EFFECTS OF JIGSAW-BASED LEARNING STRATEGY ON ACADEMIC ACHIEVEMENT OF JUNIOR SECONDARY SCHOOL STUDENTS' IN BASIC SCIENCE IN GWAGWALADA AREA COUNCIL, ABUJA.

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Abstract
The study investigated the effect of Jigsaw-based Learning Strategy on Junior Secondary School student's achievement in Basic Science in Gwagwalada Area Council of the Federal Capital Territory (FCT). The research design for the study was the quasi-experimental design. The study made use of two groups- experimental and control groups. The experimental group was taught with Jigsaw Learning Strategy while the control group was taught with conventional teaching strategy. The reliability index of the instrument was 0.89 using kuder- Richardson formula 21. The experimental groups comprised 65 male and female and the control group comprised 55 male and female students, making a total of 120 students. The instrument used to collect data in the study was Basic Science Achievement Test (BASAT). The t-test statistic was used to test the hypotheses, while means and standard deviations were used to answer the research questions. The study revealed that Jigsaw Learning Strategy was more effective in teaching Basic Science than conventional strategy. Thus, it was recommended, among others, that Jigsaw Learning Strategy should be used in teaching Basic Science at junior secondary level of the education system. Conferences and seminars on Jigsaw Learning Strategy should be organized for teachers in Federal Capital Territory schools.

Introduction

The role of Science Education in the lives of individuals and in the advancement of science and technology for the development of mankind and the society in general, is very crucial. One of such roles is the inculcation of scientific literacy among the populace. Scientific literacy, which is the gateway to achieve scientific and technological advancement and economic survival, is achievable through Science Education. The influence of science on a nation and her citizens could be seen in the production of basic human needs to social, political, educational, technological and economic advancement. The steps which scientists take during scientific investigation (science process) and

the scientific products draw the attention of the society to the fact that science makes life comfortable. Economically advanced nations of the world are distinguished by the excellence of their educational system demonstrated in their academic programmes. Academic programmes of their educational institutions give special attention to science education. However, it is apparent that many of today's science teachers are caught in the web of a change, for which they may not have been professionally prepared. Many teachers were educated in classrooms where role of the students was to memorize information, conduct well-regulated experiments, and then be tested on their ability to repeat these tasks or remember specific facts.

Science educators are constantly interested in how and when to optimally adopt different science instructional strategies in order to achieve stated educational objectives (Orji, 2010). The teaching strategies to be employed by a teacher at any given situation, according to Alebiosu (2003) and Orji (2010), depend on factors arising from teacher and student characteristics, teaching objectives, classroom learning environment, and the nature and needs of the subject. Alebiosu (2003), obviously, the traditional teacher-as-information-giver, or textbooks-guided classroom has failed to bring about the desired outcome of producing thinking students. A much heralded approach is to change the focus of the classroom from teacher-dominated to student-centered using a Jigsaw Learning Strategy (Johnson, Johnson, 2000). This allows for active participation of students in the learning process and makes it possible for the students to have control over their learning and equally leads to improvement in students' learning and retention (Johnson, Johnson & Stane, 2000). Jigsaw learning assumes that students seek information and understanding through active mental search with each group reflecting the make-up of the class in terms of ability, background and gender (Okebukola, 2004).

According to Aronson (2006), Jigsaw is a learning strategy that enables each student of a "home" 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, they return to the "home" group and teach the material to their group members. It could be an effective way of engaging students both with course materials and each other. The jigsaw requires that each student understands the material well enough to teach it to others (individual accountability), and each student is required to contribute meaningfully to the group problem-solving component (group goals).

Slavin (2011) also reported that students in jigsaw class are normally divided into groups of 5 - 6 each. Each group is given a subject which is

divided into smaller parts, equal to the ers so that each student is given a section. After the students have learned their own sections, they regroup, and each member teaches his or her section to the other members of the group. They exchange questions and make sure that the subject is well understood. Integration is achieved by having all the group members to make their presentations, so as to bring all pieces together. Integration strategy may be used in numerous subject matters from elementary school to university. So, to achieve complete learning of a subject matter, each student becomes both a learner and a teacher as well.

Basic science prepares students at the Junior Secondary School level for the study of core science subjects at the Senior Secondary School level (Olarewaju, 1994). This implies that for a student to be able to study single science subjects at the Senior Secondary School level successfully, such student had to be well grounded in basic science at the Junior Secondary School level. In view of this, basic science is given great emphasis in the Junior Secondary School curriculum. The principal reasons why Nigerian Government started Basic Science teaching in Nigerian secondary schools are as follow:

1. It provides students at the Junior Secondary School level a sound basis for continuing science education either in single science subjects or further integrated science;
2. It enhances the scientific literacy of the citizenry;
3. It allows students to understand their environment in its totality rather than in fragments;
4. It allows the students to have general view of the world of science;
5. The processes of science serve as unifying factor for the various science subjects.

It is necessary for the learner to know these processes through integrated approach of learning science (Federal Ministry of Education, 1981). In an attempt to improve the standard of science teaching and learning, a lot of research studies had been carried out. Studies in Basic science education have reported that many students at the Junior Secondary School level have developed negative attitudes towards the subject (Akpan, 1996). Many of the students at this level, because of their dismal performance in the subject, are not benefiting much from the basic science curriculum (Afuwape, 2003; Afuwape and Olatoye, 2004; Odetoyinbo, 2004; etc.). This, according to Afuwape and Olatoye (2004), has prevented many of them from offering core science subjects or performing better in the core science subjects at the Senior Secondary School level.

The Nigerian government's efforts towards making sure that Nigerian children show interest in science and science-oriented programmes (e.g. 60:40 ratio admission policies in favour of the science-oriented programmes, etc) cannot be said to have yielded much fruit. This is because many of the students at the Junior Secondary School level (J.S.S) are not showing interest in studying core science subjects (physics, chemistry, and biology) at the Senior Secondary School level. This has affected them in choosing science-oriented programmes at the Nation's tertiary institutions level. The problem stemmed from the conventional-lecture method being used by the basic science teachers at the J.S.S. level (Odetoyinbo, 2004).

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 teaching method. While jigsaw learning as an instructional method is an option for teachers, it is currently the least frequently used in Nigeria (Johnson &Johnson, 2000).

The basic science, curriculum is child-centered and emphasis is laid more on learning science as a process than as a body of knowledge (Olarewaju, 1994). Hence, teachers should actively involve students in the teaching and learning of basic science because Jigsaw 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 &Johnson, 2000).

While empirical evidence supports the use of Jigsaw learning strategies with a variety of subject areas and age groups within and outside Nigeria, the extent to which these strategies are beneficial in basic science in Nigeria and particularly in Gwagwalada Area Council, Abuja, to the best of researchers' knowledge, is unknown. Moreso, many of the research studies on the effects of Jigsaw learning teaching strategy, most especially in Nigeria, were limited to students' attitude and retention; they did not examine the possible influence of gender on achievement using Jigsaw Learning Strategy of concepts taught. If the Jigsaw learning strategies of teaching are used to teach basic science concepts, what would be their effects on students' academic achievement in basic science? Therefore, the study intent to find out the effect of Jigsaw teaching strategy on the achievement of students in Basic Science in Gwagwalada Area Council, Abuja.

This study was designed to investigate the effects of Jigsaw based Learning on secondary school students' achievement in Basic Science. Specifically, the study sought to find out if there were a difference in achievement between students who are exposed to Jigsaw Learning Strategy and their counterpart in conventional strategy.

Also, the study intends to find out the possible influence of gender on achievement using Jigsaw Learning Strategy.

The following research question and hypotheses guided the study

- What is the difference between junior secondary school students exposed to jigsaw learning strategy and those exposed to conventional strategy?
- What is the difference in achievement to Basic Science between male and female students exposed to jigsaw strategy?
- There is no significant difference between junior secondary school students exposed to jigsaw learning strategy and those exposed to conventional strategy.
- There is no significant difference in achievement of male and female students taught Basic Science using the jigsaw learning strategy.

Method

The research design for the study was quasi-experimental design. The study made use of two groups-experimental and control groups. Participants in the experimental group were taught using jigsaw strategy, while the control group was taught using conventional method. The target population used for this study comprised all JS2 Basic Science students in all public junior secondary schools in Gwagwalada Area Councils of Federal Capital Territory. The experimental group comprised 65 male and female students and the control group comprised 55 male and female students, making a total of 120 students. Simple random sampling strategy was used to select respondents from the Area Council (Gwagwalada Area Council) from where two co-educational institutions were randomly picked from co-educational institutions within the Area council.

The instrument used to collect the data was the Basic Science Achievement Test (BASAT) which consisted of 30 multiple choice objective tests, developed from listed topics of interest to be treated in this research. The questions were drawn out carefully for Junior Secondary two students (JS2) who were the participants of the study. The collected data were analyzed using mean, standard deviation and t-test statistics.

Results

Table 1: Descriptive Statistics Showing Groups' Achievement in the Post-test

Groups	**N**	**x□**	**SD**
Experimental	65	33.89	6.67
Control	55	27.85	6.00

Results in table 1 indicate that subjects in the experimental group had a mean score of 33.89 with a standard deviation of 6.67, while those in the control group had mean a score of 27.85 with a standard deviation of 6.00.In other words, the participants in the experimental group had a higher mean scores (in terms of achievement) than their counterparts in the control group.

Table 2: Descriptive Statistics Showing Experimental Groups' Achievement in the Post test according to Gender

Groups	**N**	**x̄**	**SD**
Male	38	19.45	5.69
Female	27	19.10	6.04

Results in table 2 indicate that male students had a mean score of 19.45, with a standard deviation of 5.69, while the female students had mean score of 19.10, with a standard deviation of 6.04. In other words, the male students had a higher mean score (in terms of gender) than their female counterparts.

Table 3: Two-tailed t-test Result In Respect of Mean Achievement Score between the Groups Exposed to Jigsaw and the Control Group.

Groups	Mean	SD	N	df	t-value	Std.Error	Sig.@0.05	Decision
Exptal.	34.89	6.67	65					
				118	7.44	0.1332	0.0000	Significant
Control	27.84	6.00	55					

Significant at p< .05 level of significant

Results in table 3 show that there was a significant difference; hence, the hypothesis was rejected p< .050. This means that the hypothesis was significant; therefore, the null hypothesis was rejected. Hence, the results have shown that the mean achievement scores of the experimental and control groups did differ significantly from each other.

Table 4 Two-tailed t-test Results in Respect of Mean Achievement Scores between the Male and Female Students Exposed to Jigsaw Learning Strategy.

Gender	Mean	SD	N	df	t-value	Std.Error	Sig.@0.05	Decision
Male	19.45	4.70	38					
				63	0.42	0.1121	0.3311	Not Significant
Female	19.10	5.74	27					

Significant at > 0.05 level of significant

Results in table 4: above show that the significant two-tailed value of 0.3311 at 0.05 was critical at the value of p< .050. This means that the hypothesis was significant; therefore the null hypothesis was accepted. In other words, respondents from both sexes in the experimental group did not differ significantly in their post-test achievement scores.

Discussion

The data presented in table 1. Provide answer to question one; finding revealed that the experimental group had a mean score of 33.89 with a standard deviation of 6.67 while those in the control group had mean score of 27.85 with a standard deviation of 6.00.

The subjects in the experimental group had a higher mean score than their counterparts in the control group. The result of t-test as reported in table 3 showed that there was a significant difference between achievements of students exposed to Jigsaw Learning Strategy and those exposed to conventional strategy. The implication of this finding is that the Jigsaw Strategy of learning is more effective than the conventional strategy of learning. The finding confirms those of Aronson (2002) who in his study found that students exposed to Jigsaw Strategy performed considerably better on examinations than students learning the same materials in classes conducted with traditional instruction. The result corroborated the finding of Huppert, Lomask and Lazarowitz(2002) which showed that students in the jigsaw classroom scored significantly higher in learning outcomes. Also, the study lends support to Okebukola's (2004) study which revealed that students who were exposed to jigsaw learning strategy benefited most from it. The reason could be attributed to the fact that Jigsaw Learning Strategy strengthens the power of interaction among the students which could have led to high achievement. Another reason could be that Jigsaw permits the development of cooperation which may have resulted to the significant difference.

The finding revealed that male students had a mean score of 19.45 with a standard deviation of 5.69 while the female students had mean score of 19.10 with a standard deviation of 6.04. This shows that the male students had a higher mean score than their female counterparts. The result of t-test as reported in table 4 shows that there was no significant difference in male and female students exposed to the Jigsaw Learning Strategy. The finding confirms the finding of Samuel and John (2004). It is pointless to speak of superiority or inferiority of gender especially with Jigsaw Strategy that are found to be effective with male and female students. However, the non-significant difference recorded tend to align with Bilesanmi-Awodera's (2004, 2006), study which showed that there

were no longer distinguishing differences in the cognitive, affective and psychomotor achievement of students based on gender. The reason could be as a result of the fact that Jigsaw Learning Strategy is gender-friendly and it enhances the performance of men and female students by equal margin.

Conclusion

From the findings of the study, the following conclusions could be drawn:

Jigsaw is more effective than conventional learning strategy as it concerns achievement in Basic Science, students learnt Basic Science better when using Jigsaw Learning Strategy than with the use of conventional strategy. Also, it was found that there was no significance difference between the academic achievement of male and female students exposed to Jigsaw.

Recommendations

Based on the findings in this study, the following recommendations are made:

1. Since Jigsaw Learning Strategy has been found to enhance academic achievement of students in Basic science, teachers should be encouraged to incorporate the strategy into their teaching so that students can improve their academic achievement in Basic Science.
2. Furthermore, conferences and seminars on Jigsaw Learning Strategy should be organized for teachers in schools.

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