



Effects of Inquiry and Discussion Methods on Secondary School Biology Students' Achievement and Attitudes in Delta Central Senatorial District

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ABSTRACT

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This study investigated the effects of inquiry and discussion methods on secondary school Biology students' achievement and attitudes in Delta Central Senatorial District. The study adopted pre-test post-test control group quasi-experimental design. The population of the study consisted of 17,790 senior secondary school one (SS1) Biology students in public secondary schools in Delta Central Senatorial District. A sample size of 418 SS1 Biology students in 9 public mixed secondary schools was used for the study. The instruments used for collection of data were: Biology Achievement Test (BAT) and Biology Student Attitude Scale (BSAS). The reliability of BAT and BSAS were established using Kuder-Richardson Formula 21 and Cronbach Alpha which yielded 0.77 and 0.78 reliability coefficient respectively. The data collected using BAT and BSAS were analyzed using mean, standard deviation, t-test and analysis of variance (ANOVA). The results showed that there was significant difference in the mean achievement scores of secondary school Biology students taught with inquiry and discussion methods, in favour of discussion method; there was no significant difference in the mean attitude scores of secondary school Biology students taught with inquiry and discussion methods. It was concluded that inquiry, discussion and lecture method of teaching enhance secondary Biology students' achievement but at varying degree; and inquiry and discussion methods of teaching improve secondary school Biology students' attitudes more than lecture method of teaching. However, discussion method of teaching has more effect compared to inquiry and lecture method of teaching. Based on these findings, recommendations were made.

Keywords:

Inquiry method,
Discussion method,
Academic achievement and
Attitude

INTRODUCTION

Biology is the scientific study of living organisms or objects that have the characteristics of life. The application of the knowledge of Biology in the improvement of life and socio-economic development of Nigeria has made it very important to students and invaluable to the nation. Its provision of employment opportunities to graduates who studied Biology related courses in the university has made it to become enterprising. The study of Biology helps students to gain meaningful and relevant scientific knowledge applicable in many and different fields of life such as conservation and management of natural resources, human and animal reproduction, health, agriculture, community and personal life etc.

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The problem of ineffective teaching methods has been identified as one of the causes of poor achievement and negative attitude of Biology students in secondary schools in Nigeria. The achievement of the objective of Biology at the secondary school level in Nigeria lies on the quality of instruction and instructional strategies applied by Biology teachers to enhance and improve Biology students' achievement and attitudes (behaviour). Biology teachers need to shift their mind and focus from teacher centered instructional strategies (lecture method, demonstration method etc) to student centered instructional strategies like inquiry and discussion methods which encourage active participation and interaction of students in teaching-learning process (Ajaja & Kpangban, 2000).

Inquiry method helps students to develop the ability to observe events, recognize relevant questions and facts, find out information, interpret and share information orally or in a written form with the teacher and students in the classroom situation. It is defined by Onan (2012) as student learning approach that encourages students to create personal knowledge by questioning and use of investigation process. According to

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Opara (2011), inquiry method promotes process skills development which is needed for scientific investigation in Biology. Jensen (2008) reported that inquiry method promotes learning and achievement more in science and it encourages team spirit which is an attribute of science. It helps students to develop critical thinking skills, problem-solving skills and the ability to process information gathered around them.

Discussion method of teaching is a verbal exchange of views, opinions, or ideas between two or more people involving the students in problem-solving where students carefully consider the problem, argue among themselves in a democratic manner, suggesting solution and draw conclusion (Special Teacher Upgrading Programme, 2007). It is a useful teaching technique for developing higher order thinking skills, communication skills, and enables students to interpret, analyze and manipulate information (Larson, 2000). It is a variety of forms of an opened, collaborative exchange of ideas between a teacher and students for furthering students' thinking, learning, problem-solving, understanding or literary appreciation (Wilkinson, 2009). In discussion method students participate in learning process by coming up with problems, analyzing the factors associated with the problems, developing possible solutions to the problems, putting the solutions into action and evaluating the results of the solutions (Jensen, 2008). The application of student centred instructional strategies such as inquiry and discussion method are necessary to promote effective teaching of Biology to improve Biology students' achievement and attitudes in secondary schools in Nigeria. The regular and perpetual application of lecture method of teaching at the secondary school is a menace to the study of Biology in Nigeria. Therefore, this study investigated the effects of inquiry and discussion methods on secondary school Biology students' achievement and attitudes.

RQs

1. What is the difference in the mean achievement scores of secondary school Biology students taught with inquiry and discussion methods?
2. What is the difference in the mean attitude scores of secondary school Biology students taught with inquiry and discussion methods?

Hypotheses

1. There is no significant difference in the mean achievement scores of secondary school Biology students taught with inquiry and discussion methods.
2. There is no significant difference in the mean attitude scores of secondary school Biology students taught with inquiry and discussion methods.

LITERATURE REVIEW

Concept of Inquiry Method

Inquiry is the study of natural world, proposing explanation that includes evidence gathered from the world and activities of students such as posing questions, planning investigation and reviewing what is already known in the light

of experimental evidence (Martin Hansen, 2002). Inquiry method is a student learning approach that encourages students to create personal knowledge by questioning and use of investigation process Onan (2012). It is investigative, exploratory and student activity oriented in nature. It helps students to develop the ability to observe events, recognize questions, find out information, recognize facts, interpret and share information orally or in written form with the teacher and students in the classroom situation. It helps students to develop critical thinking skills and problem-solving skills.

Concept of Discussion Method

Discussion method is a verbal exchange of views, opinions or ideas between two or more people involving the students in a problem solving where students carefully consider the problem, argue among themselves in a democratic manner, suggesting solution and draw conclusion (Special Teacher Upgrade Programme, 2007). It is a useful technique for developing higher order thinking skills, communication skills, and enable students to interpret, analyze, and manipulate information (Larson, 2000).

Concept of Achievement

Academic achievement is the degree of attainment of students in schools, colleges, universities either in class, laboratory, project or field of work in which the student is successfully exposed to, expressed by scores obtained in examination (Simpson & Troost, 2002). It enables us to determine the relative performance or rank of individual student with respect to their performance (Etuk, Koko & Eno 2011).

Concept of Attitude

Attitude is a mental or neutral state of readiness organized through experience, exerting a directive or dynamic influence upon individuals' response to all objects or situations with which it is related (Allport, 2005). Attitude has the capacity to influence learner's belief towards learning, problem-solving abilities, goal setting towards academic achievement, students' inner and external motivation. The positive attitude of a teacher will impact positively on students' achievement and attitude towards learning.

METHODOLOGY

Research Design

The study adopted pre-test post-test control group quasi-experimental design. It involves the use of pre-test and post-test on two equal groups: experimental group (inquiry and discussion methods) and control group (lecture method). The experimental and control groups were taught the same Biological concepts in intact classes using inquiry and discussion methods for the experimental group and the lecture method for the control group for the period of six weeks. Both groups were pre-tested and post-tested in order to determine the difference in their achievement and attitude before and after treatment.

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Sample

The sample size of the study consisted of 418 senior secondary school Biology students from 9 public mixed secondary schools in 3 local government areas in Delta Central Senatorial District. Simple random sampling technique involving balloting system was used to select the local government areas and schools.

Instrument

Biology Achievement Test (BAT) and Biology Student Attitude Scale (BSAS) were the instruments employed for collection of data in the study. The Biology Achievement Test consisted of 50 items of multiple choice questions on food substances, heterotrophic nutrition and feeding mechanisms in holozoic organisms and dentition in mammals. Biology Student Attitude Scale consisted of 30 items employed to seek information about attitudes of secondary school Biology students on effects of inquiry and discussion methods on their achievement and attitudes towards Biology. The instruments were validated by three experts from Delta state University, Abraka; two from Department of Science Education and the other from Measurement and Evaluation Department.

Instrument reliability

The reliability of the instruments was established using Kuder-Richardson Formula 21 and Cronbach Alpha which yielded coefficient of reliability of 0.77 and 0.78 respectively. This indicated that the instruments were reliable for the study.

Instrument administration

The experimental and control groups were assigned to sampled schools and the BAT and BSAS were administered as pre-test before treatment and as post-test after treatment to determine the scores of students before and after treatment. They were administered to obtain data for analysis.

Data analysis

Scores obtained from pre-test and post-test were 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.

RESULTS

RQ1: What is the difference in the mean achievement scores of secondary school Biology students taught with inquiry and discussion method in Delta Central Senatorial District?

Table 1: Descriptive Statistics of Mean Showing the Difference in Mean Achievement Scores of Secondary School Biology Students taught with Inquiry and Discussion Methods

Methods	N	Mean	Mean diff	SD
Inquiry	126	47.6587	12.6172	13.4861
Discussion	145	60.2759		14.6223

From table 1, it can be seen that the inquiry group had a mean score of 47.6587 with a standard deviation of 13.4861. The discussion group had a mean score of 60.2759 with a standard deviation of 14.6223. The mean score of the discussion group is higher than that of the inquiry group with a mean difference of 12.6172.

RQ2: what is the difference in the mean attitude scores of secondary school Biology students taught with inquiry and discussion methods in Delta Central Senatorial District?

Table 2: Descriptive Statistics of Mean Showing the Difference in Mean Attitude Scores of Secondary School Biology Students taught with Inquiry and Discussion Methods

Methods	N	Mean	Mean diff	SD
Inquiry	158	75.2658	0.679	3.5824
Discussion	145	75.9448		4.7034

From table 2, it can be seen that the inquiry group had a mean score of 75.2658 with a standard deviation of 3.5824 while the discussion group had a mean score of 75.9448 with a standard deviation of 4.7034. It is revealed from the table that the mean score of the discussion group is higher than that of inquiry group with a mean difference of 0.679.

Hypothesis 1: There is no significant difference in the mean achievement score of secondary school Biology students taught with inquiry and discussion methods in Delta Central Senatorial District.

Table 3: Independent Sample t-test Statistics Showing the Significant Difference in the Mean Achievement Scores of Secondary School Biology Students taught with Inquiry and Discussion Methods.

Methods	N	Mean	Mean diff	SD	Df	t-cal	Sig (2-tailed)
Inquiry	12	47.658		13.480			
	6	7	12.617	9	26	1.514	0.0
			2		9		0
Discussion	14	60.275		14.622			
n	5	9		3			

From table 3, it can be seen that the observed difference is significant, since the calculated sig value of 0.000 is less than that of critical sig value of 0.005. Therefore, Ho₁ which states that there is no significant difference in the mean achievement

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scores of secondary school Biology students taught with inquiry and discussion methods is rejected

Hypothesis 2: There is no significant difference in the mean attitude scores of secondary school Biology students taught with inquiry and discussion methods in Delta Central Senatorial District.

Table 4: Independent Sample t-test Statistics Showing the Significant Difference in Mean Attitude Scores of Secondary School Biology Students taught with Inquiry and Discussion Methods.

Methods	N	Mean	Mean diff	SD	Df	t-cal	Sig (2-tailed)
Inquiry	158	75.2658		3.5824			
			0.679		301	1.420	0.157
Discussion	145	75.9448		4.7034			

From table 4, it can be seen that the observed difference is not significant, since the calculated sig value of 0.157 is higher than the critical sig value of 0.005. Therefore, Ho₂ which states that there is no significant difference in mean attitude score of secondary school Biology students taught with inquiry and discussion methods is retained.

DISCUSSION OF RESULTS

The finding from hypothesis one revealed that there was significant difference in the mean achievement scores of secondary school Biology students taught with inquiry and discussion methods in favour of discussion method. This is because the calculated sig value of 0.000 is less than that of the critical sig value of 0.005. This finding agreed with Danladi (2020) and Abdu-Raheem (2011) which states that there was significant difference between the pre-test and achievement mean scores in the experimental and control group using discussion method in secondary school Biology.

The finding from the second hypothesis revealed that there was no significant difference in the mean attitude scores of secondary school Biology students taught with inquiry and discussion methods. This is because the calculated sig value of 0.157 is greater than the critical sig value of 0.005. This finding is in disagreement with Adeyemi (2018) report which states that there is significant difference in the mean attitude score rating of students exposed to discussion instructional strategy and those exposed to questioning instructional strategy in secondary school Biology.

According to Juin et al (2018), Obro, Ogheneaokoke and Akpochafo (2021), Obro (2022), Obro and Enayemo (2022) using effective instructional strategies, giving more guidance and feedback to students and providing opportunity for the students to take charge on their learning process, students are able to bridge the gap between the past and present and look forward to promising future in their academic achievement. Inquiry and discussion methods of teaching provide students the opportunity to interact and participate actively in learning

leading to improvement in their academic achievement and development of positive attitude towards learning Biology. They help students to develop critical thinking skills, communication skills, problem-solving skills and the ability to explore learning in their social environment.

CONCLUSION

The study concluded that inquiry, discussion and lecture methods of teaching enhance and improve Biology students' achievement but at varying degree; and inquiry and discussion methods promote Biology students' attitudes more than lecture method. However discussion method has significantly more effect compared to inquiry and lecture methods.

RECOMMENDATION

Based on the findings, it was recommended among others that:

1. Biology teachers should adopt the use of inquiry and discussion methods of teaching at the secondary school level to enhance and improve Biology students' achievement and attitude towards Biology.
2. Biology teachers should provide students the opportunity to appreciate and explore Biology concepts in learning in order to improve their achievement and raise their interest in learning Biology
3. Biology teachers should adopt the use of student centered instructional strategies in teaching-learning process to facilitate students' ability to construct knowledge on their own.

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