Effectiveness of Peer-led Guided Inquiry Strategy on Low-Achievers' Retention of Biology concepts in Paiko, Niger State Nigeria

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Abstract

The study investigated the effects of peer-led guided inquiry strategy on low-achievers' retention of Biology concepts in Paiko, Niger State, Nigeria. Two research questions guided the study. Two null hypotheses were tested in the study. Quasi-experimental design (pretest-posttest, non-equivalent design) was specifically adopted for the study. The sample for the study consists of 93 ss2 students drawn from four co-educational schools. The population of the study was the entire senior secondary school two Biology low-achieves' in Paikoro, totalling 1,785 students. Biology Retention Test was use as instrument for data collection and the instrument were validated by expects in the field of science education, educational technology and two secondary school teachers. The scores of the students' obtained from retention Test were analyzed using Analysis of variance (ANOVA) to test the hypotheses. The results of the study indicated that students' exposed to Peer-led Guided Inquiry retained than their counterparts exposed to Traditional Method. Based on the above findings it was recommended that since the strategy is gender friendly, the teaching of Biology should be done through the use of peer-led guided inquiry for low-achieving students.

Keywords
Peer-led, Guided Inquiry Strategy, Retention, Low-Achievers and Biology.

INTRODUCTION

The success in science especially Biology has been associated to the effective acquisition of scientific concepts and skills through activity based learning which includes doing an activity exercises for students to develop scientific knowledge for the attainment of sustainable development (Ogunmade, Bajulaye &

Okedeji, 2007). The importance of Biology is underlined by the fact that it is a compulsory subject and a basic requirement for admission into tertiary institutions for science students. According to Usman & Danbana (2015), Biology is needed for development and future of national industrial hingeson Biology which is regarded as the pillar of science and technology. It serves as a major driving force of economic power in the current society today, especially in the pharmaceutical and beverage industries where materials are converted into drugs, medicines, chemicals and other by products which are useful household equipment made available to man (Gafney & Varma-Nelson, 2008).

Nigeria depends to a large extent on products of Biological sciences, Biochemistry and microbiology such as; drugs, antibiotics, cosmetics beverages and other food products. One basic way of achieving the above, is through methods which involves learning new knowledge in order to building on prior knowledge and helping students to developing cognition through learning by their peers (Gafney & Varma-Nelson, 2008). The group of students can be homogenous or heterogeneous ability or age range. The process involves a variety of instructional strategies which includes; cross-age tutoring (CAT); peer-assisted learning strategies (PALS); reciprocal peer-tutoring (RPT); student team's achievement divisions (STAD); cooperative integrated reading and comprehension (CTRC); team's homes tournaments (TGT); peer-led guided inquiry (PLGI); Jigsaw, Team-Assisted individualization (TAI); simple structures, reverse-role Tutoring and class wide peer-tutoring (CWPT) (Ogunleye, 2010).

Peer-led guided inquiry is a systematic, peer-mediated teaching strategy. Peer-led guided inquiry involves students learning from each other in modes which are symbiotically beneficial and involves exchange of ideas, knowledge, experience and skills among colleagues or participants (Crossgrove & Curran, 2008). In Peer-led guided inquiry student's work together in groups to practice an activity or skills and provide each other with immediate response. It is thus, well-structured teaching plan that can improve the effectiveness of equilibrium literacy programs. (Olorutooba, & Lawal, 2010).

The basic focus of the study is on the Peer-Led-Guided Inquiry (PLGI) which is a learning strategy that allows the students' to actively participate in the class work in Biology thereby enhancing the learning outcomes in Biology. Similarly, the learning strategy basically aimed at correcting the teacher-centred approach of teaching Biology which does not allow group or peer interaction during the learning processes. (Orlich, Harder, Callahum, Travism& Brown, 2010). Adamu (2010) defined low- achiever as a student who has attained his potential and yet performs very poorly in school subjects. So also, Gazi, Oloruntegbe and Orimogunle (2010) opined that, a low-achiever is that student who performs below average in school subjects. Enhanced this may also lead to students' ability to retain concepts better in a given task.

Retention is seen as what is left after learning has taken place over a given period of time. Retention can be the repeat of performance of a task of learnt behaviour earlier acquired. In relation to teaching and learning, it means the act of remembering what has been learnt in the classroom. It is the preservative factor of the mind (Nwagbo&Okoro, 2012).

Danbana (2012) report gender differences in Biology retention, where males do better than females. Although over the past decades the wide gap in Biology retention between male and female learners has been drastically reduced, but the gender imbalances still persist. Several reasons have been attributed to this, one of which is the traditional method of teaching (Wasagu, 2006).The learner's ability to retain concepts taught is also associated with their gender which denotes categorization of students into male and female.

Another study was carried out on the effects of guided inquiry teaching methods on students' achievement in logic among (SS1) students in Jalingo, Taraba State by Njelite (2008). One hundred and ninety-seven (197) students from four senior secondary schools in Jalingo educational zone were used. A simple random sampling technique was used to assign students to the experimental and control groups. Logic Achievement Test (LAT) was used to collect data. The data obtained were analysed using mean,

standard deviation and Analysis of Covariance (ANCOVA). Results from the study revealed that guided inquiry method was significantly better than the conventional methods of teaching in enhancing student's achievement in logic.

Furthermore, Derak (2007) also studied the effects of inquiry and laboratory approaches of teaching Geometry on students' Achievement and interest. A quasi-experimental non-equivalent control group design was used for the study. A sample of ninety-eight (98) Junior secondary schools two (JSS2) students from three (3) schools in Ika Education Zone of Delta State were used for the study. A simple random sampling technique was employed to compose the two treatment and one control groups. Each group consisted of intact classes of male and female students. The treatment groups were taught Geometry using inquiry and laboratory approaches while those in the control group were taught the same geometry using the conventional teaching approach. All the students were pre and post tested with two instruments- the Geometry Achievement Test (GAT) and Geometry Interest Scale (GIS). Data generated from the study were analyzed using mean, standard deviation, t-test and Analysis of Covariance (ANCOVA) techniques in which the respective pre-test of the two dependent variables served as covariate. Results from the study revealed that the laboratory approach had significantly improved students' achievement and interest in geometry more than the inquiry approach.

Another study conducted by Ezenwosu and Nworgu (2013), investigated the efficacy of Peer Tutoring and gender on students' achievement in Biology. The study sample size was 228 senior secondary schools' student. The sampling technique used was purposive sampling to sample government co-educational secondary schools from Aguata in Anambra State. The result analysed in the pre-test and post-test experimental groups showed the male mean achievement scores of 35.95% (SD=1.02) and 61.76% (SD=9.90) respectively while that of the female showed 34.64% (SD=8.45) and 61.59% (SD=9.02) respectively. On the other hand, the mean achievement score of the pre-test and post-test male students in the control group was 35.00% (SD=7.80) and 52.61% (SD=9.70) respectively while that of the female

showed 33.56% (SD=8.16) and 57.06 (SD=1.05) respectively. The result revealed that students taught Biology using Peer tutoring significantly performed better than the students taught using conventional method. The study also showed that there was no significant difference in the mean score of male and female students taught using Peer tutoring. This implies that Peer tutoring enhance gender achievement

Statement of the Problem

Research evidences have shown that Nigerian Secondary Schools Biology Teachers lack the needed skills in identifying and teaching low-achievers' of the subject and they continue to teach students with one method of teaching as if these students study and understand at the same pace or rate. Other researcher also posited that adequate teaching and learning are not taking place as far as Biology is concerned in secondary schools. Students' record poor performance in Biology, it is an evidenced in SSCE examination poor outcomes. Many researchers have used different strategies to salvage the persistence problems such as use of Computer Assisted Instruction, use of Power Points, models, Programme Instruction amongst others, but yet the poor retention of students have persisted Therefore, one of the ways of enhancing the prevailing problems of low academic retention in Biology especially low-achievers' is by enriching its contents, methods and strategies of teaching Biology. Essentially, the overall academic retention of low-achievers' in Biology among secondary school students raises doubts on the efficacy of the teaching strategies used by tutors in schools. The present reforms of science education are the shift from the conventional lecture method of teaching characterized by teacher centeredness to learner cantered approach which enhances the development of conceptual understanding and meta-cognitive capabilities in the students. Therefore, this research work, investigated the effectiveness of Peer-led Guided Inquiry Strategy on Low-Achievers Retention of Biology Concepts in Paiko, Niger State, Nigeria.

Research Questions

The following research questions guided the study:

1. Is there any difference in the mean retention scores of students exposed to peer-led guided inquiry and those exposed to the traditional method?

2. Is there any difference in the mean retention scores of male and female low-achievers when exposed to the peer-led guided inquiry?

Research Hypotheses

The following null hypotheses were formulated to guide the study:

HO_1: There is no significant difference in the mean retention scores in Biology of low achieving students exposed to peer-led guided inquiry strategy and those taught with traditional method.

HO_2: There is no significant difference in the mean retention scores in Biology of male and female low-achieving students exposed to peer-led guided inquiry strategy?

Methodology

This study adopted quasi –experimental design which consists of pretest, posttest non- equivalent control group. The entire population of this study comprised of senior secondary school two (SS2) Biology Low-achievers' in Paikoro Local Government area of Niger State with a population of 1,785 students' based on their school records, report sheets and teachers' ratings while the target population are the low-achievers'. The participants that were sampled for the study comprised of 93 low-achievers' in Paiko, Niger State. Four schools were randomly selected in Paiko, Niger State. The low-achievers' were selected from the intact classes based on their past examination records. The result forms the bases for categorizing the students into high (70-100), medium (40-69) and low ability groups (1-40). The low-achievers' were identified in each intact class for the purpose of recording data that were collected before and after treatment. The four schools selected randomly were categorized into experimental and control groups. A total of two (2) schools (experimental) and two schools (control) respectively. The instruments used for the study were validated by expertise and pilot tested. The instruments are;

1. Operational Guide for Peer-Led Guided Inquiry Strategy (OGPLGIS)

2. Operational Guide for Traditional Lecture Method (OGTLM)

1. Operational Guide for Peer-Led Guided Inquiry strategy consists of 8 lessons that were used to teach the experimental groups. The lesson notes were based on the steps developed by (Quitadamo, Brahler& Crouch, 2010). The basic characteristics of the guide are as follows; the research assistants (teacher) divides the learners into peer-groups, the students' in each peer freely thinks about the approaches to the problem, the tutor roams about the class to ask questions from each peer, sharing of each peer consensus solution for discussion, the research assistant later reinforces the learning process.

2. Operational Guide for Traditional Lecture Method (OGTLM) the guide consists also of 8 lessons based on the traditional lesson. The general guide of the lesson includes; general information, introduction, presentation, evaluation and conclusion.

Results

Mean and Standard Deviation were used to answer research questions and the data obtained was analysed using inferential statistics of the analysis of variance (ANOVA).

Research Question 1: Is there any difference in the mean retention scores of students exposed to peer-led guided inquiry and those exposed to the traditional method?

Table 1. Mean and Standard Deviation of Retention Scores of Peer- led Guided Inquiry and Traditional Group.

Method	N	Post-test		Retention		Mean Diff.
		$\bar{X}$	SD	$\bar{X}$	SD	
Peer-led	43	68.49	12.61	63.60	11.72	4.89

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Traditional	49	46.43	14.97	36.02	13.50	10.41

Table 1 reveals the mean and standard deviation of retention scores of low-achievers' when exposed to peer-led guided inquiry (experimental group) and traditional method (control group). From the table, it was observed that the mean retention scores of students in the two groups differ, where peer-led guided inquiry method had mean scores of 63.60 with standard deviation of 11.72 while the traditional method had mean scores of 36.02 with standard deviation of 13.50. The table further shows that the peer-led guided inquiry recorded higher mean difference score of 4.9 as against 10.41 by the traditional method. This implies that there is difference in the retention of students in the two groups in favour of low-achievers' exposed to peer-led guided inquiry.

Research Question 2: Is there any difference in the mean retention scores of male and female low-achievers' when exposed to the peer-led guided inquiry?

Table 2: Mean and Standard Deviation of Retention Scores of Male and Female Low-achievers' at Post-test when Exposed to Peer-led Guided Inquiry

Group	Gender	N	Post-test		Retention		Mean Diff.
			$\bar{X}$	SD	$\bar{X}$	SD	
	Male	24	68.13	14.28	62.71	11.23	5.42
Peer-led							
	Female	19	68.95	10.49	64.74	12.53	4.21

Table 2 reveals the mean and standard deviation of retention scores of male and female students exposed to peer-led method of inquiry. From the table, the mean retention scores of the two groups differ, where male students had mean scores of 62.71 with standard deviation of 11.23 while their female counterparts

had mean scores of 64.74 with standard deviation of 12.53. The table further shows that male low-achievers' recorded mean difference score of 5.42 as against 4.21 recorded by their female counterparts. This implies that there is difference between the mean retention scores of male and female low-achievers' when exposed to the peer-led guided inquiry.

Table 3. Summary of ANOVA Result of Retention Scores of Experimental and Control Group

Source of Variation	Sum of Square	Df	Mean Square	F	P
Between Groups	17426.046	1	17426.046	108.04*	.000
Within Groups	14515.259	90	161.281		
Total	31941.304	91			

*Significant at 0.05 level

There is no significant difference in the mean retention of male and female low-achievers' exposed to peer-led guided inquiry strategy?

The table 3. Reveals that significant difference exists in the retention scores of low-achievers' exposed to the peer-led guided inquiry and traditional method ($F_{(1, 90)}$ = 108.04, $p < 0.05$). Hence, the hypothesis was rejected. This implies that significant difference exists between the retention scores of low-achievers' exposed to peer-led guided inquiry and traditional method.

Table 4. Summary of ANOVA Result of Retention Scores of Male and Female Students in the Experimental Group

Source of Variation	Sum of Square	df	Mean Square	F	P
Between Groups	43.637	1	43.637	.313NS	.0579
Within Groups	5722.643	41	139.577		
Total	672.119	41			

NS: Not Significant at 0.05 level

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The table 4. Reveals that significant difference does not exists in the retention scores of male and female low-achievers when exposed to the peer-led method of inquiry ($F_{(1, 41)}$ = 0.313, p> 0.05). Hence, the null hypothesis was retained. This implies that significant difference does not exists between the retention scores of male and female low-achievers' exposed to peer-led guided inquiry.

Discussion of Results

The ANOVA result of the impact of peer-led guided inquiry strategy on low-achiever's retention in biology showed that there was a significant difference in the mean retention scores of the experimental group than their counterparts in the control group. As a result, the null hypothesis which states that, there is no significant difference in the mean retention scores in Biology of low achieving students exposed to peer-led guided inquiry strategy and those taught with traditional method was reject. The result therefore, is supported by the finding of Nworgu (2005) who noted that the experimental group i.e. those taught using] peer-led guided inquiry strategy perform better in Biology and Chemistry than the control group. Also in agreement with the findings of Olufumilayo (2010) who study revealed that students taught using the guided inquiry method performed significantly better than those taught using the demonstration and conventional methods. The finding is in agreement also with the findings of; Dekar (2007),Crossgrove and Curran (2008) who noted that, students taught using guided discovery method perform significantly better than those exposed to traditional method of teaching. To justify the result or findings it showed that the teaching strategy (peer-led) had impact on the low-achiever's retention because of the more relax atmosphere in the tutorial process by their peer.

The result in hypothesis two also revealed that, there was no significant difference in the retention of low-achievers' (exposed to the teaching of Biology by a peer). The ANOVA comparison showed that male and female had equal tendencies to excel in Biology when exposed to the peer – led guided inquiry strategy of teaching. Hence the null hypothesis which states that, there is no significant   difference in the mean

retention scores in Biology of male and female low-achieving students exposed to peer-led guided inquiry strategy was retained. The finding is in agreement with the finding of Nwagbo and Chukelu (2001) who observed that gender was not a significant factor in Biology. Hence male and female retention was equivalent when exposed to peer-led guided discovery. The finding is in disagreement with that of; Nworgu (2005) who established that female students performed better than their male counterparts in Biology when taught using guided inquiry and demonstration methods of teaching.

Conclusion

Based on the findings above, peer – led guided inquiry strategy is considered to be an effective teaching and learning strategy to improve low-achievers' retention in Biology concepts and it gives students high degree of independence needed to communicate effectively and to help their fellow students to comprehend abstract concepts through the supervisory role of their teachers. The experimental group impacted significantly better than their counterparts in the control group exposed to the conventional method of teaching. It also revealed that there was no disparity in terms of the impact of peer – led guided inquiry strategy on gender retention (male and female) in Biology. In order words, peer – led guided inquiry strategy is gender friendly.

Recommendations

Based on the findings the following recommendations were made;

1. Since the strategy is gender friendly, the teaching of Biology should be done through the use of peer-led guided inquiry for low-achieving students.

2. The state, federal and other agencies should ensure that teaching of Biology is shifted from teacher dominated approach that is teacher-centred to students-centred peer-led guided inquiry has the potential to impact positively on the retention of male and female students.

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