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Effects of Guided Discovery Instructional Strategy on Students' Attitude, Towards Biology in Secondary Schools, Federal Capital Territory-Abuja, Nigeria

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A B S T R A C T
This study investigated the Effects of Guided Discovery Instructional Strategy on Students' attitude, towards biology in senior secondary schools in Federal Capital Territory, Abuja, Nigeria. The study was a quasi-experimental, which involved intact classes groups of students assigned to two treatment groups. The population of the study was 36,188 SSII Biology Students in Federal Capital Territory from which 102 students were sampled and assigned to the two groups (experimental and control). Two research questions and two hypotheses tested at p< 0.05 level of significance guided the study. The instruments used for data collection was Biology Attitude Scale (BAS). The trial test to determine coefficient of stability of Biology Attitude Scale (BAS) was carried out using the pilot-test reliability technique. The reliability coefficient of the instrument was done using Pearson Product – Moment Correlation to determine the internal consistency of the Biology Attitude Scale (BAS) items which gave a reliability index of 0.81. The data collected were analysed using descriptive statistics to answer the research questions while ANCOVA and Mann Whitney were used to test the hypotheses. The study revealed that Guided Discovery Instructional Strategy is more effective than Conventional teaching method and that the male and female participants are very similar in their mean scores for attitude towards biology which implies that Guided Discovery Instructional Strategy is not gender bias. It is therefore recommended among others that biology teachers in senior secondary schools should adopt the use of guided discovery instructional strategy in order to improve attitude towards biology concepts in students.

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Introduction

Education is a process of acquiring knowledge through study or imparting the knowledge by way of instructions or some other practical procedures. It is a gradual process which brings positive changes in human life and behavior. Education can be categorized into Informal, Non-formal and formal education. Ojelade, et al (2016) submitted that science education, as a field of study and instructional practice, plays a central role in developing the scientific literacy, critical thinking, and problem-solving skills necessary for national development and global competitiveness. It encompasses a range of disciplines Physics, Chemistry, Biology, Earth Science, and more. Each contributing uniquely to the understanding of natural phenomena and the advancement of technology. Among these, Biology occupies a crucial position because it directly relates to life, health, and the environment, making it highly relevant in addressing modern challenges such as climate change, pandemics, food security, biodiversity loss, and sustainable

development. However, formal education embodies science education and in the evolving landscape of science education, especially Biology, there is a growing concern over the negative attitudes of students toward the subject (Ubom, et. al, 2024).

Biology is not just a subset of science; it is a gateway discipline that integrates knowledge from chemistry, physics, and environmental science to explain complex living systems. Within the framework of science education, Biology serves as the medium through which students gain insights into the structure and function of life from the molecular to the ecological level. This comprehensive perspective enables learners to appreciate the interdependence of life and the responsibility of humans in preserving biological systems (Adeosun & Olatunji, 2023). One of the central goals of science education is to foster scientific literacy, which is the ability to apply scientific knowledge in real-world contexts. Biology, through its focus on health, genetics, nutrition, ecosystems, and disease control, directly contributes to this goal by providing learners with the tools to make informed decisions about personal and public health, agriculture, and environmental stewardship (Eze & Ibe, 2022). For instance, understanding the biological basis of diseases such as COVID-19 or malaria is essential for promoting public health awareness, a key outcome of a strong science education foundation. Moreover, Biology contributes significantly to national development by serving as a preparatory ground for careers in medicine, nursing, biotechnology, agriculture, and environmental science. Through robust science education curricula, students are introduced early to the foundational knowledge required for specialized fields. This is particularly crucial in Nigeria and other developing countries, where shortages in medical personnel and environmental experts can be mitigated through stronger Biology education (Ogbonna & Alade, 2021).

Analytically, the success of science education in promoting Biology learning depends on several key variables, including curriculum relevance, instructional strategies, teacher quality, learning environment, and student engagement. Studies have shown that traditional lecture-based approaches fail to stimulate interest and retention in Biology due to their passive nature (Aregbesola, 2023; Okoli & Musa, 2020). Among several pedagogical responses to this challenge, the Guided Discovery Instructional Strategy (GDIS) has gained prominence for its ability to actively engage learners, promote curiosity, and improve attitudes toward science. The strategy allows students to explore concepts through structured inquiry under the guidance of a teacher, thereby cultivating a positive learning environment and reshaping students' perceptions toward Biology (Ojelade, et al. 2024). On the other hand, the integration of inquiry-based methods, such as guided discovery, problem-based learning, and hands-on laboratory work, leads to improved student outcomes. This analytical perspective underscores the necessity of aligning Biology instruction with best practices in science education. For example, in a study conducted by Hassan and Aremu (2024), secondary school students taught Biology through inquiry and discovery-based strategies showed significantly higher interest and deeper conceptual understanding compared to those taught using traditional methods. This finding reinforces the constructivist theory underpinning science education that students construct knowledge more effectively when actively involved in the learning process. Furthermore, the interdisciplinary nature of Biology makes it an ideal platform for implementing STEM (Science, Technology, Engineering, and Mathematics) integration. The cross-cutting concepts of systems thinking, energy flow, and modeling, which are central to STEM education, are also inherent in biological systems such as photosynthesis, genetics, and homeostasis. This alignment provides an opportunity for science educators to leverage Biology as a unifying subject that fosters holistic and practical science education (Adamu & Yusuf, 2023).

Scientific attitudes are a set of attitudes related to a particular opinion, or perspective accepted by individual (Perwitasari & Djukri, 2018). Scientific attitudes are about the habituation and demonstration of various moral values in doing a scientific quest. Attitudes towards science are only focused in someone's interest to science, whether she/he likes science or not. Scientific attitudes are crucial competency to be developed because students' scientific mindset, scientific attitudes, and interests are also enhanced and empowered in the instructional process, Jaleel & Philip (2017) clearly states that students who possess better scientific attitude will always keen to acquire new ideas that will surely lead to a better achievement in cognitive area. Moreover, scientific attitudes have the relatively permanent impact on the students. Students' curiosity, critical thinking, cooperation with others, perseverance, creativity and inventiveness, open-mindedness, respect for evidence, and sensitivity to the environment

were measured and analyzed. Attitude plays a pivotal role in students' academic development, particularly in science subjects such as Biology, where motivation, interest, and engagement significantly affect achievement and long-term retention.

From 2000s downline, science educators have expressed growing concern over the negative attitude of many secondary school students toward Biology (Uzoechi & Asogwa, 2020). Students' well-developed scientific attitudes will increase their resilience against deception and misconceptions. Attitude, often shaped by perceptions of difficulty, abstract content, and passive instructional approaches, contributes to poor academic performance and declining enrollment in biology-related fields. As a result, there has been an increasing emphasis on identifying and implementing effective instructional strategies that can improve students' affective disposition toward Biology. The urgency of building students' scientific attitudes (Kurniawan et al., 2019) is parallel with the latest demand from our society. Learning process dominated by direct method is an orthodox choice in today's learning paradigm. There have been a vast number of learning models which can be implemented on science by teachers to improve students' scientific attitudes (Liou, 2020; Secgin & Sungur, 2020). One such approach is the Guided Discovery Instructional Strategy (GDIS). Guided discovery learning, rooted in constructivist theory, is a student-centered instructional model in which learners are led through a structured exploration of scientific concepts, rather than being passive recipients of information (Aminu, 2023). This strategy contrasts with the traditional, teacher-centered lecture method, often characterized by memorization and limited learner engagement.

Furthermore, gender remains a significant moderating variable in science education research. Differences in male and female students' attitudes, perceptions, and responses to various instructional strategies have long been debated. While some studies report that males exhibit more favorable attitudes toward science, others suggest that appropriate instructional strategies like GDIS can reduce or eliminate gender disparities (Adamu & Yusuf, 2023). The difference between the mean attitude scores of male and female senior secondary school students taught Biology using the guided discovery instructional strategy refers to the variation in how positively or negatively each gender group perceives the subject and teaching method. Research generally suggests that while both male and female students may benefit from guided discovery learning, gender differences in attitude can still emerge due to factors like interest, confidence, and prior experience. Studies have found that females sometimes report more positive attitudes toward Biology under interactive teaching methods, though findings can vary by context (Oludipe & Awokoyemi, 2019). By encouraging active participation, inquiry, and critical thinking, In view of these developments, it becomes pertinent to investigate how students' attitudes toward Biology differ when taught using guided discovery versus conventional methods.

Purpose of the Study

The general purpose of the study is to investigate the effects of guided discovery instructional strategy on secondary school students' attitude, academic achievement and retention in Biology.

Specifically, the objectives of the study are to:

I. Investigate the difference between the mean attitude scores of senior secondary school students taught Biology using the guided discovery instructional strategy and their counterpart taught using the conventional teaching method.

II. Determine the difference between the mean attitude scores of male and female senior secondary school students taught Biology using the guided discovery instructional strategy

Research Questions

The following research questions were raised to guide the study:

1. What is the difference between the mean attitude scores of senior secondary school students taught Biology using the guided discovery instructional strategy and their counterparts taught using the conventional teaching method?
2. What is the difference between the mean attitude scores of male and female senior secondary school students taught Biology using the guided discovery instructional strategy?

Hypotheses

The following null hypotheses were generated to be tested at 0.05 level of significance.

H_{01}. There is no significant difference between the mean attitude scores of senior secondary school students taught Biology using the guided discovery instructional strategy and their counterparts taught using the conventional teaching methods.

H_{02}. There is no significant difference between the mean attitudes scores of male and female senior secondary school students taught Biology using the guided discovery instructional strategy.

Literature Review

The role of instructional strategies in shaping students' attitudes toward science subjects, particularly Biology, has attracted significant scholarly attention. Among various instructional approaches, the **Guided Discovery Instructional Strategy (GDIS)** stands out as an effective method that fosters active participation, engagement, and curiosity, which are key to developing a positive attitude toward science learning (Bruner, 1961; Aminu, 2023). This literature review critically examines empirical and theoretical works related to the effects of guided discovery on students' attitudes, with a focus on Biology education in secondary schools. Attitude in educational research is a multidimensional construct that reflects students' feelings, interests, motivation, and values regarding a subject (Ajayi & Ogunlade, 2022). In the context of Biology, attitude influences how students perceive the subject's relevance, their willingness to engage with Sbiological concepts, and their intention to pursue science-related careers (Uzoechi & Asogwa, 2020). A positive attitude enhances classroom engagement, while a negative attitude may lead to poor performance and reduced enrollment in science courses. The literature confirms that instructional strategies are significant mediators of students' attitudes (Okebukola, 2021).

Guided discovery learning is rooted in **Jerome Bruner's Constructivist Theory**, which posits that learners construct new knowledge based on prior understanding through active engagement and problem-solving (Bruner, 1961). In GDIS, the teacher facilitates structured inquiry by providing materials, guiding questions, and step-by-step prompts that lead students to discover concepts independently. The method enhances deep understanding, promotes intrinsic motivation, and encourages students to take ownership of their learning a combination that is known to foster positive attitudes (Aminu, 2023). Multiple studies have demonstrated that GDIS significantly improves students' attitudes toward Biology. For instance, Eze and Nworgu (2021) conducted a quasi-experimental study involving 120 Nigerian secondary school students and reported that students taught with GDIS showed more favorable attitudes toward Biology than their counterparts taught with traditional methods. Similarly, Hassan and Yaya (2023) found that guided discovery increased students' interest, participation, and enjoyment in biology classes, particularly among learners previously disinterested in science.

Another study by Akindele and Olatunji (2024) explored gender dynamics in students' responses to guided discovery and found that both male and female students developed more positive attitudes, though females showed slightly higher gains in motivation and classroom engagement. This suggests that GDIS is not only effective in improving general attitudes but also in promoting gender equity in science classrooms. Furthermore, in an experimental study conducted by Ogundele and Abubakar (2022), the use of guided discovery activities such as model building, interactive questioning, and data interpretation in biology lessons led to significant attitudinal changes among students. The researchers emphasized that the active nature of GDIS promotes learners' curiosity, fosters persistence in problem-solving, and makes Biology lessons more enjoyable, thus transforming students' perception of the subject from abstract and difficult to interesting and relatable. Contrary to GDIS, the conventional lecture-based method—still dominant in many Nigerian schools has been criticized for its passive nature, overemphasis on memorization, and limited learner engagement (Okwilagwe & Oladimeji, 2020). Students often develop negative attitudes due to the monotony of lectures and lack of interactive activities. Comparatively, guided discovery not only enhances cognitive outcomes but significantly improves students' affective responses, as seen in studies conducted by Nwankwo and Ezeonu (2023), where students reported greater satisfaction and enthusiasm when taught with inquiry-based strategies.

The influence of GDIS on gender-based attitudinal outcomes has also been studied. While some earlier studies highlighted male dominance in science achievement and interest, recent findings suggest that student-centered approaches like guided discovery help neutralize such disparities (Adamu & Yusuf, 2023). This is attributed to the collaborative and supportive nature of GDIS, which accommodates diverse learning styles and reduces anxiety especially among female students, who may feel marginalized in traditional classroom settings. Despite its numerous advantages, implementing GDIS comes with challenges. These include large class sizes, lack of instructional materials, inadequate teacher training, and time constraints (Chukwuemeka, et al.; Ikechukwu & Mbakwe, 2022). For the strategy to be effective, teachers must be well-versed in inquiry-based pedagogies, assessment for learning, and classroom management. Moreover, schools must provide laboratories, manipulatives, and digital tools to support active learning environments. The review of literature affirms that Guided Discovery Instructional Strategy has a significant positive effect on students' attitude toward Biology in secondary schools. Unlike traditional methods, GDIS stimulates curiosity, encourages exploration, and fosters a supportive learning environment that benefits both male and female students. The reviewed studies consistently highlight the strategy's ability to enhance learners' emotional investment and commitment to Biology. However, challenges in its implementation suggest the need for systemic reforms, including teacher retraining, curriculum revision, and infrastructural support to facilitate widespread adoption. These insights validate the importance of investigating GDIS as a viable alternative to conventional pedagogies, particularly within the context of Nigerian secondary education.

Methodology

The design of this study was pretest, posttest control group quasi-experimental design. The study comprised of experimental group (EG) and the control group (CG). The sample size of one hundred and two (102) Biology students formed the sample of the study; The instruments for data collection was Biology Attitude Scale (BAS). BAS was a 20 - item instrument attitude oriented scale built on a modified four point Likert scale format of Strongly Agree (SA), Agree (A), Disagree (DA) Strongly Disagree (SD). For easy computation, the responses to positive statements will score as follows: SA=4, A=3, D=2, SD=1. The All the instruments were developed by the researcher. BAS was calculated using Pearson Product-moment correlation, this shows that the instrument is reliable. The null hypothesis was calculated using ANCOVA and the significant level for the statistical test was put at 0.05 level of significance, which allowed for rejection or acceptance of a hypothesis. For the Biology Attitude Scale built on a modified four-point Likert scale, a grand mean score of 2.5 and above was regarded as positive attitude while a mean score of below 2.5 was regarded as negative attitude.

Table 1: Distribution of Respondents by Groups

S/No	Group	Sample	Total	Percentage
	Gender	Male Female		
1	Experimental	29 21	50	49.02
2	Control	28 24	52	50.98
	Total	57 45	102	100

Table 1 showed that fifty (50) respondents representing 49.02% formed the experimental group while fifty-two (52) respondents representing 50.98% formed the control group. Total sample of the study was one hundred and two (102).

Table 2: Distribution of Respondents by Gender

Gender	No of Respondents	Percentages
Male	57	55.88
Female	45	44.12
Total	102	100%

Data Analysis and Results

The answers to Research questions were presented using descriptive statistics of mean and standard deviation

Analysis of Research Questions

Research Question One: What is the difference between the mean attitude scores of senior secondary school students taught biology using guided discovery instructional strategy and their counterparts taught using the conventional teaching method?

Table 3: Mean Attitude Scores of Experimental and Control Group

Group	n	Mean	Standard Deviation	Mean Difference
Experimental	50	62.12	5.06	**11.37**
Control	52	50.75	3.07	

Source: Research Field Survey (2025)

The data presented on table 3 represent a summary of descriptive statistics comparison between experimental group and control group in relation to mean scores for attitude scale. The mean for the experimental group (62.12) is higher than that of the control group (50.75), indicating that the intervention to the experimental group had some effect, increasing their attitude mean score. The standard deviation of the experimental group (5.06) is higher than that of the control group (3.07), suggesting that the control group's scores are more tightly clustered around the mean, while the experimental group's scores show greater variability. The mean difference of 11.37 indicates that the experimental group has a higher average score compared to the control group. This implies a positive effect of the guided discovery instructional strategy on students' attitude towards Biology.

Research Question two: What is the difference between the mean attitude scores of male and female senior secondary school students taught biology using guided discovery instructional strategy?

Table 4: Mean Attitude Scores of Male and Female Students of Experimental Group

Gender	n	Mean	Standard Deviation	Mean Difference
Male	29	62.10	4.89	**0.04**
Female	21	62.14	5.42	

Source: Research Field Survey (2025)

The data presented on table 8 represent a summary of descriptive statistics comparison between male and female participants in the experimental group in relation to attitude mean scores. The mean for the male participants (62.10) is slightly lower than the mean for the female participants (62.14). The standard deviation for the male participants (4.89) is lower than the female participants (5.42), indicating that the female participants' scores are more spread out (more variability) compared to the male participants' scores, which are more concentrated around the mean. The mean difference of 0.04 is quite small, suggesting that, on average, the male and female participants are very similar in terms of attitude towards Biology. This implies a positive effect of guided discovery instructional strategy on both male and female student's attitude towards biology and it's not gender bias.

Analysis of Hypotheses

Hypothesis One: There is no significant difference between the mean attitude scores of senior secondary school students taught biology using guided discovery instructional strategy and their counterparts taught using the conventional teaching methods.

Table 5: Summary of Mann-Whitney U Test Results Analysis for Attitude Scores of Experimental and Control Group

Group	N	Mean	SD	U-test	Sig.	Decision
Experimental	50	62.12	5.06	61	0.001	**Rejected**
Control	52	50.75	3.07			

The result of the Mann–Whitney U test revealed a statistically significant difference in the achievement of students in the experimental group (M = 62.12, SD = 5.06, n = 50) compared to the control group (M = 50.75, SD = 3.07, n = 52), U = 61, p < .001. The null hypothesis one was rejected, indicating that there is significant difference between the mean attitude scores of senior secondary school students taught biology

using the discovery instructional strategy and their counterparts taught using the conventional teaching methods.

Hypothesis Four: There is no significant difference between the mean attitudes scores of male and female senior secondary school students taught biology using the guided discovery instructional strategy.

Table 6: Summary of Mann-Whitney U Test Results for attitudes scores of male and female Students in Experimental Group

Group	N	Mean	SD	U-test	Sig.	Decision
Male	29	62.10	4.89	306	0.976	**Accepted**
Female	21	62.14	5.42			

A Mann–Whitney U test was conducted to examine whether there was a statistically significant difference in achievement scores between male (n = 29, M = 62.10, SD = 4.89) and female students (n = 21, M = 62.14, SD = 5.42). The result indicated no significant difference between the two groups, U = 306, p = 0.976. Therefore, the null hypothesis four was not rejected, indicating there is no significant difference between the mean attitudes scores of male and female senior secondary school students taught biology using the discovery instructional strategy.

Discussion of Findings

The study examined the effects of guided discovery instructional strategy on students' attitude, towards biology in secondary schools, Federal Capital Territory-Abuja, Nigeria. It was observed from the results there was significant difference between the mean attitude scores of senior secondary school students taught biology using the guided discovery instructional strategy and their counterparts taught using the conventional teaching method. This result was corroborated with that of Ogundele and Abubakar (2022), who submitted that guided discovery instructional strategy led to significant attitudinal changes among students. The researchers emphasized that the active nature of GDIS promotes learners' curiosity, fosters persistence in problem-solving, and makes Biology lessons more enjoyable, thus transforming students' perception of the subject from abstract and difficult to interesting and relatable. Also, the method enhances deep understanding, promotes intrinsic motivation, and encourages students to take ownership of their learning a combination that is known to foster positive attitudes (Aminu, 2023). GDIS has shown significant improvement on students' attitudes toward Biology. For instance, Eze and Nworgu (2021) found that students taught with GDIS showed more favorable attitudes toward Biology than their counterparts taught with traditional methods. Similarly, Hassan and Yaya (2023) found that guided discovery increased students' interest, participation, and enjoyment in biology classes, particularly among learners previously disinterested in science.

The second hypothesis stated that there was no significant difference between the mean attitude scores of male and female senior secondary school students taught biology using the discovery instructional strategy. This was supported by the study of Akindele and Olatunji (2024) explored gender dynamics in students' responses to guided discovery and found that both male and female students developed more positive attitudes, though females showed slightly higher gains in motivation and classroom engagement. This suggests that GDIS is not only effective in improving general attitudes but also in promoting gender equity in science classrooms. Contrarily to this study, Adamu and Yusuf, (2023) found differences in male and female students' attitudes, perceptions, and responses to various instructional strategies. They submitted that the difference between the mean attitude scores of male and female senior secondary school students taught Biology using the guided discovery instructional strategy refers to the variation in how positively or negatively each gender group perceives the subject and teaching method. Also, Oludipe and Awokoyemi, (2019) reported that while both male and female students may benefit from guided discovery learning, gender differences in attitude can still emerge due to factors like interest, confidence, and prior experience.

Conclusion and Recommendations

This study critically investigated the Effects of Guided Discovery Instructional Strategy (GDIS) on Students' Attitude Toward Biology in Secondary Schools within the Federal Capital Territory, Abuja.

The findings revealed a significant improvement in the attitudes of students taught using GDIS compared to those taught using the conventional teaching method. This underscores the pedagogical strength of guided discovery in fostering curiosity, active engagement, and enjoyment in biology classrooms. The discovery-based approach provided learners with opportunities to explore biological concepts interactively, which not only improved comprehension but also transformed their perception of Biology from an abstract, difficult subject to an enjoyable and relatable one. Furthermore, the study found no statistically significant difference in the attitude scores between male and female students taught using GDIS. This suggests that the strategy is inclusive and beneficial across gender lines, supporting equity in science learning. However, conflicting findings from prior studies such as those by Adamu and Yusuf (2023), and Oludipe and Awokoyemi (2019), indicate that gender disparities in response to instructional methods may still exist in some contexts due to factors like confidence, prior knowledge, and personal interest. Taken together, the study confirms that guided discovery is a transformative instructional strategy capable of enhancing students' affective disposition toward Biology and should be considered a viable alternative to traditional teaching methods in Nigerian secondary education.

Recommendations

1. Comprehensive training and retraining workshops should be organized for Biology teachers to enhance their competency in implementing guided discovery strategies. This training should include how to formulate inquiry-based questions, manage discovery learning activities, and use instructional materials that support experiential learning. Continuous professional development will ensure that teachers are well-equipped to adopt and sustain the use of GDIS in their classrooms.
2. Successful implementation of guided discovery strategies requires access to adequate laboratory facilities, teaching aids, and instructional materials. Therefore, school administrators and policymakers should invest in equipping Biology laboratories and classrooms with necessary resources such as models, charts, specimens, and digital tools that facilitate hands-on learning.
3. Given the mixed findings on gender-related differences in response to GDIS, future research should further explore the underlying factors that influence male and female students' attitudes differently. Longitudinal and qualitative studies across different socio-economic and cultural contexts may help clarify these differences and inform more targeted instructional interventions that promote inclusiveness in science education.

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