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Perceived difficulty levels of basic concepts in biology by teachers in senior schools in Ogbomosho, Nigeria

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ABSTRACT

Over the years, many factors have been visible that lead to unimpressive performance in biology. One of the factors includes ineffectiveness and inefficiency of biology teachers which results from the difficulties faced with some biology concepts. The study investigated perceived difficulty levels of basic concepts in biology by teachers in senior schools in Ogbomosho, Oyo State. The study adopted a descriptive research of the survey type. The population for this study comprised all biology teachers in Ogbomosho. A simple random sampling technique was employed to select 262 respondents. The research instrument for this study was the Biology Teachers' Perceptions Questionnaire on Difficult Concepts (BTPQDC). Three research questions were raised in the study. The research questions were analyzed using frequency count, percentage and cross-tabulation. The results showed that biology teachers perceived the majority of the basic concepts as not difficult. The concepts include the conservation of energy topics such as laws of thermodynamics, food chain, water cycle, micro and macro elements and holozoic nutrition Also, biology teachers perceived some reasons as the cause of difficulty in the basic concepts of biology. They include misconception of the concepts, insufficient subject-matter knowledge of the concepts, abstractness of the concepts, and complexity of the topic.

INTRODUCTION

Science is a fundamental part of human society that helps transform the environment towards improving the general quality of life. Science is defined as any system of knowledge concerned with the physical world and its phenomena and entails unbiased observations and systematic experimentation (Bauer & Kirchner, 2020). Science involves pursuing knowledge covering general truths or the operations of fundamental laws. Science is the body of knowledge systematically arranged and showing the operation of general laws and also as a systematic knowledge of the physical or material world gained through observation and experimentation (Harman et al., 2019). Science has made a great impact today in the world in terms of development and advancement in many areas of living to eradicate poverty, combating hunger, improving the health and well-being of people. The essence of teaching science at all levels of education is to obtain some desirable changes in students at the end of teaching. The desirable changes are; acquiring intellectual skills, behavioral development, ability to judge and reason well, development of interest in Science, Technology and Mathematics, and easy acquisition of problem-solving skills in science (Cebrián & Junyent, 2015).

Biology is a branch of science that specifically focuses on the study of living organisms, their taxonomy, structure, function, growth, evolution, and environmental interaction (Alberts et al., 2020). Through scientific inquiry and experimentation, biologists seek to uncover the fundamental principles and mechanisms that govern life (Sadava et al., 2018). The subject of biology has remained important for the survival of life on Earth because it is a natural science that deals with the study of life and the relationship between living organism and their physical environment (Luwoye et al., 2021). Biology has been applied in the production of food, shelter and clothing, which are three necessities of life. Biology occupies a unique position in the school curriculum as it is central to many science-related courses such as medicine, pharmacy, agriculture, nursing, biochemistry, and it plays a vital role in the development of a nation (Mathew et al., 2016). Perception is organizing, identifying, and interpreting sensory information to represent and understand the presented information, or the environment (Leung, 2023). Perception involves signals that go through the nervous system, resulting from physical or chemical stimulation of the sensory system. Perception is not only the passive receipt of these signals, but also shaped by the recipient's learning, memory, expectation, and attention. Falade (2013) described perception as a means of receiving and collecting; a way of taking possession and apprehension with the mind or senses that give us information about properties and elements of a system to create an experience about it. It involves the sense of touch, sight, taste, hearing and smell to identify things in an attempt to describe them. Perceptions of teachers largely determined the level of understanding reached by the students. Hence, the teachers' perception is the most important educational input in predicting students' achievement (Akram et al., 2022; Bond et al., 2018; Wanner & Palmer, 2015). Perception is critical because it influences the information that enters working memory. Background knowledge in the form of schemas affects perceptions and subsequent learning. Teachers perceive difficult topics differently. Therefore, it is apparent to assess the biology teachers' perceptions of difficulty levels of basic concepts in biology in Ogbomosho, Nigeria.

It is generally believed that educators presume whatever teachers consider vital content, they are likely to be taught effectively. However, whatever is perceived as difficult will possibly not be taught well. Hence, teachers are likely to be facing difficulties which may pose a negative effect on students' conceptual understanding in the school (Licorish et al., 2018). It is on this note that educators have carried out several researches on teachers' perception of difficult concepts in sciences (Jennings & Bearak, 2014). Abe & Owoeye (2017) investigated teachers' perception of difficult topics in the Biology curriculum in Akure South Local Government Area of Ondo, State Nigeria. The researcher selected thirty-two (32) teachers from twenty (20) Senior Secondary Schools for the study. The result of the study revealed that, out of forty-one (41) topics, nineteen

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(19) were found to be very easy to teach. The study also found that the experience and qualification of the teachers influence the perception of difficult topics in the Biology curriculum. Etobro & Fabinu (2017) investigated the teachers' perceptions of important and difficult biology content in secondary schools in Kwara State. The study found that the biology content areas perceived by teachers as important belong to what can be called "Applied Biology". The study also found that biology content areas perceived as difficult by teachers to teach belong to "Pure Biology". Examples of biology topics perceived as difficult to teach included Ecology, Chromosome, Cellular, Respiration, Growth and Heredity.

Ladd & Sorensen (2017) and Banerjee et al. (2016) submitted that teaching experience is positively associated with student achievement gains throughout a teacher's career. Gains in teacher effectiveness associated with experience are most steep in teachers' initial years but continue to be significant as teachers reach the second, often third, decades of their careers. They also found out that as teachers gain experience, their students learn more, as measured by standardized tests, but they are also more likely to do better on other measures of success, such as school attendance.

Statement of the problem

Biology is undoubtedly a key discipline in understanding and responding to some of the most pressing issues of the day, from the many challenges arising from population growth and human impact on ecosystems and services to climate change (Kim & Diong, 2012). It plays a vital role in the development of a nation. According to Nwakonobi (2010) recent advances in biochemistry, physiology, ecology, genetics, and molecular biology have made the subject a central focus of most human activities. It was, however, observed that despite the importance of biology, the performance of students in the West African Senior School Certificate Examinations (WASSCE) has not been impressive.

There are several studies on biology teachers' perceptions of difficulty levels of topics in the biology curriculum outside Ogbomosho. Still to the best knowledge of the researcher, studies on biology teachers' perceptions of difficulty levels of basic concepts in biology have not been carried out in Ogbomosho before and most of the previous studies did not investigate reasons why the teachers are facing such difficulties. On this premise, the researcher investigated the senior school biology teachers' perceptions of difficulty levels of basic concepts in biology in Ogbomosho, Nigeria. The main purpose of this study was to determine the perceived difficulty levels of basic concepts in biology by teachers in senior schools in Ogbomosho, Oyo State, Nigeria. Specifically, this study determined:

1. Teachers' perceptions of difficulty levels of basic concepts in biology;
2. Reasons for their perceived difficulty levels of basic concepts in biology.
3. The differences in the perceptions held by biology teachers on the difficulty level of basic concepts in biology based on teachers' qualifications

Research questions

The following research questions were answered:

1. What are biology teachers' perceptions of difficulty levels of basic concepts in biology?
2. What are the reasons for biology teachers' perceptions of the difficulty levels of basic concepts in biology?
3. Is there any significant difference in the perceptions of teachers on the difficulty levels of basic concepts in biology based on qualifications?

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METHODS

The study adopted a descriptive research of the survey type. The population for this study was all the biology teachers in Ogbomosho, Oyo State. With more realistic timescales, the sampling uses fewer individuals with representative qualities to represent the huge scale (Adeoye, 2023). A simple random sampling technique was employed to sample 262 respondents. The research instrument for this study was the Biology Teachers' Perceptions Questionnaire on Difficult Concepts (BTPQDC). The BTPQDC has two parts. The first part consists of Nine (9) items to be answered by the respondents based on four scales responses on the level of difficulties: Very Difficult (VD), Difficult (D), Fairly Difficult (FD), and Not Difficult (ND). The second part contains Ten (10) items on the reasons for difficulties in the basic biology concepts. The questionnaire's content was used to rate difficulty levels of biology concepts as perceived by biology teachers in the area of study and to determine the reasons for such difficulty levels. The instrument was appropriately validated by three lecturers in the Department of Science Education, University of Ilorin. The reliability was determined using the test-retest method and analyzed using Cronbach's Alpha with a 0.88 reliability index. The research questions were analyzed using frequency count, percentage computation, and cross-tabulation.

RESULTS AND DISCUSSION

Research question 1: What are biology teachers' perceptions of difficulty levels of basic concepts in biology?

Table 1 reveals that biology teachers perceived the majority of the basic concepts in conservation of energy to be not difficult. From the table, biology teachers had the perception that only one concept is very difficult; that is, applying the first and second laws of thermodynamics to an ecological phenomenon with a 42.7% very difficult response. The table further shows that biology teachers perceived six concepts as difficult; pyramid of energy: pyramid of numbers, trophic levels, nitrogen cycle, photosynthesis, and chemosynthesis. This can be deduced from the table, which revealed that (difficult response) had the highest percentages in all four concepts, with 61.8%, 41.2%, 54.2%, 48.9%, 38.9%, and 38.2%, respectively. Finally, the table reveals that eight concepts were not difficult, while two were fairly difficult. The concepts that were not difficult are the first law of thermodynamics 71.0%; the second law of thermodynamics 66.4%; food chain 93.1%; decomposition in nature 54.2%; water cycle74.0%; microelements 81.7%; macro elements 72.5%; and holozoic nutrition 54.2%. However, the fairly difficult concept is food web 61.8% and carbon cycle 55.7%.

Table 1. Frequency and percentages of the perception held by biology teachers on the difficulty levels of basic concepts in conservation of energy

S/N	Conservation of energy concepts	Not Difficult (%)	Fairly Difficult (%)	Difficult (%)	Very Difficult (%)	Total
1	The first law of thermodynamics	186 (71.0)	46 (17.6)	30 (11.5)	0 (0.0)	262 (100.0)
2	The second law of thermodynamic	174 (66.4)	84 (32.1)	4 (1.5)	0 (0.0)	262 (100.0)
3	Application of the first and second laws of thermodynamics	36 (13.7)	42 (16.0)	72 (27.5)	112 (42.7)	262 (100.0)
4	Pyramid of energy	62 (33.7)	16 (6.1)	162 (61.8)	22 (8.4)	262 (100.0)

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S/N	Conservation of energy concepts	Not Difficult (%)	Fairly Difficult (%)	Difficult (%)	Very Difficult (%)	Total
5	Pyramid of numbers	60 (22.9)	76 (29.0)	108 (41.2)	18 (6.9)	262 (100.0)
6	Food chain	244 (93.1)	18 (6.9)	0 (0.0)	0 (0.0)	262 (100.0)
7	Food web	100 (38.2)	162 (61.8)	0 (0.0)	0 (0.0)	262 (100.0)
8	Decomposition in nature	142 (54.2)	50 (19.1)	44 (16.8)	26 (9.9)	262 (100.0)
9	Trophic levels	54 (20.6)	22 (8.4)	152 (58.0)	34 (13.0)	262 (100.0)
10	Carbon Cycle	76 (29.0)	146 (55.7)	22 (8.4)	18 (6.9)	262 (100.0)
11	Nitrogen Cycle	56 (21.4)	64 (24.4)	128 (48.9)	14 (5.3)	262 (100.0)
12	Water Cycle	194 (74.0)	32 (12.2)	26 (9.9)	10 (3.8)	262 (100.0)
13	Micro Elements	214 (81.7)	32 (12.2)	14 (5.3)	2 (0.8)	262 (100.0)
14	Macro Elements	190 (72.5)	30 (11.5)	32 (12.2)	10 (3.8)	262 (100.0)
15	Photosynthesis	84 (32.1)	44 (16.8)	102 (38.9)	32 (12.2)	262 (100.0)
16	Chemosynthesis	72 (27.5)	54 (20.6)	100 (38.2)	36 (13.7)	262 (100.0)
17	Holozoic Nutrition	142 (54.2)	94 (35.9)	16 (6.1)	10 (3.8)	262 (100.0)

Research question 2: What are the reasons for biology teachers' perception of the difficulty levels of basic concepts in biology?

Table 2 depicts some coherent reasons identified by the biology teachers for the perceived difficulties. The most important reasons were misconception of the concepts with the highest number of percentages (87.8%), followed by insufficient subject-matter knowledge of the concepts (83.2%), abstractness of the concepts (68.7%), voluminous nature of the curriculum (61.8%), complexity of the topic (57.3%) and teachers' lack of knowledge updates (53.4%). However, content not studied in the institution (1.5%) had the lowest percentage.

Table 2. Frequency and percentages of the reasons for teachers' perceived difficulty in basic concepts in conservation of energy

S/N	Reasons	Frequency	Percentage
1	The abstractness of the concepts	180	68.7
2	Voluminous nature of the curriculum	162	61.8
3	Complexity of the topic	150	57.3
4	Misconception of the concepts	230	87.8
5	Insufficient subject-matter knowledge of the concepts	218	83.2
6	Content not studied in the institution	4	1.5
7	Insufficient Teaching Experience	40	15.3
8	Lack of Teaching Aids	78	29.8
9	Low commitment to work	80	30.5
10	Teachers' lack of knowledge updates	140	53.4

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Research question 3: Will there be any significant difference in the perceptions of biology teachers on the difficulty levels of basic concepts in biology based on teachers' qualifications?

Table 3. Cross tabulation of the perceptions held by biology teachers on difficulty levels of basic concepts in conservation of energy based on teachers' qualification

Qualification	Perceptions of Difficult Selected Concepts				Total
	Not difficult	Fairly difficult	Difficult	Very difficult	
Qualified	1429 (42.3%)	786 (23.3%)	933 (27.6%)	227 (6.7%)	3375 (100.0%)
Less qualified	559 (51.8%)	226 (20.9%)	177 (16.4%)	117 (10.8%)	1079 (100.0%)
Total	1988 (44.6%)	1012 (22.7%)	1110 (25.0%)	344 (7.7%)	4454 (100.0%)

Table 3 reveals an observed difference in the perceptions of biology teachers on difficulty levels of basic concepts in energy conservation based on teachers' qualifications. Based on the response of not difficult, qualified had 42.3%, and less qualified had 51.8%, respectively. Regarding fairly difficult responses, qualified had 23.3%, while less qualified had 20.9%, respectively. Given difficult responses, the qualified had 27.6%, while the less qualified had 16.4%. Lastly, according to very difficult response, the qualified had 6.7%, while the less qualified had 10.8% respectively.

The findings of this study revealed that biology teachers perceived most of the basic concepts in biology as not difficult. This implies that teaching biology in secondary schools should be effective. However, it was observed that some of the concepts were also perceived as difficult. This is corroborated by the work of Etobro & Fabinu (2017), who found out that teachers perceived some Biology topics such as Ecology, Chromosome, Cellular, Respiration, Growth and Heredity as difficult to teach. Therefore, for the correct conception of biology topics or concepts by the students, the teacher plays a pivotal role in bringing about effective and efficient teaching and learning processes. Nevertheless, this outcome proves that the expected excellent performance that is expected of all biology students at the senior secondary certificate examination will be hard to achieve. This is because biology teachers are still facing difficulties with some of the concepts, which will henceforth posit the inability of the students to fully understand the entire concept taught.

The findings also showed that biology teachers submitted that six major reasons were perceived as the cause of difficulty in the basic concepts of energy conservation. They include misconception of the concepts, insufficient subject-matter knowledge of the concepts, the abstractness of the concepts, the voluminous nature of the curriculum, the complexity of the topic and teachers' lack of knowledge updates. This implies that these difficulties may lead to students' misconceptions of biology topics and, therefore, affect the student's performance in school. This finding supports similar studies by Byukusenge et al. (2023) which observed that abstractness and lack of simplification of concepts are the reasons for difficulty in science concepts. Another finding in this study revealed an observed difference in the perceptions of biology teachers on difficulty levels of basic concepts in biology based on teachers' qualifications in favor of qualified teachers. Qualified teachers have less difficulty in basic biology concepts than their unqualified counterparts. This finding supports the result of Abe & Owoeye (2017) who found out that the experience and qualification of teachers influence the perception of difficult topics in the Biology curriculum. This is because qualified and experienced teachers have more training programs to implement the biology curriculum.

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CONCLUSION

The study concluded that biology teachers perceived most of the basic concepts in energy conservation as not difficult. The study also concluded that biology teachers submitted that there are six major reasons perceived as the cause of difficulty in basic concepts in energy conservation. Also, there was a significant difference in the perceptions held by biology teachers on basic concepts in the conservation of energy in all the variables, including teachers' qualifications, teaching experience, teachers' gender and school location. Based on the findings, the following recommendations are advanced:

1. Since some of the concepts in biology are perceived as difficult by biology teachers. Biology teachers should try to always update their knowledge through seminars, conferences and individual research through the Internet.
2. The government should organize on-the-job training, seminars, workshops, symposia and conferences at intervals for biology teachers in secondary school to enrich them academically and increase their classroom productivity.
3. Curriculum planners have to make the subject matter of biology curriculum more contemporary, meaningful and interesting for both the teachers and students, reflecting the recent developments in the field to the curriculum and relating lessons with daily life issues.

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