Investigating the Effect of Inquiry and Lecture Methods on Students' Achievement in Biology

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ABSTRACT

This study was conducted to investigate the effect of inquiry and lecture methods on secondary school students' achievement in Biology. Two research questions and two hypotheses were formulated to guide the study. The study adopted quasi-experimental pre-test, post-test, control group research design. Three hundred and twenty (320) Biology senior secondary school one students from nine (9) selected sampled schools in Delta Central Senatorial District were used as research sample. The simple random sampling technique was used to select the sampled schools. The experimental group was exposed to inquiry method while the control group was taught with lecture method. Biology Achievement Test (BAT) was used to collect data for both pre-test and post-test. A reliability coefficient of 0.77 was obtained using Kuder-Richardson Formula 21. Data collected was analyzed using statistics of mean and standard deviation to answer the research questions and t-test and analysis of variance (ANOVA) to test the hypotheses at 0.05 level of significance. The results showed that there was significant difference in the achievement of students instructed using the inquiry and the lecture method in favour of inquiry method; there was no significant difference in the achievement of male and female students instructed using the inquiry and the lecture methods. It was concluded that inquiry and lecture methods of teaching enhance students' achievements Biology but inquiry method was more effective for the improvement of Biology students' achievements. Based on this, recommendations were made.

Keywords: Inquiry method, Lecture method, Academic achievement.

INTRODUCTION

Biology is the scientific study of life. Its study has a pivotal position in science and technology because of its nature and importance attached to life. Biology is the branch of natural science that is concerned with the study and research on living things including their taxonomy, structure and function (Obigbor & Ajaja, 2023). The study of Biology covers many areas such as Cell Biology, Botany, Zoology, Genetics, Ecology, Biochemistry, Microbiology etc. Biology helps students to acquire scientific knowledge and skills to build their lives and the nation.

According to Federal Ministry of Education (FME, 2008), At the secondary school level, the goals of the Biology curriculum are to help students develop the laboratory and field skills necessary to study Biology, as well as the content knowledge and analytical reasoning skills necessary to apply that knowledge to issues of individual and community health, agriculture, and practical scientific attitudes.

Teaching and learning Biology effectively to raise students' academic performance is crucial to accomplishing the goals outlined above. In order to achieve the goals of science education in secondary schools, research has shown that the current mode or strategy of teaching and learning of science subjects, including Biology, requires a significant change or transition from teacher-centred instructional strategies to student-centred instructional strategies such as inquiry-based learning, concept mapping, problem-based learning, project-based learning, discussion instructional strategy, etc. Improving students' academic performance and conduct through more effective scientific teaching necessitates taking into account

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students' individuality, the classroom environment, specific learning scenarios, and the content itself (attitudes) (Obro, 2022).

According to Ajaja and Eravwoke (2010), making Biology learning effective is related to study skills or behaviour and the teaching methods applied by teachers to make students to learn better if they are given the opportunity to participate actively in teaching-learning process. Activity- based teaching methods that help students to retain information, practice the work they learned, reflect and review the knowledge they acquired (Obro, Ogheneaokoke & Akpochafo, 2021). Utilisation of the process of science through enquiry methods of teaching help students to recall biological knowledge more easily (Nkok, 2019).

Inquiry is a term often used in science classroom to express scientific process in search and construction of knowledge (Guisti, 2008). Inquiry method or inquiry-based learning is an approach that assists students to develop knowledge, experience and understanding through research. Onan (2012) defined inquiry method as students learning approach that encourage students to create personal knowledge by questioning and use of investigation process. It equips students with problem-solving skill, creative skill, critical thinking skill and science process skill (Chukwuemeka, 2005).

Lecture method is the oldest method of teaching. It is an approach which involves the introduction of the topic or concept by explanation or brainstorming about the topic and then giving work examples (Tukur et al, 2016). Students are not able to construct their individual knowledge because they are not given the opportunity to participate in teaching-learning process. Achievement through lecture method is minimal as revealed by research studies. Lecture method has not benefitted students much due to its passive nature as it does not create opportunity for students' active participation in learning (Obro, 2023).

Academic achievement describes the outcome that shows the degree to which students have achieved their learning goals. According to Arora (2016), academic achievement is the degree or level of success or proficiency someone attains in some academic works. Examinations or ongoing evaluation are frequently used to measure educational success or achievement. It enables students to determine the relative position or rank with respect to their performance (Etuk et al, 2011). Students' achievement in secondary schools Biology needs to be enhanced through the use of student-centred instructional strategies.

RQs

1. Is there a difference in the achievement of students instructed utilising the inquiry and lecture method?
2. Is there a difference in the achievement of male and female students instructed utilising the inquiry and lecture methods?

Hypotheses

H_{01}: There is no statistically significant difference in the achievement of students instructed utilising the inquiry and lecture methods.

H_{02}: There is no statistically significant difference in the achievement of male and female students instructed utilising the inquiry and lecture methods.

METHODOLOGY

This study adopted a quasi-experimental pre-test, post-test, control group research design. According to Borg and Gall (2007) quasi-experimental design is a suitable alternative to experimental design when randomization is not used or applied. This design facilitates collection of data from respondents through the use of Biology Achievement Test (BAT). The experiment/treatment group was exposed to inquiry method, while the control group was exposed to lecture method. Both groups were instructed with same biological

concepts in intact classes for six weeks. They were pre-tested before treatment and post-tested after treatment to ascertain the difference in achievement score.

The study population consisted of all the secondary school Biology students in Delta Central Senatorial District. The sample size consisted of 320 secondary school one Biology students from nine selected sampled schools in Delta Central Senatorial District. The simple random sampling technique was used to select the sampled schools and local government areas. Biology Achievement Test (BAT) was the instrument adopted for collection of data. The BAT consisted of fifty (50) multiple choice questions on biological concepts (Nutrition in animals and Dentition in mammals) which were selected from past WAEC questions. The instrument was validated by two experts from Science Education Department and Measurement and Evaluation Department in Delta State University, Abraka, Delta state, Nigeria.

The reliability coefficient was established using Kuder-Richardson Formula 21 which yielded 0.77. Both the experiment/treatment and the control groups were assigned to sampled schools and BAT was administered to collect data for pre-test before and after treatment. Data collected was subjected to analysis using the statistics of mean to answer the research questions and t-test and analysis of variance (ANOVA) to test the hypotheses at a 0.05 level of significance.

RESULTS

RQ1: Is there a difference in the achievement of students instructed utilising the inquiry and lecture methods?

Table 1: Descriptive Statistics of Mean Showing the Difference in Achievement of Students Instructed Utilising the Inquiry and Lecture Methods

Teaching methods	N	Mean	Mean Diff
Inquiry	158	53.2848	
			5.6261
Lecture method	126	47.6587	

From table 1, it can be seen that the inquiry method group had a mean score of 53.2848. The lecture method group had a mean score of 47.6587. The mean score of the inquiry method group is higher than that of the lecture method group with a difference of 5.6261.

RQ2: Is there a difference in the achievement of male and female students' instructed utilising the inquiry and lecture methods?

Table 2: Descriptive Statistics of Mean Showing the Difference in the Achievement of Male and Female Students Instructed Utilising the Inquiry and Lecture Methods

Sex	N	Mean
Males instructed with inquiry method	75	54.00
Females instructed with inquiry method	83	52.63
Males instructed with lecture method	60	47.91
Females instructed with lecture method	66	47.42

From table 2, it can be seen that the male students instructed utilising the inquiry method had a mean score of 54.00, while the female students instructed utilising the inquiry method had a mean score of 52.63. The male students instructed utilising the lecture method had a mean score of 47.91, while the female students

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instructed utilising the lecture method had a mean score of 47.42. It is revealed that the male students instructed utilising the inquiry method had the highest mean score.

Hypotheses:

H_{01}: There is no statistically significant difference in the achievement of students instructed utilising the inquiry and lecture methods

Table 3: Independent Sample t-test Statistics Showing the Difference in the Achievement of Students taught with Inquiry and Lecture Methods

Teaching methods	N	Mean	Mean diff	SD	Diff	t	Sig (2-tail
Inquiry	158	53.2848		13.7855			
			5.6261		282	3.450	0.001
Lecture	126	47.6587		13.4861			

From Table 3, it shows that the observed difference is significant since the calculated sig value of 0.001 is less than the critical sig value of 0.005. Therefore, H_{01} which states no statistically significant difference in the achievement of students instructed utilising the inquiry and lecture methods is rejected.

H_{02}: There is no statistically significant difference in the achievement of male and female students instructed utilising the inquiry and lecture methods.

Table 4; Analysis of Variance (ANOVA) Statistics Showing the Difference in Achievement of Male and Female Students Instructed Utilising the Inquiry and Lecture Methods

Groups	Sum of squares	Df	Mean square	F	Sig (2-tail)
Between group	2299.463	3	766.488		
				4,089	0.007
Within group	52489.861	280	187.464		
Total	64789.324	283			

From table 4, it can be seen that no statistically significant difference in the achievement of male and female students instructed utilising the inquiry and lecture methods because the calculated sig value of 0.007 is greater than the critical sig value of 0.005. With this, H_{02} which states that no statistically significant difference in the achievement of male and female students instructed utilising the inquiry and lecture methods is retained.

DISCUSSION

The findings of hypothesis one revealed a significant difference in the achievement of students instructed utilising the inquiry and lecture methods in favour of inquiry method. This could be explained by the fact that inquiry method provides students the opportunity to participate actively in teaching-learning process unlike lecture method which is passive in nature. This finding is in line with Abdi (2014) and Mwenda and Ndayanbaje (2021) report which asserted a significant difference in the achievement of students instructed utilising the inquiry and lecture method as students instructed utilising the inquiry method achieve more than those instructed utilising the lecture method.

The second finding indicated no significant difference in the achievement of male and female students

instructed utilising the inquiry and lecture methods. This implies that gender has no influence in the achievement of students instructed utilising the inquiry and lecture methods. This may be because both male and female students were provided equal opportunity to participate actively in learning. This finding is in line with Ekomaye (2019) and Ukamaka (2013) report which stated that gender has no significant influence in students' achievement in Biology and Physics when exposed to guided-inquiry.

CONCLUSION

It was concluded that the inquiry and the lecture methods of teaching enhance Biology students' achievement but inquiry method is more effective for the improvement of students' achievement in Biology.

RECOMMENDATIONS

1. Inquiry method should be adopted by Biology teachers at the secondary school level to provide opportunity for students to participate actively in learning.
2. Government and stakeholders in the educational sector should organize seminars and workshops to expose teachers to the use of inquiry method in secondary schools to improve students' achievement in science subjects including Biology.

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