

IMPACTS OF PEER-LED GUIDED INQUIRY STRATEGY ON LOW-ACHIEVERS ACHIEVEMENT OF BIOLOGY CONCEPTS IN PAIKO, NIGER STATE NIGERIA

ALI, FATI;¹ ALABI, T. O.;² KUTA, I. I.;³ TUKURA C. S.;⁴ NDATSU, A.⁵;
& MOHAMMED AMINA NANA⁶

Department of Educational Technology^{1,2,3,4&6}

Science Education Department⁵

Federal University of Technology, Minna

Email: fatitahiru@gmail.com; ¹ dralabiomotayo2012@gmail.com;²

Phone No: +234-803-517-9715; +234-803-857-3000

Abstract

The study investigated the Impacts of Peer-led Guided Inquiry Strategy on Low-Achievers Achievement of Biology Concepts in Paiko, Niger State, Nigeria. Two research questions were used to guide the study. Two Null hypothesis were used for the study. Quasi-experimental design (pretest-posttest, non-equivalent design) was specifically used for the study. The population of the study was the entire senior secondary school two Biology low-achievers in Paikoro totalling 1,785 Students. The sample was 93 Low- Achievers drawn from four co-educational schools that were randomly selected. The research instruments (BAT) were validated by experts in the field of Science Education and Educational Technology. A pilot test was conducted to determine the reliability of the BAT items. The data obtained from the pilot test was analysed using Pearson Product Moment Correlation Coefficient and reliability coefficient of 0.57 was obtained. The scores of the students obtained from the posttest were analysed using Analysis of Covariance (ANCOVA) to test the hypotheses. The results of the study indicated that students exposed to Peer-led Guided Inquiry performed significantly better than their counterparts exposed to Traditional Method. Based on the above findings it was recommended that the tutors of Biology should as a matter of urgency utilize interactive teaching methods such as Peer-led Guided Inquiry Strategy in teaching and learning of the subject Biology.

Keywords: Peer-led, Guided Inquiry Strategy, Achievement and Low-Achievers

Introduction

The success in science especially Biology has be 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). One basic way of achieving the above, is through methods which involves learning by new knowledge by building on prior knowledge and helping students to developing cognition through learning by peers. (Gafney & Varma-Nelson, 2008). The groups 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 teams achievement divisions (STAD); cooperative integrated reading and comprehension (CTRC); teams 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-centered 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- achievers 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. Achievement has been defined differently by many scholars and researchers, some of these definitions are: Achievement can be defined as something that has been done or achieved through effort, as a result of hard work. Also, it is the act of achieving something; the state or condition of having achieved or accomplished something (Carrier, 2005).

Statement of the Problem

Research evidences has shown that Nigerian Secondary Schools Biology Teachers lack the needed skills in identifying and teaching low-achievers of the subject. Secondary schools tutors continue to teach students with one method of teaching as if these students study and understand at the same pace or rate (Usman & Danbana, 2012). Similarly, other researcher posited that adequate teaching and learning are not taking place as far as Biology is concerned in secondary schools. Therefore, one of the ways of enhancing the prevailing problems of low academic achievement in Biology especially low-achievers is by enriching its contents, method and strategies of teaching of Biology. Essentially, the overall academic achievement 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 is the shift from the conventional lecture method of teaching characterized by teacher centeredness to learner centered approach which enhances the development of conceptual understanding and meta-cognitive capabilities in the students. In addition, the methods utilized by the tutors do not encourage self-construction of knowledge, self-assessment and social interaction among students. Therefore, this research work, investigated the Impacts of Peer-led Guided Inquiry Strategy on Low-Achievers Achievement of Biology Concepts in Paiko, Niger State, Nigeria.

Research Questions

- (i) Would there be any difference in the mean achievement of low-achievers Biology students exposed to peer-led guided inquiry strategy and those taught with traditional method?
- (ii) Could there be any difference in the mean achievement of male and female low-achievers exposed to peer-led guided inquiry strategy?

Research Hypotheses

The following null hypotheses were formulated to guide the study:

HO₁: There is no significant difference in the mean achievement scores of Biology students exposed to peer-led guided inquiry strategy and those taught with traditional method.

HO₂: There is no significant difference in the mean achievement scores of male and female low-achievers 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 group. A total of two (2) schools (experimental) and two schools (control) respectively. The instruments that were used to conduct this study are;

- (i) Operational Guide for Peer-Led Guided Inquiry Strategy (OGPLGIS)
- (ii) Operational Guide for Traditional Lecture Method (OGTLM)
- (iii) Biology Achievement Test (BAT)

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.

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.

Biology Achievement Test (BAT) was developed by the researcher based on an approved table of specification for test items. Twenty multiple choice items were developed with five (5) options (answers) with only one correct option.

The instructional guides and Biology achievement test were given to four university lecturers, a secondary school Biology teacher, for face and content validity. Their comments, suggestions and corrections were used to reconstruct the guide and also to fine tune the test instrument and ensure its suitability for the class it was meant to serve.

To determine the reliability of the BAT, a pilot test was conducted in Day Secondary school Gabadna, Niger State. Test-retest method was used on a sample of thirty students in the same ratio (15 males, 15 females). The first test was administered to the whole class but low-achievers were identified before the administration this was because the low-achievers should

not feel rejected, but after the test the scripts of the target participants was separated and marked. After a period of two weeks the same test was re-administered to the class and the same procedure was taken. The two scores from the tests were computed and analysed using Pearson Product Moment Correlation and reliability index of 0.57 was obtained

Method of Data Collection

Before the administration of the instruments the researcher visited the schools with a permission letter from the Head of Department to seek for permission to use their schools and the subject teachers.

The researcher trained the research assistants on the use of the operational guides for peer-led Guided Inquiring strategy and the operational Guide for conventional lecture method for one week. There after pretest was administered to the sampled classes in all the sampled schools in Paiko, Niger State. The fourth week was the commencement of the teaching procedure in line with the operational guides. The research assistants give the students notes on the topic to be treated and the peer-led groups leaders carry out the teaching in line with the steps as designed by (Quitadamo, Brahler & Crouch, 2010).

Phase One: preliminary stage/Problem Analysis phase.

Step one 1: The tutor group the students in units/peers between 4 and 6 in combined ability level based on the pretest scores and the learners begin to identify the problem

Step 2: The learners begin to freely develop creative strategies to the problem by orally explaining, drawing or responding to their thought process.

Step 3 the learner break down the component of each problem, discusses adequate ways of arguing over the merit of each strategy until they arrived at consensus

Phase two: Activity session (learner as facilitator)

Step 1: Each peer's solution is shared out to other peers. This will enable each peer to correlate their work with others and reflect on their problem-solving effectiveness.

Step 2: The tutor give the process and the solution feedback to each peer.

Step 3: The tutor goes ahead to reinforce the peer-led learning by including same type of problem-solving questions.

Control Group: The traditional method of lesson: The following stages were used for the lesson:

Step 1: The tutor leads the lesson by introduction

Step 2: The tutor highlights the theory about the topic

Step 3: The tutor presents the lesson by explaining the content of the lesson step—wise

Step 4: Tutor summarizes the lesson and writes the note on the black board.

Step 5: Tutor concludes the lesson answer learners' questions.

Step 6: Tutor then evaluates the lesson by allowing the student to undertake some exercises and write down their result and ask questions

Step7: The tutor collects the exercises and mark.

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) of the pretest and posttest scores

Research Question One: Is there any difference in the Mean achievement scores of low-achievers exposed to peer-led guided inquiry and those exposed to traditional method?

Table1: Mean of Achievement Scores of Peer-led Guided Inquiry and the Traditional Method at Pre-test and Post-test

Group	N	Pre-test	Post-test		Mean Gain
		\bar{X}	\bar{X}	SD	
Peer-led	44	27.91	68.49	12.61	40.58
Traditional	49	26.22	46.43	14.97	20.21

Table 1 reveals the Mean of pre-test and post-test scores of students exposed to peer-led guided inquiry (experimental group) and the traditional method (control group). From the table, it was observed that the Mean scores of the two methods at post-test differ; Students exposed to peer-led guided inquiry had Mean scores of 68.49 while students exposed to the traditional method had Mean scores of 46.43. The table further, shows that the peer-led guided inquiry group recorded higher Mean gain score of 40.58 as against 20.21 recorded by the traditional method group. This implies that there is difference between the low-achievers' achievement exposed to the two methods in favour of students exposed to the peer-led guided inquiry method.

Research Question Two: Is there any difference in the mean achievement scores of male and female students exposed to peer-led guided inquiry?

Table 2: Mean of Achievement Scores of Male and Female Low-Achievers at Pre-test and Post-test when Exposed to Peer-led Guided Inquiry

	Gender	N	Pre-test	Post-test		Mean Gain
			\bar{X}	\bar{X}	SD	
Peer-led	Male	24	26.67	68.13	14.28	41.46
	Female	19	29.47	68.95	10.49	39.48

Table 2 reveals the Mean of male and female low-achievers exposed to the peer-led guided inquiry. From the table, the Mean scores of male and female students exposed to Peer-Led Guided Inquiry at post-test differs, where male students had mean scores of 68.13 while their female counterparts had Mean scores of 68.95. The table further shows that male students recorded Mean gain score of 41.46 as against 39.48 recorded by their female counterparts. This implies that difference exists between the Mean achievement scores of male and female low-achievers when exposed to peer-led guided inquiry.

Table 3: Summary of ANOVA Result of the Pre-test Scores of Low-achievers when Exposed to Peer-led Guided Inquiry and the Traditional Group

Source of Variation	Sum of Square	df	Mean Square	F cal	P
Between Groups	64.831	1	64.831	0.519 ^{NS}	0.47
Within Groups	11238.159	90	124.868		
Total	11302.980	91			

NS: Not Significant at 0.05 level

Table 3 shows the ANOVA comparison of pre-test scores of low-achievers when exposed to the peer-led guided inquiry and the traditional methods. The table reveals that there is no significant difference in the pre-test scores of the two groups ($F_{(1, 90)} = 0.519, p > 0.05$). Hence, Analysis of Variance (ANOVA) was used in testing the null hypotheses in this study.

HO₁: There is no significant difference in the Mean achievement scores of Biology students exposed to peer-led guided inquiry strategy and those taught with traditional method.

Table 4: Summary of ANOVA Result of Post-test Achievement Scores of Experimental and Control Group

Source of Variation	Sum of Square	df	Mean Square	Fcal	Pvalue
Between Groups	11144.995	1	11144.995	57.558*	.000
Within Groups	17426.744	90	193.630		
Total	28571.739	91			

*: Significant at 0.05 level

Table 4 shows the ANOVA comparison of post-test scores of low-achievers in experimental group i.e those taught with the peer-led guided inquiry method and those taught with the tradition method. The table reveals a significant difference in the post-test scores of the two methods ($F_{(1, 90)} = 57.558, p < 0.05$). Hence, hypothesis one was rejected. This implies that there is significant difference between the achievement of low-achievers exposed to peer-led guided inquiry method and traditional method.

HO₂: There is no significant difference in the mean achievement scores of male and female low-achievers exposed to peer-led guided inquiry strategy.

Table 5: Summary of ANOVA Result of Post-test Achievement Scores of Male and Female Students in the Experimental Group

Source of Variation	Sum of Square	Df	Mean Square	F	P
Between Groups	7.172	1	32.508	.044 ^{NS}	.835
Within Groups	6669.572	41	162.672		
Total	6676.744	42			

NS: Not Significant at 0.05 level

Table 5 shows the ANOVA comparison of post-test scores of male and female low-achievers in the experimental group. The table reveals that no significant difference exists in the post-test scores of the two groups ($F_{(1, 41)} = 0.044, p > 0.05$). Hence, hypothesis two was not rejected. This implies that significant difference does not exist between the achievements of male and female low-achievers exposed to peer-led guided inquiry strategy.

Discussion

The result of the study revealed that the achievement level of the students in Biology (Low-achievers) was generally low at the initial stage of the study (pretest result) but the level of achievement improved significantly in the experimental group after the treatment. The ANOVA result of the impact of peer-led guided inquiry strategy showed that there was a significant difference in the mean achievement scores of the experimental group than their counterparts in the control group. 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 achievement 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 achievement 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 injury strategy of teaching. 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 achievement was equivalent when exposed to peer-led guided discovery. The finding is in dis agreement with that of; Nworgu (2005) who established that female students performed better than their male counterparts in Biology when taught using guided injuriy and demonstration methods of teaching.

Conclusion

Based on the findings above the following conclusion were drawn; the study established that peer – led guided inquiry strategy of teaching Biology concepts to low-achievers 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 achievement (male and female) in Biology.

Recommendations

Based on the findings the following recommendations were made;

- (i) The curriculum planner's educators are of the view that learning should be child centered or student centered and activity based; therefore, teaching should be made interactive through the use of peer-led guided inquiry which is known to impact positively on low-achievers achievement.
- (ii) Since the strategy is gender friendly, the teaching of Biology should be done through the use of peer-led guided inquiry especially to the low-achievers who tend to achieve better than their peers.

References

- Adamu, B. (2010). Enriching science technology and mathematics education in Nigeria: Problems and Prospects key note address in matt A.G.A. (Ed.) 41st Annual Conference Proceedings, 2000 STAN HEBN PLC.
- Carrier, K. (2005). Key issues for teaching learners in the classroom. *Middle School Journal*, 37 (4), 17-24.

- Crossgrove, K., & Curran, K. L. (2008). Using clickers in non-majors and majors level Biology courses: students opinion, learning, and long-term retention of course material. *CBE Life Sci. Educ.*, 7,146-154.
- Gazi, M. A., Oloruntegbe, K. O., & Orimogunje, T. (2010). Volumetric analysis chemistry students performance: combined influence of study habit, physiological and psychological factors. *Scientific Research and Essays*, 5(11), 1325-13332.
- Gafney, L., & Varma-Nelson, P. (2008). Peer-led team learning: evaluation, dissemination, and institutionalization of a college level initiative. In: *Innovations in science education and technology*. (16.ed) New York, Springer: K.C. Cohen.
- Nworgu, I. N. (2005). Effect of gender sensitization package on students achievement in integrated science. *Journal of Science Teachers Association of Nigeria*, 40(1&2), 74-78.
- Nwagbo, C. R., & Chukelu, U. C. (2001). Effects of Biology practical activities on students' process skills acquisition. *Journal of Science Teachers' Association of Nigeria*, 46,(1), 58-70.
- Ogunleye, B. O. (2010). Implementation of chemistry practical work in senior secondary schools in Ogun State, Nigeria. *African Journal of Educational Management*, 13 (2), 227-242.
- Ogunmade, T. O., Bajulaye, A. A., & Okedeji, S. A. (2007). The state of learning resources in secondary science, technology and mathematics (STM) education for sustainable development in Lagos State.
- Olorutooba, S. B., & Lawal, F. K. (2010). Effects of science – technology society (STS) approach and lecture method on academic advancement creative traits development of junior secondary school integrated science students. *Journal of Studies in Science and Mathematics Education*,1(1), 26-32.
- Olufunmilayo, J. O. (2010). Comparative effects of guided – discovery and concept mapping strategies on students' achievements. *Humanities and Social Science Journal*, 5,(1), 1-6.
- Orlich, D. C., Harder, R. J., Callahan, R. C., Trivisan, M. S., & Brown, A. H. (2010). Teaching strategies: A guide to effective instruction. Ninth edition. Lusa: Wadsworth Cengage Learning.
- Quitadamo, I. J., Brahler, C. J., & Crouch, G. J. (2010). Peer-led team learning: A prospective method for increasing critical thinking in undergraduate science courses. *Science Educator Spring*, 18(1), 29 – 39.
- Usman, I. A., & Dambana, B. T. (2012). Effects of science-technology-society (STS) instructional strategy on gender difference in genetics among NCE students. *Nigerian Educational Forum*, 20(1),153-165.