

EFFECT OF INQUIRY METHOD ON STUDENTS' ACADEMIC ACHIEVEMENT IN BIOLOGY AT SENIOR SECONDARY SCHOOL IN IDAH KOGI STATE

ABU, Alice Oladehinde (PhD)

Department of Science Education

Faculty of Education

Prince Abubakar Audu University Anyigba,

Kogi State, Nigeria

Corresponding Author: abu.a@ksu.edu.ng

Abstract

The study examined effect of guided inquiry and conventional instructional methods on students' achievement in biology. A total of senior secondary two 61 students with average mean age of 18.1 years were randomly sampled from Idah education zone, Kogi state, Nigeria. The instrument used in collecting data was a 20 item-4 option multiple choice and 2 essay questions namely Biology Achievement Test (BAT) developed by the researcher on the concept Pollution. The BAT was used to measure students' Achievement in the pre-test and post-test. The investigator developed guided inquiry and lecture methods lesson notes. The test items, lesson notes and marking scheme for these methods were validated and found reliable before use. The test had a reliability of 0.87 using test-retest approaches. Pre-test-post-test experimental control group design was used. The experimental group was taught using guided inquiry method, while the control group had their lessons instructed with traditional lecture instructional method. The pre-test result showed that, the two schools were comparable before the administration of the treatment respectively. The test scores for the post-test collected were used for data analysis and testing of the hypothesis. The hypothesis was tested at 0.05 level of significance. The t-test for two independent groups' results showed that students taught with guided inquiry method achieved better in Biology than those taught with the lecture instructional method. The study showed that students taught with guided inquiry method had higher mean score enhanced the academic achievement of learners in biology, than the traditional instructional method. Even though the subjects in the experimental and control groups were equated in terms of pre-test, there were differences of the students taught with guided inquiry instructional method and lecture instructional method. The researcher commended among others that for the improvement of the quality of teaching and learning in science and enhancement of the students' performance using guided inquiry method should be encouraged and established.

Keywords: Inquiry method, Academic Achievement, Biology, Students

Introduction

Biology is a science subject and a core or precondition subject to one who wants to study courses relevant to general biology, medicine, nursing, agriculture, bio-chemistry and biology education amongst others. This is further confirmed by the requirements for admission into Nigerian universities as outlined in the Joint Admission and Matriculation Board (JAMB, 2019). Despite the significance and position biology subject occupied as a core / pre-requisite and admission requirements in Joint Admission and Matriculation in some disciplines' in Nigerian Universities such as Medicine, Pharmacy, Biochemistry, Science Education among others. Evidence abounds that lends support to the claim of low level performance in Senior

Secondary Certificate Examination (SSCE) Olorundare (2014) and West African School Certificate Examination (WASSCE, 2012).

Some studies have demonstrated that student's academic performance in senior secondary school certificate biology and other science subjects' examinations since eighties had remained poor (Olorundare, 2014). Therefore, it become obvious that there have been no appreciable improvement in the general performance of students that sat for biology in the senior secondary certificate examination over the years Abu, (2008). The reason is not farfetched, based on some studies attributing the poor performance of students in SSCE biology to intelligence aptitude and socio-economic background.

Others attributed it to teaching methods Ugwuadu (2011). Instances of poor instruction abound in schools. Obiekwe (2008), opined that many science teachers prefer the traditional lecture method of teaching. The traditional method according to these scholars is mainly authoritarian in nature. Naboth (2012) and David (2017) observed that teachers who provide a good teaching method and teacher's student relationship and apply good teaching methods might improve academic achievement of students thereby motivating them to score high marks. Gillis, (2004) mentioned that science – centered approach of teaching which had been reported to be more effective in realizing the objectives of the subject whereby more than one sense organ is involved by the learner to achieve his/her aims. According to Nwagbo (2006); any approach that guarantees improved process of teaching science (biology) to achieving the specified objectives of the lesson and performance should therefore be investigated for possible implementation. From this viewpoint guided inquiry instructional method could offer a better alternative against traditional lecture instructional approach in senior secondary school education.

Guided Inquiry instructional method according to Muhammed (2011), has been described as problem solving and a method of teaching that involves probing, finding out, questioning, thinking, analyzing, synthesizing, discovering and evaluating. A variety of studies investigated the effectiveness of inquiry of inquiry instructional method as it enhanced the student's performance in science subjects Muhammed (2011). Ugwuadu (2010), concluded a study on the effect of guided inquiry and lecture methods on students' academic achievement in biology in senior secondary school using SS1 students, the results of the findings revealed that guided inquiry strategy proved more effective than the lecture method in enhancing students' academic achievement in biology.

Also Opara (2011) compared guided inquiry teaching methods on Senior Secondary One (SS1) biology students results showed that inquiry teaching method favors the students more than the subjects taught with traditional lecture method with less mean scores. Similarly studies carried out by Ogunbiyi. (2012), Ifeanyi – Uche and Ejabukwa (2013) and Unogu (2015) respectively using guided instructional method and traditional lecture method on student's academic achievement in biology in senior secondary schools. Results of the findings revealed that students with guided inquiry instructional strategy offer as a technique of teaching biology in the senior secondary school in Nigeria thus, this study was backed upon. Unless such a study is made the soundness of the choice of guided inquiry as a teaching strategy or technique cannot be defended.

Statement of the Problem

A lot has been done to improve teaching of biology in secondary schools in Nigeria such as using different innovative teaching strategies, training and retraining of biology teachers, provision of laboratory equipment among others. In spite of that, students continue to perform poorly in biology. This situation has created the need for more effective method. It then becomes necessary to explore the efficacy of alternative method of redressing this situation. Therefore, the problem of this study posed as a question is which of the two identified

teaching methods guided inquiry and traditional (Lecture) Methods would enhance SS II students' achievement in Biology concepts in Idah, Kogi State, Nigeria.

Research Questions

Research question one: What is the differences in the mean score of students taught with guided inquiry method and those taught with traditional lecture method?

Hypothesis

One null hypothesis was formulated and tested at 0.05 level of significance.

H₀1: There is no significant mean difference between the post-test mean scores of students taught biology using guided inquiry method and those with the traditional method.

Method

The research design adopted for this study was a quasi-experimental group design. The experimental and control groups were pre-tested before treatment and post-tested after the treatment was administered. The population of the study comprised all the 1,401 senior secondary school two (SS2) students in Idah educational zone of Kogi state, Nigeria. Two senior secondary schools were randomly selected for the study and randomly sorted out into experimental and control groups. The researcher selected these schools in order to have subjects with similar educational backgrounds. The considerations for comparable educational standard were: teachers are recruited by the same body using set down criteria by the state ministry of education. The same state government funds supplies science equipment and other teaching resources to the schools on an equitable basis. The schools use the prescribed West African School Certificate syllabus for Biology. These students were also admitted through the State Ministry of Education, Kogi State, Nigeria. The experimental and control groups were made up of 30 biology students each. The number of sample selected was guided by central limit theory. Sambo (2008), proposed that a minimum of 30 students are viable for experimental studies of this nature.

The instrument used was a research-developed 20 item, 5 option multiple choice test and 2 essay Biology Achievement Test (BAT) questions constructed on Food Tests for the pre/post-test. One secondary school biology teacher, two university biology senior lecturers as well as a specialist in test construction, validated these materials to ascertain their appropriateness for the study. The pretest and posttest marking schemes, as well as the lesson notes for the control and experimental groups developed by the researcher were examined for content validity and appropriateness for the two groups. The materials were revised in line with the corrections and recommendations made before they were used in the selected schools. The achievement instrument was pilot-tested to establish its reliability. The reliability co-efficient when computed gave $r=0.87$. This value of 0.87 showed that the test was reliable and as such would test what it was out to test.

The achievement test was administered to both the students in the experimental and control groups, before test questions were based on the teaching topic selected for the study. The achievement test was designed for a period of two hours. The aim of the pre-test taken by the two groups (i.e. experimental and control) was to determine student's initial knowledge of the material they would learn later for the study. The pre-test was also used to determine the comparability of the two groups with regards to their achievement on the pre-test scores. The outcome of the results for experimental and control groups were equivalent or comparable

before the commencement of the experimental study. The summary of the result is presented in Table 1.

Table 1

T-test on Mean, Standard Deviation, and T-ratio of the Pre-Test Mean Scores for Experimental and Control Groups

Group	N	X	Sd	t-cal	T-Crit	P.Value	Remark
Experimental	30	10.75	8.65	0.64	1.99	0.05	Not significant
Control	30	10.77	8.73				

* Not Significant at $P < 0.05$

There is no significant mean difference between experimental and control group scores in the pre-test, t-value of 0.64 is not significant at $P < 0.05$. From Table 1, the result suggests that the experimental and control groups were similar because the calculated t-value of 0.64 was less than the critical t-value of 1.99 at 0.5 alpha level of significance. Table 1 also shows the mean and standard deviation of scores for the pre-test scores of the experimental and control groups. It can be seen from Table 1 that the mean of 10.75 with the standard deviation of 8.65 for the experimental group was close to the mean of 10.77 with the standard deviation of 8.73 of the control group. Therefore, the two groups may be described as having similar characteristic parent populations for all practical purposes.

Immediately after the pre-test the groups were exposed to instructional techniques; the experimental group to guided inquiry. Most of the lessons were activity based. Students were engaged doing things either individually or groups and advancing the desired goal. The traditional lecture method was used to direct the lessons of the control group, on the same concept, "Pollution". In using this method, the researcher delivered the pre-planned lessons to the students with or without materials or instructional aid. In this approach, the researcher proceeded directly to the task of solving the problem without giving the students the opportunity to discover things on their own or find solution to the problem. Interaction between the students and the teacher was minimal. The students were not given the opportunity to contribute fully in the lesson. In short the delivered was teachers' centered.

At the end of the exercise, a similar test used as pre-test was administered as post-test for each group. The treatment was given in four lessons for two weeks in each group. A waiting period of fourteen days was allowed for the groups before administering the post-test. This waiting period was to minimize the possibility of students remembering items in the pre-test the researcher first administered. The post test scores were used to measure the effect of guided inquiry instructional method under investigation.

Results

The data collected through the post-test for control and experimental groups were scored. For analysis, the two study groups in respective of schools were pooled together according to the method of instruction used and computed. In order to compare groups' differences t-test for independent groups was used. The result of the analysis is shown in Table 2.

Table 2:

Summary of t-test comparison of the post-test mean scores of experimental and control group in Biology Achievement Test (BAT)

Group	N	X	SD	df	T-cal	T-Crit	P-Value	Decision
Experimental	31	79.53	13.97	38	10.7	1.96	0.01	Significant
Control	30	29.83	8.07					

Significant at $P \leq 0.05$

The result in Table 2 reveals a statistical significance difference between the post-test mean scores of students taught with the guided inquiry method and those with the traditional method. This is significant because the calculated t-ratio 10.7 is greater than the t-critical value of 1.96 at 0.05 level of significance. Also the p-value 0.01 is lower than the level of significance of 0.05. It can be seen from Table 2 that the mean score of 79.53 and standard deviation of 13.97 for experimental group that was taught with guided inquiry instructional method, was higher than the mean score of 29.03 and standard deviation of 8.07 for the control group that was taught using traditional lecture instructional method. It can be concluded that there was a significant difference between groups exposed to guided inquiry method and traditional instructional method in their achievement in biology, in which it was in favor of the experimental group. Based on this result, the null hypothesis was rejected.

Discussion

The result in Table 2 showed that the post-test means scores of subjects in experimental group in guided inquiry method was greater than that of the subject in control group traditional lecture method. This shows that the use of guided inquiry approach in teaching biology is potentially viable in enhancing students, academic achievement at senior secondary level of education. Therefore, the result of this study supports Muhammed (2011) who opined that the better performance of students taught using guided inquiry approach compared with those taught using traditional lecture instructional method underscores the importance of greater involvement and learning of science concepts. It should be noted that e-learning methods, as the guided inquiry, allow learners to achieve the objective of the concept taught. Besides evoking and sustaining interest, it concretizes learning and making learning less stressful. The observed facilitative effect of guided inquiry method on students, concept attainment in biology supports Ugwuadu (2010); Opara (2011); Ogunbiyi (2012); Ifeanyi-Uche & Ejabukwa (2013) & Onoga (2015) and Okolochas (2010) holds great potential for enhancing students' performance in biology thereby making their mean scores to be higher. Therefore it is very necessary for teachers of biology to review their approaches and method of teaching.

Conclusion

This study has shown that guided inquiry instructional approach can be used to enhance the academic achievement of learners in Biology, than lecture instructional method. Even though, the subjects in the experimental and control groups were equated in terms of

pre-test, there were differences of the subjects taught with guided inquiry and traditional instructional method.

Recommendations

From the findings of this study, the following recommendations are made:

- i. Biology teachers' should adopt guided inquiry technique in teaching biology concepts in view of its high facilitative effect on students' performance.
- ii. For the improvement of the quality of teaching and learning in biology and enhancement of the students' performance should be integrated into science classrooms.

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