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Effect Of Guided Discovery And Lecture Methods On The Achievement Of Students In Biology In Delta North Senatorial District

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Abstract
This study investigated the effect of guided discovery and lecture methods on students' performance in Biology at Delta North Senatorial District (DNSD). A quasi-experimental design was used, with 176 students from four secondary schools participating. The Biology Achievement Test (BAT) was employed to collect data. The goal of the research was to assess the achievement differences between students taught using the guided discovery method versus the lecture method, as well as to examine gender differences within each teaching approach. The findings revealed that students taught using guided discovery achieved significantly higher scores compared to those taught through lecture. Additionally, a significant gender difference was observed among students taught via guided discovery, with male students outperforming female students. However, no notable gender differences were found in the lecture-based group. The results suggest that the guided discovery method is more effective in improving students' Biology achievement than the lecture method. It was recommended, among other recommendations, that educators integrate guided discovery method into Biology teaching to enhance student achievement, especially in senior secondary schools.
Keywords: Guided Discovery, Lecture Method, Biology, Academic Achievement, Sex

INTRODUCTION

Education plays a vital role in the progress and sustainable development of any nation. Akilaiya, as referenced in Ekwue and Umukoro (2017), argues that education serves as the cornerstone of civilisation, driving positive living, societal progress, and substantial growth. The survival of individuals and society is predominantly contingent upon the nature and calibre of education received. Daily, individuals confront novel challenges and reformulate strategies to address them. Consequently, there is an ongoing pursuit of solutions to challenges, and frameworks for addressing projected tasks are developed. One way humanity can acquire the knowledge needed to solve these problems is through the study of Science and Technology. Science focuses on gaining knowledge, whereas technology applies that knowledge in ways that align with cultural and societal values (Oluchukwu, 2015).

Biology is a field within the realm of science. Biology is the scientific discipline that examines the phenomenon of life. It is characterised as the scientific examination of organisms or entities exhibiting life properties (Oyovwi, 2021). This subject is essential for pursuing applied courses such as Medicine, Pharmacy, Laboratory Technology, Biochemistry, Genetics, and Molecular Biology in universities. The

utilisation of biological knowledge in enhancing life and the socio-economic conditions of society has rendered it highly significant and valuable. Its role in societal development and the creation of career possibilities for graduates of biology-related programs at the university has established it as an international company.

The study of Biology provides students with the ability to use scientific concepts and principles to solve real-world problems. Advances in Biochemistry, Ecology, Genetics, and Molecular Biology have made the field essential in addressing various human concerns, such as food shortages, pollution, population growth, radiation, diseases, health, hygiene, family dynamics, resource management, conservation, Biotechnology, and ethical issues (Agboghoroma & Oyovwi, 2015).

The study of Biology has specific challenges related to the aspects influencing its comprehension as a discipline. Persistent reports of inadequate achievement in Secondary School Certificate Examinations (SSCE) Biology have raised significant concern among science educators in Nigeria, prompting a deliberate quest for improved pedagogical methods to enhance meaningful learning in secondary schools. Identify the causal variables underlying the recurrent failures in examinations at the Senior Secondary School. As noted by Glasson in Esiobu (2015), despite the significance of Biology, students' performance in the Biology section of the WASSCE has been insufficient. According to the WAEC Chief Examiners Reports from 2020, 2021, and 2022, data on students' performance in the Biology component of the secondary school certificate exam show that, on average, more than eighty percent (80%) of students scored below the credit level in the last three years of the WASSCE. The most challenging areas for students in the Biology section of the WASSCE involve practical questions on food tests, particularly for carbohydrates, proteins, and fats/oils. The inadequate academic achievement of secondary school Biology students has raised concerns among several stakeholders, including parents, educational administrators, educators, psychologists, counsellors, and particularly those involved in mainstream science education. The high rate of students' poor performance and negative attitudes toward learning Biology is attributed to several factors, including the lack of qualified teachers, ineffective teaching methods, insufficient laboratory resources, poorly organized laboratory activities, and a lack of commitment to Biology studies from both educators and students. Additionally, negative student behaviors, such as partial or complete absenteeism from Biology classes, further contribute to the challenges in Biology education.

The calibre of a nation's output is contingent upon the proficiency of its educators. Teachers are essential in shaping a nation's development by influencing the quality of education pupils get through effective teaching methods. They are significant factors in promoting academic success and fostering positive attitudes towards Biology among students. Educators are crucial for the effective functioning of the educational system (Obadara, 2018). Aina, Ogundele, and Olanipekun (2018) assert that among all resources inside the educational system, teachers are the most essential educational assets. In its National Policy on Education (FRN, 2014), the Nigeria government recognized the crucial role of teachers, emphasizing that the quality of an educational system is limited by the quality of its educators.

Efficient pedagogical strategies facilitate successful learning outcomes. Effective and inventive pedagogical methodes serve as conduits for the dissemination of information and experience within the classroom context (Oyovwi, 2018). Innovative teaching methods, such as the discovery method, concept mapping, cooperative learning, and inquiry-based learning, improve student engagement, interaction, and involvement in the learning process. The capacity of students to pose enquiries and uncover their responses is deemed highly beneficial for studying. The guided discovery method of teaching has become essential and beneficial for Biology instruction due to its inherent characteristics.

The guided discovery teaching method, as described by Adamu (2019), is an instructional style wherein the teacher facilitates students' independent exploration of facts. The guided discovery method enables students to explore, exercise judgement, contribute to knowledge, and acquire information independently or collaboratively to solve a specific task. It fosters curiosity and enhances pupils' eagerness to seek solutions to challenges. The guided discovery method enhances students' learning by promoting study, exploration, and the construction of vital knowledge, hence facilitating collaboration and engagement within the classroom (Noroozi, 2017). In the guided discovery method, educators and students are instrumental in formulating enquiries, generating responses, and organising materials and case studies.

Guided discovery activities facilitate the development of individual responsibility, cognitive strategies, report generation, problem-solving abilities, and comprehension skills in pupils. Ojo (2017) stated that the student-centered approach is an active teaching strategy where the teacher guides students through a problem-solving process to discover solutions to the topic being studied. He observed that guided discovery is seen as a pedagogical method in which the learner, with minimal assistance from the instructor, strives to uncover and formulate solutions to an identified problem through a comprehensive information-gathering process.

An alternative to the guided discovery method in Biology teaching is the lecture method. In this approach, the teacher verbally presents a topic, theme, or concept to the class. The lecture method, used in science instruction, is considered a teacher-centered approach. This instructional strategy involves the teacher delivering information to students, who are expected to passively receive the knowledge being shared. This method empowers educators to oversee the classroom environment. The lecture method comprises a series of structured actions or activities orchestrated by the educator, aimed at facilitating the student's acquisition, retention, and application of knowledge to novel challenges and situations. The lecture method is a widely utilised and expedient means of conveying knowledge, commonly employed in conventional classroom training. This method involves learners utilising dictation, direct copying from textbooks or chalkboards, memory recall, and repetition for the acquisition of knowledge (Musengimana, Kampire, & Ntawiha, 2021).

Researchers such Wanjohi (2016) and Sanda and Mazila (2017) endorsed the lecture method, emphasising that the concern is in the delivery rather than the inherent potential for facilitating meaningful learning. In fact, the majority of educators employing the lecture method typically struggle to engage students or encourage them to assume responsibility for their learning, primarily due to the necessity of completing the syllabus before the semester concludes (Andala & Ng'umbi, 2016). Students educated by the lecture method demonstrate greater proficiency in applying their knowledge to urgent problem-solving scenarios during assessments (Sanda & Mazila, 2017). The effectiveness of any teaching method is partially contingent upon student achievement.

The term "achievement" denotes the measurable extent of knowledge that pupils exhibit in assessments within a specific academic discipline. It is the outcome of the assessments that students completed. In an educational context, "achievement" denotes any commendable learning demonstrated by the student. Academic achievement refers to the knowledge and skills that students have attained in educational domains. Li and Chai (2018) characterised "achievement" as the grades awarded to students for their adherence to instruction and learning processes. Student achievement is often regarded as the exhibition of knowledge learnt or abilities developed in a specific academic area. It denotes an individual's degree of proficiency in a specific academic discipline. Achievement can be defined as the exhibition of gained knowledge through learning following multiple exposures to a specific instructional method in the classroom.

Illahi and Khandai (2015) characterised achievement as the outcome of a classroom learning experience. Achievement in biology denotes the score attained by biology students in examinations following their instruction on the subject matter. The achievement of pupils is a vital outcome of any educational institution. All parents, guardians, teachers, and students aspire for optimal academic achievement. Student achievement is commonly employed to qualitatively evaluate schools and educators. Students may be categorised as high achievers, ordinary achievers, or poor achievers according to their achievement in a specific academic field. Achievement holds great importance. A multitude of factors, including learner characteristics, the school's organisational environment, curriculum development, the teaching-learning framework, home influences, and pedagogical methods utilised by educators, exert varying degrees of impact on students' achievement regardless of gender.

Sex refers to the biological distinction between male and female. Gender differences in science education have been a subject of considerable interest among researchers. Sex is often viewed as a significant factor in predicting academic performance (Maduabum, 2016). Research has yielded diverse findings on the impact of guided discovery learning on the performance of male and female students. The study of sex differences across various fields continues to be a prominent area of research. It is believed that effective

teaching strategies can enhance student performance, irrespective of gender. This study aimed to investigate the impact of guided exploration and lecture-based teaching methods on the performance of Biology students at DNSD.

Statement of the Problem

The teaching and learning of Biology in Nigerian secondary schools encounter several challenges that can impede the achievement of educational objectives. One significant issue is the use of ineffective teaching methods, which has been identified as a factor in students' poor performance in Biology. Many students struggle to grasp Biology concepts due to the reliance on traditional lecture-based teaching. There is an increasing demand for the adoption of more active, relevant, and innovative teaching strategies that align with the content, improve lesson clarity, offer instructional variety, and foster better knowledge retention and lifelong learning. Continuous reports of low performance in Biology among students in Nigeria raise concerns for educators, emphasizing the need for improved teaching methods to enhance learning outcomes. Teachers need to move away from teacher-centered approaches and adopt student-centered methods that promote active participation and interaction with both the learning materials and biological concepts to improve student performance in Biology. The main question of this study is: "Can the use of guided discovery and lecture methods improve students' achievement in Biology?"

Purpose of the Study

The main goal of this study is to evaluate the effect of guided discovery and lecture methods on students' performance in Biology. Specifically, the study aims to:

1. compare the average achievement scores of students taught Biology using the guided discovery method versus the lecture method;
2. investigate the differences in average achievement scores by gender among students taught Biology through the guided discovery method;
3. examine the gender-based differences in average achievement scores among students taught Biology using the lecture method.

Hypotheses

Three null hypotheses were developed to direct the study:

1. There is no significant difference in the mean achievement scores between students taught Biology using guided discovery and lecture method.
2. There is no significant difference in the mean achievement scores between male and female students taught Biology using the guided discovery method.
3. There is no significant difference in the mean achievement scores between male and female students taught Biology using the lecture method.

METHODS

This study utilized a quasi-experimental design with both pre-test and post-test measures to assess the intended changes. A quasi-experimental design involves a research approach where participants are not randomly assigned to groups but instead, the independent variables are manipulated to observe their effects on dependent variables. The study's target population consisted of 20,658 SSII Biology students in secondary schools within the DNSD during the 2023/2024 academic year. A sample of 176 SS2 students was selected from four coeducational secondary schools in the DNSD using a simple random sampling technique.

The research instrument for data collection was the Biology Achievement Test (BAT), which contained 50 multiple-choice questions on Food Nutrition, covering topics such as Food Substances, Heterotrophic Nutrition, Feeding Mechanisms in Holozoic Organisms, and Mammalian Dentition. Some of the questions were adapted from past SSCE exams, while others were developed by the researcher to cover the taught content. To ensure both face and content validity, the researcher consulted three experts in Science Education and Measurement and Evaluation, as well as the study supervisor and an experienced Biology teacher. The reliability of the BAT was tested using the Kuder-Richardson Formula 21 (KR-21), and the instrument was administered to 50 students at Okurekpo Secondary School, which was not part of

the study. A reliability coefficient of 0.77 was obtained, indicating that the instrument was reliable for the research.

The treatment procedure followed a four-phase process. First, consent was obtained from the principals of the selected schools, and Biology teachers were briefed on the study's objectives. In the second phase, schools were randomly assigned to three groups: guided discovery, lecture method, and a control group. The third phase involved a one-week training program for Biology teachers in the experimental groups, focusing on the use of guided discovery and lecture methods. Teachers practiced these methods and were assessed on their implementation, while the control group teachers continued using the lecture method without training.

The fourth phase involved administering pre-tests to the students before the treatment. The BAT was used to assess their prior knowledge of the topics, followed by the Biology Students' Interest Scale. The instruction took place over six weeks, with the experimental groups being taught using the guided discovery and lecture methods. In the guided discovery method, students worked in small groups to explore key concepts through critical thinking and interaction with resources, while the lecture method involved direct teacher-student interactions. Both methods promoted student engagement, and at the end of each session, the teacher assessed the students' understanding of the material. Data from the pre-test and post-test were analyzed using mean, standard deviation, t-tests, and ANCOVA at a 0.05 significance level.

RESULTS

Table 1: ANCOVA results comparing mean achievement scores of students taught with guided discovery and lecture methods

Source	Type III Sum of Squares	df	Mean Square	F	Sig (2-tailed)
Corrected Model	87053.095	2	43526.547	421.585	.000
Intercept	35582.995	1	35582.995	344.640	.000
Pre-achievement	9.542	1	9.542	0.092	.000
Groups	83482.565	1	83482.565	808.586	.000
Error	17861.399	173			
Total	622785.008	176			
Corrected Total	104914.494	175			

Table 1 indicates a significant difference, as the calculated significance value of 0.00 is below the critical threshold of 0.05. Hence, the null hypothesis is rejected.

Table 2: t-test comparing the disparity in mean achievement scores by sex among students taught using guided discovery at post-test

Sex	N	Mean	Mean Diff	SD	df	tcal	Sig (2-tailed)
Male	58	74.47	8.89	5.16	105	3.024	0.003
Female	49	69.31	8.68				

Table 2 reveals a significant difference in the performance of male and female students taught using Guided Discovery, with a calculated significance value of 0.003, which is below the critical threshold of 0.05. As a result, the second hypothesis is rejected.

Table 3: ANCOVA statistics comparing the mean achievement scores by sex among students instructed with lecture method

Source	Type III Sum of Squares	df	Mean Square	F	Sig (2-tailed)
Corrected Model	87.869a	2	43.934	0.324	.725
Intercept	2730.491	1	2730.491	20.115	.000
Pre-achievement	12.462	1	12.462	0.092	.763
Sex	54.776	1	54.776	0.404	.527
Error	8959.204	66	135.476		
Total	57688.000	69			
Corrected Total	9047.072	68			

Table 3 indicates that the observed difference is not significant, as the significance value of 0.527 is above the critical threshold of 0.05. Thus, the null hypothesis is not rejected.

Discussion

The study found a significant difference in the average achievement scores of Biology students, with the guided discovery group outperforming the lecture method group. This suggests that guided discovery was more effective in improving students' performance compared to the lecture method. The success of the guided discovery approach can be attributed to the learning experiences it provided, which engaged students in both cognitive and practical activities, leading to greater achievement than their peers taught using the lecture method. This aligns with Yusuf (2014), who noted that student-centered instructional strategies like guided discovery enhance comprehension and retention. It also supports the findings of Iserameiya and Uwameiye (2018), who argued that discovery methods improve critical thinking and engagement, resulting in better outcomes. These results are consistent with Daja's (2015) research, which showed that guided discovery improved engagement and academic performance in Biology at the senior secondary level. Similarly, Garuma (2022) found that the guided discovery method was more effective in improving secondary school students' performance in Biology compared to traditional teaching methods.

The study also revealed a significant difference in the achievement scores of male and female students taught using guided discovery, with male students outperforming female students. This performance gap may be due to male students enjoying the learning activities more, which could have allowed them to approach the lessons with a more relaxed mindset. However, this finding contradicts the conclusions of Adigun (2015) and Rovai and Baker (2015), who suggested that females generally perform better in discovery-based learning due to increased collaboration and confidence-building opportunities. On the other hand, this finding aligns with Ihejiamaizu, Neji, and Agiande (2020), who reported no significant gender-based differences in performance when guided discovery was used.

Additionally, the study showed no significant difference in the average achievement scores between male and female students taught using the lecture method, suggesting that both genders valued the learning activities equally, regardless of gender. This finding aligns with Abdulwahab, Oyelekan, and Olorundare (2019), who reported similar achievement levels for both genders in traditional instruction. It is also consistent with Ozioko's (2015) study, which found no significant gender differences in the post-test performance of students taught with either the lecture or guided discovery methods in Biology.

CONCLUSION

The study revealed that guided discovery significantly enhances students' performance in Biology compared to the traditional lecture method. This improvement is attributed to the active engagement and problem-solving tasks provided by guided discovery, which foster critical thinking and better retention. Furthermore, while a significant gender difference was observed in the performance of students taught using guided discovery, no such difference was found in the lecture method group. This suggests that both genders perform equally well when taught through lectures. The study emphasizes the value of adopting

student-centered teaching methods, such as guided discovery, to improve educational outcomes in Biology.

RECOMMENDATIONS

Based on the findings, the following recommendations are suggested:

1. Educators should incorporate guided discovery methods into Biology instruction to improve student performance, particularly in senior secondary schools.
2. Teachers should ensure equal participation from both male and female students in the learning process, especially when using teaching methods that encourage active engagement.
3. Future research should explore the long-term effects of guided discovery on student performance and compare it with other student-centered methods across various subjects.
4. Educational authorities should provide thorough training for teachers on the effective implementation of guided discovery and other innovative teaching strategies to improve student outcomes in Biology.

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