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RELATIVE ANALYSIS OF STUDENTS PERCEPTION OF DIFFICULT CONCEPTS IN BIOLOGY AMONG SENIOR SECONDARY SCHOOLS IN KAURA, KADUNA STATE, NIGERIA

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ABSTRACT

The study investigated the students' perception of difficult concepts in biology among senior secondary schools in Kaura, Nigeria. The study was guided by three research questions and one hypothesis. The research design was descriptive survey design. Population of the study was all the senior secondary school biology students in Kaura Local Government Area with 2550 senior secondary school students, from which 1387 SSII biology students from three senior secondary school in the study area was selected as sample, using Krejcie and Morgan (1970). The instrument for data collection in this study was Students' Perception of Difficult Concepts in Biology Questionnaire (SPDCBQ), with a reliability coefficient of 0.76. The data gathered was analyzed using simple percentage, mean score and standard deviation for the research questions, while the null hypothesis was tested using t-test statistics. Findings revealed that some topics (Mendelian

Introduction

Science is a systematic pursuit of knowledge that seeks to understand the world around us. Akilu & Matazu, (2024) highlighted that the entirety of knowledge gained through science forms what is known as scientific knowledge. Science serves as the foundation for comprehending the universe and its phenomena. According to Nwagbo (2016), science is a human-driven intellectual endeavor aimed at uncovering insights about the natural world and organizing these findings to benefit humanity. The significance of science in achieving national objectives, aspirations, and economic growth underscores the

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genetics, nervous system, reproduction, homeostasis, genes and chromosomes) proved to be more difficult to the students than other topics. Also, the perception of difficulty of concepts in biology is controlled by gender. From the findings, it was recommended that there is a need to make the subject content of senior secondary school biology curriculum more current, meaningful and interesting for the students, reflecting the current developments in the field and relating teaching-learning process with daily life issues. The study concluded that the students perceived some topics as more difficult than others in Biology and gender has a significant difference on students' perception of difficult Biology topics.

Keywords: Biology, Concept, Difficult, Perception, Student,

Substantial investments and support many nations allocate to advancing science and technology. This perspective aligns with Achor & Agbidye (2014) and Ada's (2018) assertion that the fast-paced technological changes worldwide necessitate prioritizing science education.

Agogo (2015) and Maduawesi et al. (2016) emphasized that the classification of countries as developed, developing, or underdeveloped often reflects their level of technological progress. This makes science education a critical priority. Okeke (2014) defined science education as an interdisciplinary field that includes scientific content (e.g., Biology, Physics, Chemistry, and Agriculture) and the processes for teaching and learning these subjects. Babajide (2015) described it as an area of study that equips learners with both scientific knowledge and methodologies for practical application. Igbaji et al. (2017) expanded on this, stating that science education applies educational theories rooted in philosophical, sociological, and psychological principles to foster cognitive, emotional, and physical growth through systematic processes involving observation, deduction, and empirical testing.

In Nigeria, secondary school science education focuses on three main subjects: Biology, Chemistry, and Physics. These subjects prepare students for further studies in science-related fields at the tertiary level. Biology, a natural science, covers topics ranging from microscopic organisms to the biosphere, encompassing the interactions of all living things on Earth (Adekunle & Femi-Adeoye, 2016). Due to its broad scope and relevance, Biology is a core subject in secondary school examinations and a popular choice among students. Adeyemo (2016) noted that Biology's study is vital for understanding human life and the environment. Owino et al. (2015) observed that Biology education provides learners with knowledge applicable to various aspects of life, which explains its popularity among senior secondary school students in Nigeria.

Despite its popularity, students often struggle with Biology, as documented by WAEC (2017, 2018) and several studies. Factors contributing to these difficulties include

abstract concepts, overloaded curricula, and disconnected teaching methods (Cimer, 2016; Igbojinwaekwu, 2017; Igbojinwaekwu & Dorgu, 2019). Specific topics, such as genetics, hormonal regulation, and photosynthesis, are often cited as challenging (Tekkaya Ozkan & Sungur, 2014; Zeidan, 2015). Ozkan (2013) argued that these difficulties negatively impact students' motivation and performance. Addressing these challenges requires creating engaging learning environments that consider students' interests and experiences, as suggested by Ahmad and Mitalistiani (2018).

Cimer (2016) linked effective learning in Biology to students' perceptions of their classroom environments, which influence their engagement and success. Researchers like Osborne et al. (2015) pointed out that outdated, overloaded curricula and the separation of science from everyday life discourage student interest. Furthermore, the reliance on rote memorization in Biology learning makes it harder for students to grasp abstract concepts (Zeidan, 2015; Durmaz, 2017). To enhance the quality of science education, researchers advocate for integrating students' perspectives into curriculum development and teaching strategies (Macbeath & Mortimore, 2012; Ekici, 2015).

Modern science teaching emphasizes a student-centered approach, moving away from traditional teacher-led instruction. This shift, as described by Akinnubi et al. (2015), involves fostering inclusivity, cooperation, and diversity in the classroom. Although this approach is gaining traction, challenges remain in its implementation.

Statement of the Problem

The performance of secondary school students in science subjects, particularly Biology, has been a cause for concern. Over the years, a noticeable decline in students' academic achievement has been documented. Studies, such as those by Nzelum (2015), Akinyemi (2016), and Owoeye (2016), highlight the downward trend in the academic performance of senior secondary school students in Nigeria. This issue has raised significant concern among parents, teachers, and curriculum developers, especially regarding external examinations like the West African Examination Council (WAEC) and National Examinations Council (NECO).

Several researchers have identified various factors contributing to students' poor performance. These include teaching methods, the abstract nature of certain Biology topics, students' lack of comprehension, and their attitudes and interest in the subject (Nasr, 2011; Adeshina & Akinbobolola, 2015). Experiencing repeated failures often leads some students to question their intellectual capabilities, resulting in feelings of helplessness. Consequently, they may develop a low tolerance for challenges and give up quickly when faced with difficulties, further contributing to their negative attitudes toward the subject (Chu, 2015).

According to reports from WAEC subject heads, the 2018, 2022 SSCE results revealed that students struggled with specific Biology topics. In particular, student performance in Kaura Local Government Area was reported to be the lowest in the past five years. In light of this, the present study aims to explore senior secondary school students' perceptions of challenging concepts in Biology within Kaura, Nigeria.

Objectives of the Study

The objectives of this research are as follows:

1. To explore the biology concepts that senior secondary school students in a Local Government Area of Kaduna State find challenging.
2. To examine the influence of gender on students' perceptions of challenging biology concepts in Kaura Local Government Area, Kaduna State.
3. To investigate the factors contributing to the difficulty of these biology concepts in Kaura Local Government Area, Kaduna State.

Research Questions

The study was guided by the following research questions:

1. Which biology concepts do senior secondary school students in Kaura Local Government Area, Kaduna State, find challenging?
2. Are there gender differences in how senior secondary school students in Kaura Local Government Area perceive difficult biology concepts?
3. What factors contribute to the difficulty of biology concepts among students in Kaura Local Government Area, Kaduna State?

Research Hypotheses

The research was guided by the following null hypothesis:

HO_1: There is no significant difference in the perceived level of difficulty in biology between male and female students in Kaura Local Government Area, Kaduna State.

METHODOLOGY AND MATERIALS

Research Design

This study adopted a descriptive survey research design, which involved collecting data to understand the nature of a situation as it existed during the study. According to Akpan (2014), this design is suitable for descriptive research as it aims to explore and describe existing conditions.

Population of the Study

The study population included all biology students in Kaura Local Government Area of Kaduna State. At the time of the research, the study area had a total of 2,550 senior

secondary school students (SS1–SS3), as reported by the Ministry of Education Zonal Office, Kaura, Kaduna State (2024). Table 1 provides further details.

Table 1: Population of the Study

S/N	Name of school	Status	No of Male Students	No of Female Students	Total number
1	GSS Kaura	Co-educational	352	317	669
2	GSS Fada Takad	Co-educational	260	185	445
3	GSS Bondong	Co-educational	243	189	432
4	GSS Kadarko	Co-educational	201	147	348
5	GSS Garaji	Co-educational	154	132	286
6	GSS Manchok	Co-educational	215	155	370
	TOTAL		**1425**	**1125**	**2550**

Source: MOE Zonal Office, Kaura, Kaduna State Ministry of Education (2024)

Sample and Sampling Technique

To obtain a sample for this study, three senior secondary schools were chosen at random from a total of six, using a simple random sampling method (hat draw). The selected schools had a combined student population of 1,387, which was used as the study's sample. This sample size aligns with the recommendations of Krejcie and Morgan (1970), who suggest that for populations below 5,000, a sample size of 15% to 20% is appropriate. The study specifically focused on SSII students, as they are considered more stable compared to SSI students, who are beginners, and SSIII students, who are preparing for their SSCE examinations.

Table 2: Sample of the Study

S/N	Name of school	Codes	No of SS Students
1	GSS Kaura	A	669
2	GSS Bondong	B	432
3	GSS Garaji	C	286
	Total		**1387**

Instrumentation

The tool used for data collection in this study was a structured questionnaire titled Students' Perception of Difficult Concepts in Biology Questionnaire (SPDCBQ). This instrument comprised 29 items aimed at exploring students' views on biology concepts perceived as challenging. It sought to identify these difficult concepts and examine how students' academic performance supports or refutes their difficulty.

Validity of Instrument

The instrument was reviewed and validated by two senior lecturers holding PhDs from the Department of Education, Ahmadu Bello University, Zaria. They assessed its face and content validity and provided expert recommendations to improve the quality of the questionnaire.

Reliability of Instrument

To determine the reliability of the instrument, it was administered to an intact class at GSS Fada Takad, which falls within the study's population. The split-half method (odd and even item approach) was utilized to evaluate the individual test items, and the Spearman-Brown formula was applied to calculate reliability. A reliability coefficient of 0.76 was obtained, confirming the SPDCBQ as a dependable tool for the research.

Method of Data Analysis

The data obtained from the respondents was analyzed using mean scores and standard deviation to address the research question, while t-test statistics at a 0.05 significance level were employed to evaluate the null hypothesis.

RESULTS AND DISCUSSION

Research Question One: What biology concepts do senior secondary school biology students perceive as difficult in Kaura Local Government Area, Kaduna State?

Table 3: Topics Perceived by Students to be Difficult

S/N	Item Statement	Yes	No
1	Mendelian Genetics	975 (70.30%)	412 (29.70%)
2	Nervous system	919 (66.26%)	468 (33.74%)
3	Reproduction	868 (62.58%)	519 (37.41%)
4	Homeostasis	844 (60.85%)	543 (39.15%)
5	Genes and chromosomes	836 (60.27%)	551 (39.73%)
6	Sensory organs	821 (59.19%)	566 (40.81%)

S/N	Item Statement	Yes	No
7	Evolution	820 (59.12%)	559 (40.88%)
8	DNA synthesis	792 (57.10%)	595 (42.90%)
9	Skeletal system	767 (55.30%)	620 (44.70%)
10	Mitosis and meiosis	763 (55.01%)	624 (44.99%)
11	Excretory system	640 (38.94%)	847 (61.06%)
12	Enzymes	604 (43.54%)	783 (56.46%)
13	Classification	536 (38.64%)	851 (61.36%)
14	Cell and organelles	530 (38.22%)	857 (61.78%)
15	Transport of materials	521 (37.57%)	866 (62.43%)
16	Protein synthesis	514 (37.06%)	873 (62.94%)
17	Photosynthesis	475 (34.24%)	912 (65.76%)
18	Ecology	394 (28.41%)	993 (71.59)
	Aggregate Mean Score	**3.14**	**S.D 1.78**

The data in Table 3 shows that 975 (70.30%) students found Mendelian genetics to be difficult, 919 (66.26%) struggled with the nervous system, 868 (62.58%) had difficulty with reproduction, and 844 (60.24%) pointed to homeostasis as a challenging topic. Additionally, 836 (60.27%) students found genes and chromosomes difficult, 821 (59.19%) cited sensory organs as challenging, and 820 (59.12%) mentioned evolution. Furthermore, 792 (57.10%) of the students found DNA synthesis difficult, 767 (55.30%) pointed to the skeletal system, 763 (55.01%) struggled with mitosis and meiosis, 640 (46.14%) found the excretory system difficult, and 604 (43.54%) identified enzymes as a challenging subject. Other topics identified as difficult include classification (536, 38.64%), cell and organelles (530, 38.22%), transport of materials (521, 37.57%), and protein synthesis (514, 37.06%). Lastly, 475 (34.24%) of the students considered photosynthesis a difficult topic. In summary, most students found subjects such as Mendelian genetics, nervous system, reproduction, and several other biological topics challenging.

Research Question Two: Is there any gender disparity in perception of difficult concepts in biology among senior secondary school students in Kaura Local Government Area, Kaduna State?

Table 4: Response on the Perception of Male and Female Students on Difficult Biology Topics

Gender	N	Mean	Std. Deviation
Male	707	50.97	4.79
Female	680	48.24	4.65

Table 4 aimed to determine whether there is a gender difference in the perception of challenging biology topics. The results revealed that the average score for male students was 2.73, which was higher than that of female students. This analysis indicates that male students generally perceive biology topics as more difficult than their female counterparts. Therefore, there is a gender disparity in how senior secondary school students in Kaura Local Government Area, Kaduna State, perceive difficult topics in biology.

Research Question Three: What are the reasons for the difficulties of the biology concepts in Kaura Local Government Area, Kaduna State?

Table 5: Reasons Why Students Perceive Certain Topics as Difficult

S/N	Item Statement	Yes	No
19	Unavailable instructional materials	867 (62.50%)	520 (37.50%)
20	Students don't know the real meaning of certain words	840 (60.56%)	647 (39.44%)
21	Poor attitude of teachers to teaching	836 (60.27%)	551 (39.73%)
22	Lack of practical classes or lessons	824 (59.41%)	563 (40.59%)
23	Poor students study habits	821 (59.19%)	566 (40.81%)
24	Abstractness	804 (58.45%)	583 (41.55%)
25	Poor teaching methods by the teacher	782 (55.10%)	605 (42.90%)
26	Topics cannot be practicalised or demonstrated	521 (41.57%)	866 (58.43%)
	Aggregate Mean Score	**3.08**	**S.D 1.72**

Table 5 aimed to explore the reasons why students find certain topics challenging. The results showed that 867 (62.50%) of students cited the unavailability of instructional materials as a factor, while 840 (60.56%) pointed to a lack of understanding of specific terms or words. Additionally, 836 (60.27%) believed that teachers' poor attitude toward teaching contributed to the difficulty of some topics, and 824 (59.41%) highlighted the absence of practical classes. 821 (59.19%) mentioned that poor study habits among students make certain topics harder to grasp, while 804 (58.45%) identified the abstract

nature of some topics as a barrier. Moreover, 782 (55.10%) felt that ineffective teaching methods contributed to the difficulty, and 521 (41.57%) agreed that some topics are impractical or cannot be demonstrated.

Test of Null Hypothesis

The null hypothesis were tested at 0.05 level of significance and the result are presented below.

Hypothesis One: There is no significant difference in the perception level of difficulty among male and female students in Biology in Kaura Local Government Area, Kaduna State.

Table 6: t–test Analysis of Difference in the Perception Level of Difficulty among Male and Female Students in Biology

Variable	N	Mean	Std. Dev.	Df	t-cal	P	Remark
Male	707	50.97	4.79	1385	2.56	0.004	S
Female	680	48.24	4.65				

* Significant at ≤0.05

Table 6 analysed the difference in the perception level of difficulty among male and female students in Biology. Result indicates that the t-calculated value of 2.56, while the p-value is 0.004, which is less than the level of significance (0.05) at 1385 degree of freedom. The null hypothesis is therefore rejected, meaning that perception level of difficulty of biology concepts is affected by gender.

Discussion of Findings

An analysis of research question one revealed that students found certain topics particularly difficult. The researchers identified specific topics, such as Mendelian genetics, the nervous system, reproduction, homeostasis, and genes and chromosomes, as especially challenging. This observation aligns with the findings of Tekkaya et al. (2014), who also reported that secondary school students struggle with topics like hormones, genes and chromosomes, mitosis and meiosis, the nervous system, and Mendelian genetics. Cimer (2016) also noted that students find a variety of biology topics difficult, including water transport in plants, protein synthesis, respiration, photosynthesis, gaseous exchange, cellular processes, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics, and the central nervous system.

The analysis of research question two showed that gender plays a significant role in students' perception of difficult biology topics, suggesting that both male and female students find biology equally challenging. This supports the findings of Kyado, Abah & Samba (2019) and Kubiatko, Tukur & Rovnanova (2020), who identified gender differences in science achievement in schools. However, the result contradicts Kojigili & Mohammed (2016) findings, which indicated no statistically significant effect of sex on performance differences between male and female students.

In response to research question three, students listed various reasons for their perceived difficulties in biology. These reasons included a lack of instructional materials, confusion about certain terms, inadequate teaching, the absence of practical classes, poor study habits, abstract concepts, and ineffective teaching methods. This corresponds with the findings of Tekkaya et al. (2014), Cimer (2016), and Zeidan (2015), who identified teaching methods, the abstract nature of biological concepts, and the organization of biology as major challenges in learning the subject. Additional difficulties mentioned included overloaded curricula, the interdisciplinary nature of biology, and challenges with textbooks.

Finally, the test of the null hypothesis revealed that the t-calculated value of 2.56 was greater than the p-value of 0.004, leading to the rejection of the null hypothesis. This indicates that students' perceptions of difficulty in biology are influenced by gender, consistent with the findings of Achor and Agbidye (2014). However, this contradicts Oyovwi's (2021) conclusion that gender is not a significant factor in understanding integrated science concepts.

Conclusion

Based on the findings of this study, it can be concluded that students view certain topics in Biology as more challenging than others. Gender influences how students perceive the difficulty of these topics. Factors such as abstractness, complexity, misconceptions, lack of instructional materials, inadequate practical sessions, teachers' ineffective teaching methods, and poor study habits among students contribute to their perception of the difficulty of these topics.

Recommendations

Based on the findings of the study, the following recommendations are suggested:

1. The senior secondary school biology curriculum should be updated to make the content more relevant, engaging, and reflective of recent advancements in the field.
2. Lessons should connect the teaching and learning process to real-life situations to enhance students' understanding and interest.

3. Emphasis should be placed on interactive and practical teaching methods rather than relying solely on traditional lectures. This approach would foster inquiry-based learning, allowing students to explore topics of personal interest.

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