Upper Bound
Male	19.03	0.20	18.63	19.43
Female	18.92	0.19	18.56	19.29

$H_0$3: There is no significant interaction effect of treatment and gender on students' achievement

Table 5 revealed that the interaction effect of treatment and gender on students' achievement was not significant ($F_{(2,\ 206)}$ = 1.63; p>0.05).

Hence, hypothesis 3 was not rejected. This implies that treatment and gender had no effect on students' achievement.

Discussion of Findings

Main Effect of Treatment on Students' Achievement in Basic Science

The results of this study showed that the treatment had significant main effect on students' achievement in basic science. The result showed that jigsaw strategy was more effective, followed by buzz group strategy, while the conventional strategy was the least effective. The efficacy of jigsaw strategy was as a result of the fact that the students were allowed to process their own knowledge development through social interaction by working primarily in groups, to dialogue and evaluate information. It may also be due to the fact that it gave students the opportunity to take ownership of their learning will, better understanding of the given materials, this direct interaction with the information and material, may have promote the observed achievement in basic science. This could be attributed to the opportunity given to contribute to a group, through collaboration and discussion, whereby they asked questions in order to clarify their understanding and provide critical feedback in appropriate manners.

This effectiveness of jigsaw strategy in this study was in tandem with the assumption of Social Interdependent Theory, which stated that the ways in which participants' goals are structured determined how they interact, and the interaction pattern determined the outcomes of the situation (Johnson et al., 2007). This could be because jigsaw strategy offered students the opportunity to interact with each other through positively structured interrelationship (group of students), and this could have led to better achievement gain in this group than the others. This finding is in agreement with the findings of Gambari (2010) and Hanze and Berger (2007). Berger and Hanze (2009) who in their separate studies reported that Jigsaw strategy was more effective than individualistic and conventional classroom instruction, respectively. Fajola (2000) who also established better performance of students taught in jigsaw learning settings compared to students using the conventional teaching method. This was also supported by Kilic (2008)'s finding, that when compared with the traditional method, the jigsaw technique affected students' academic achievement positively in the concepts in the principles and methods of teaching course. The

finding of this study was not supported by the findings of Hanze and Berger (2007), Sherman (2006) and Shaaban (2006) who in their separate studies found no significant difference in the achievement of students that were taught physics using Jigsaw and those taught using conventional strategies, respectively.

The buzz group strategy was also found to be effective than the conventional strategy. This may be as a result of the fact that, in buzz group strategy, students were allowed to discuss on only one issue, question, or point, share and discuss on their points within the group. This could also be due to the fact that this strategy offered students the opportunity to ask each group to share their points preferably one point from each group at a time, have them discuss on the point shared and reached a reasonable conclusion that was generally accepted, after which they related their conclusion with the key learning points. Also, teachers were allowed to provide support for the learning activities in form of scaffolding. Other activities offered by buzz group learning strategy include analysis, synthesis, evaluation, evaluation, collaboration, problem solving, and creative work group experiences (Chickering and Kytle, 2002).

This effectiveness of buzz group strategy was supported by the assumption of Vygotsky's Social Constructivist Theory, which states that constant self-evaluation and monitoring is necessary for groups to continue to be successful and for individuals to be constantly challenged within their zones of proximal development by holding each group member accountable for mastering the relevant material(Fleer et al., 2009).This finding on the efficacy of buzz group strategy in this study was supported by the findings of Pascarella and Terenzini (2005)that buzz group strategy improved students' educational gains than conventional strategy, respectively. This finding was also supported by Lair (2008) that implementation of buzz group learning strategy in the classroom, enhance higher-order thinking skills, which led to higher student success and persistence rates at the institution.

Main Effect of Gender on Students' Achievement in Basic Science

Gender was found to have no significant main effect on students' achievement in basic science, that is, gender had no influence on achievement of students in basic science. The reason for this may be due to the equal learning opportunity given to the both male and

female students during the study. This finding was supported by the findings of Obiekwe (2008) who found that there was no gender difference in achievement of students that were exposed to different teaching strategies in basic ecological concepts in biology. The finding of this work was also supported by Okoro (2011), who conducted research on the effectiveness of expository and guided discovery on students' achievement in biology. The result showed that there was no significant difference in the achievement of male and female students exposed to the two groups of teaching methods. Also, Ibe (2004) reported that there was no significant difference in the achievement of male and female students used to determine the effect of guided inquiry and demonstration methods on science process skill acquisition among biology secondary school students. This finding was in agreement with the finding of Ukoh (2012) who found that gender did not have a significant main effect on students' achievement in physics.

Interaction Effect of Treatment and Gender on Students' Achievement in Basic Science

In this study the findings showed that the treatment and students' gender had no significant effect on the students' achievement in basic science. This could mean that the treatment was suitable to both sexes with respect to basic science concept that was taught. This implied that students' knowledge of genetics concepts was not significantly affected by treatment applied and their scientific reasoning ability differences in this study, that is, being formal, transitional or concrete scientific ability has no different effect on the various instructional strategies applied. Moreover, this may be attributed to the equal opportunity the strategies offered for each gender group to equally participate during application of treatment. This finding was in mutual agreement with the findings of Yusuf (2005) that gender has no interaction effects on students' achievement in a learning group in Social Studies.

Conclusion

The exposure of learners to Jigsaw and Buzz Group learning strategies positively improved students' achievement in basic science. The findings have therefore revealed importance of using instructional strategies that are participatory and students centred where students are trained to take control and direct their learning process (es) for

effective learning while the teacher facilitates the learning process. The study also revealed that there was need for both male and female students to be given the same opportunity in teaching and learning activities as gender was not found to have significant effect on achievement.

Recommendations

1. In view of the fact that the jigsaw and buzz group method were more effective in teaching basic science and enhancing students' achievement in basic science, the Ministry of Education should ensure that curriculum developers incorporate jigsaw and buzz group strategies in the instructional methods for junior secondary schools.
2. Mode of instruction had no differential effects on male and female students' achievement in basic science. Hence, teachers should make teaching and learning of science gender unbiased.
3. Ministry of Education should ensure that their teachers are trained regularly on the use of innovative instructional learning strategies e.g. jigsaw and buzz group strategies.
4. The curriculum planners should ensure that they incorporate jigsaw and buzz group strategies in basic science curriculum, because it will help to promote students' achievement in the subject.

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