PERCEPTION OF DIFFICULT CONCEPTS IN BIOLOGY AMONG SENIOR SECONDARY SCHOOL STUDENTS' IN KANO STATE

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Abstract
The study sought to find out the difficult concepts in biology among senior secondary school two (SS 2) students' in Kano state. An instrument (questionnaire) was administered to 400 SS II students in some selected senior secondary schools in Kano State, Nigeria. The data collected were analyzed both qualitatively and quantitatively. The result showed that there was no significant difference in the perception of students on difficult topics in Biology on the basis of their subject areas - Science, Commercial or Arts (F(2, 397) = 1.523, p> 0.05, Partial η2= .008, R2=.003). Moreover, findings revealed that students usually have difficulties in five major topics. Among of which were nutrient cycling in nature, ecological management, conservation of natural resources, pests and diseases of crops as well as reproductive system in plants. However, teaching strategies, students' attitude, inadequate learning resources and students' learning habits were the reasons adduced by students of the perceived difficult topics. It can be concluded from the study that SS II students perceived some topics as difficult and some as not difficult in Biology. It was recommended that integrating biological concepts to daily life and provision of adequate and functional resources should be made available.
Keywords: Biology, Concepts, Difficulty and Perceptions

Introduction

The characters in current teaching appear to be discipline-centred, teacher-centred teaching, and the student learning is just passive surface learning. A wealth of evidence has been reported to support the concept that under the discipline-centred teaching, the needs, concerns, and requirements of teachers and students are not considered because the subject content is driven by, and depends mainly on the disciplinary content that must be presented. Science teaching requires attention to both the content of the course and the process of moving students from their initial state of knowledge and understanding to the desired level. In fact, teaching is part of a whole that comprises the teacher, the learner, the disciplinary content, the teaching/learning process, and the evaluation of both the teacher and the learner. A shift from the traditional teacher-centred to a progressive mode of teaching-learning process had led to an increased interest in learners' individual differences. The new paradigm is student centered, based on inclusiveness, cooperative learning and encouraged diversity. In spite of the new approach to the teaching-learning process, students' performance in examinations appears to be discouraging; prompting researchers to investigate the causes of the poor performance and how to improve on the teaching-learning process (Samba & Eriba, 2012).

There has been consistent decline in the performance of students in public examinations conducted by the west African Examination Council (WAEC) and the National Examination Council (NECO) in sciences across the country over the years (Agogo, 2003). Ahmed and Abimbola (2011) argue that because of its numerous importance, Biology is the most popular choice, among science subjects nationwide, offered by candidates sitting for the senior secondary school certificate examinations. According to WAEC Research Report (2008) and (2009), despite the popularity of Biology, results of research studies always revealed the poor performance of students in the subject. Results from findings revealed that a vast number of factors are responsible for the students' poor performance: difficult biological concepts: the nature of science itself and its teaching methods as well as the biological level of organization and the abstract level of the concepts (Zeidan, 2010).

Cimer (2011) argued that many concepts or topics in biology, including water transport in plants, protein synthesis, respiration and photosynthesis, gaseous exchange, energy, cells, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics, Mendelian genetics, genetic engineering, and the central nervous system can be perceived as difficult to learn by secondary school students. While Tekkaya et al. (2008) found that hormones, genes and chromosomes, mitosis and meiosis, the nervous system, and Mendelian genetics were considered difficult concepts by secondary school students. Ozcan, (2003) stressed that experiencing difficulties in so many topics in biology negatively affects students' motivation and achievement. Students' difficulties with many topics in biology have stimulated researchers to investigate why students experience such difficulties and how to overcome these difficulties. Experiencing difficulty in Biology could be attributed to many factors such as classroom learning environment, lack of interest in learning science, overloaded curriculum content and delineation of science from society, among others.

Designing learning environments while ignoring students' interests and expectations causes several learning problems as well as decreasing their interest in biology (Zeidan, 2010). Cimer (2011) indicates that there is a close relationship between students' perceptions of their classroom learning environment and their success. Osborne and Collins (2009) also report that students'diminishing interest in learning science was due to the curriculum content being overloaded and not generally related to working life, the lack of discussion of topics of interest, the absence of creative expression opportunities, the alienation of science from society and the prevalence of isolated science subjects. Biological science includes many abstract concepts, events, topics and facts that students have to learn. This makes it hard for students to learn them (Durmaz, 2007). Also, in addition to determining the factors that negatively affect students' learning in biology, understanding students' views on what makes their biology learning effective is crucial, as many researchers suggest that in order to improve the quality of teaching and learning in school, students' views must be taken into consideration by researchers, teacher educators, schools and teachers (Ekici, 2010).

It is thought that how students perceive the learning environment in biology affects their attitudes towards biology and its learning (Ozcan, 2003). Therefore, understanding secondary school students' perceptions of biology will help policymakers, teachers and teacher educators plan more effective teaching activities that can help students learn biology better and have more positive attitudes towards it. Gender differences may perhaps influence students' perception on, and achievement in biology difficult concepts. According to European Union (EU), gender differences in science achievement are the smallest (EU, 2010). It was further stressed that despite performing equally well as boys in most countries, girls tend to have a weaker self concept in science, Biology inclusive than males, i.e., on average, girls had lower levels of belief in their science abilities than boys. Yet, both boys and girls are similarly interested in science; and there is no overall difference in boys' and girls' inclination to use science in future studies or jobs. The reason why boys perceive biological concepts easier than girls could be attributed to socialization factors and classroom experiences leading to low self-esteem and passive dependent behaviour among girls.

Purpose of the Study

The purpose of this study is to investigate the difficult concepts in biology among senior secondary school two (SS 2) students' in Kano state. The study sought to:

(i) Identify the topics in SS II students perceive difficult to learn.
(ii) Find out if gender influences students' perception of difficult topics in SS II Biology.
(iii) Find out the causes of topic difficulties by SS II Biology students.

Research Questions

The following research questions were raised to guide the study:

(i) What Biology topics do SS II students perceive as difficult?
(ii) Is there any difference in the perception of male and female students of difficult Biology topics?

(iii) What are the causes of the difficulties experienced by the SS II students in biology?

Methodology

The study employed a survey design. The study was carried out in Local Education Authority comprising of Kumbotso, Gwale, Ungogo and Dala of Kano State, Nigeria. Two schools were randomly selected from each of the local government areas. The population consisted of all the 138 senior secondary schools and about 16,221 Senior Secondary School Two (SSII) students in the study area, out of which 400 senior secondary II biology students were sampled using stratified random sampling method. Fifty (50) biology students were selected from each school. The four hundred students were selected from the Science, Commercial and Arts classes using proportionate to size sampling technique. The instrument used for data collection was the Biology Difficult Topics Questionnaire (BDTQ). It was constructed by the researchers and consisted of three sections: A, B and C. Section A contained the bio-data, while Section B consisted of senior secondary II (SSII) topics drawn from the National Curriculum. Section C consisted of open-ended items that sought the students' causes of difficulties as well as possible remedies. The instrument was validated by two experts in biology unit from the Department of Science and Technology Education, Bayero University, Kano, Nigeria. The instrument was then pilot-tested on one hundred SS II students that were not used in the study. The instrument was validated using Cronbach alpha, which gave an index of .77. The validated instrument was thereafter administered to the respondents by the researcher, with the assistance of the biology teachers in the schools. The data obtained were scored and analyzed. The scoring was based on a-four point Likert Scale: 1 very difficult (VD); 2 difficult (D); 3 averagely difficult (AD) and 4 not difficult (ND).

Results

Research Question 1: What Biology topics do SS II students perceive as difficult?

Table 1: Showing the frequency distribution of the perception of students on the level of difficulty of Biology topics in the National Curriculum.

S/N	TOPIC	S D	ND
1	Digestive system	137 (34.3%)	263 (65.8%)
2	Transport system	96 (26.1%)	304 (76.1%)
3	Respiratory system	93 (23.3%)	307 (76.8%)
4	Excretory system	101 (25,3%)	399 (74.8%)
5	Nutrient cycling in nature	263 (65.8%)*	137 (34.3%)
6	Ecological management	273 (68.3%)*	127 (31.8%)
7	Tolerance	65 (16.3%)	335 (83.8%)
8	Adaptation	134 (33.6%)	266 (66.6%)
9	Pollution	156 (39%)	244 (61%)
10	Conservation of natural resources	221 (55.3%)*	179 (44.8%)
11	Pests and diseases of crops	238 (59.5%)*	162 (40.6%)
12	Reproductive systems in vertebrates	75 (18.8%)	325 (81.3%)
13	Reproductive system in plants	201 (50.3%)*	199 (49.8%)
14	Classification of plants	165 (41.3%)	235 (58.8%)

***Perceived difficult topics**

Table 1 showed the level of difficulties of Biology topics in the National Curriculum. Majority of the topics were perceived as not being difficult by the students. However, nutrient cycling in nature, ecological management, conservation of natural resources, pests and diseases of crops as well as reproductive system in plants were perceived to be difficult by the students.

Research Question 2: Is there any difference in the perception of male and female students of difficult Biology topics?

Table 2a: Showing the descriptive statistics of the perception of male and female students of difficult Biology topics

Gender	N	Mean `	Std. Deviation	Std. Error Mean
Male	202	2.85	.494	.035
Female	198	2.86	.510	.036

Table 2b: Showing the Chi-Square Tests of the perception of male and female students of difficult Biology topics

Gender	N	df	$\chi 2$		α
Male	202	34	44.382	0.11	
Female	188				

Table 2a showed that the mean score of male students is 2.85 while that of the female students is 2.86. This implies that there is no difference in the perception of difficult Biology topics between the male and female students. Table 2b showed the Chi-Square Tests of the perception of male and female students of difficult Biology topics. The table revealed that there was no difference in the perception of male and female students of difficult Biology topics, $\chi 2$ (34, N = 400) = 44.38, p = .110. This implies that male and female students perceived the Biology topics in the same way. This implies that, gender has no significant effect on students' perception of difficult Biology topics. This result could be an indication that biology topics pose same level of difficulty to both male and female students. This shows that the students' performance in Biology is not a function of their sex. The insignificant difference between the male and female students may be due to their exposure to similar socialization factors and classroom experiences as well as less emphasis on gender inequalities.

Research Question 3: What are the causes of the difficulties experienced by the senior secondary II students in biology?

Table 3a: Students' causes of the perceived Biology difficult topics

S/N	Students' causes	No of students	%
1	Abstractness	321	80.25
2	Complexity	305	76.25
3	Misconception of topics	298	74.5
4	Unavailable instructional materials	250	62.5
5	Poor attitude of teachers to teaching	250	62.5
6	Lack of practical classes	245	61.25
7	Poor students study habits	97	24.25

Table 3 shows the different reasons adduced by the students for their perception on biology difficult topics. The highest commonly advanced sources was abstractness of topics indicated by 321 (80.25%) students, while the least commonly source was lack of practical classes indicated by 97 (24.25%) students. Other causes included complexity, misconception of topics, unavailable instructional materials, poor attitude of teachers to teaching, lack of practical classes and poor students study habits.

Discussion

The findings of this study showed that, SS II students perceived five Biology topics out of the fourteen topics in SS II as contained in the National Curriculum to be difficult. These are nutrient cycling in nature, ecological management, and conservation of natural resources, pests and diseases of crops as well as reproductive system in plants. This finding is in line with Tekkaya et al. (2008) who earlier reported that secondary school students generally find hormones, genes and chromosomes, mitosis and meiosis, the nervous system, and Mendelian genetics difficult to learn. Cimer (2011) identified many concepts or topics in biology, which include water transport in plants, protein synthesis, respiration and

photosynthesis, gaseous exchange, energy, cells, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics, Mendelian genetics, genetic engineering, and the central nervous system perceived as difficult to learn by secondary school students.

The study revealed that gender has no significant difference on students' perception of difficult Biology topics. This result could be an indication that biology topics pose same level of difficulty to both male and female students. This shows that the students' perception of difficult topics in Biology is not a function of their gender. This finding agrees with Areola (2005) who holds that the effect of sex in the difference in performance between male and female is not statistically significant.

The finding also supports Ivowi (2009) who found out that sex was not significant factor in the understanding of physics concepts. The result of this study therefore contrasts with that of Njoku (2004) and Isa (2005) who revealed that there exist gender differences in science achievement in the schools. The study revealed that students adduced some reasons for their perception of difficult Biology topics. They attributed their causes of difficulty of the perceived difficult topics to abstractness, complexity, misconception of topics, unavailable instructional materials, poor attitude of teachers to teaching, lack of practical classes and poor students study habits. This finding is in consonance with the findings of Zeidan, (2010); who identified the nature of science itself and its teaching methods as well as the biological level of organization and the abstract level of the concepts as reasons for encountering difficulty in learning biology.

Conclusion

It can be concluded from the study that SS II students perceived some topics as difficult and some as not difficult in Biology. However, the study revealed that gender has no significant difference on students' perception of difficult Biology topics. Similarly, the study revealed that students' choice of subjects had no effect on their perception of difficult topics in Biology. Furthermore, the students attributed their causes of difficulty of the perceived difficult topics to abstractness, complexity, misconception of topics, unavailable instructional materials, poor attitude of teachers to teaching, lack of practical classes and poor students study habits.

Recommendations

The following recommendations are stated:

1. There is a need to make the subject content of senior secondary school biology curriculum more contemporary, meaningful and interesting for the students, reflecting the current developments in the field and relating teaching learning process with daily life issues.
2. Biology instruction should be supported by qualified textbooks, instructional materials, hands-on, mind-on sessions and observations as well as experiments that actively engage students in learning processes.
3. There is need to teach biology dynamically, not as a static subject in textbooks, emphasizing inquiry instruction that would allow students to pursue areas of personal interest.

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