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Tertiary Institution Students' Perception of Difficult Topics in Organic Chemistry Curriculum in Imo State

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Abstract

This research work examined the perception of difficult topics in the organic chemistry curriculum by students in some tertiary institutions in Imo state. It attempted to find the causes of the perceived difficulties, if gender differences and school nature influence students' perception of difficult topics. Four research questions were formulated. The population consisted of all the final year students of education chemistry, pure and applied chemistry from the three selected tertiary institutions (AIFCE, FUTO and Federal Polytechnic, Nekede) in Imo State. 50% of each respondent were randomly drawn from the total population of 502 students to make up the sample size of 251 students. The data obtained were analyzed using mean scores. The results obtained showed that twelve topics were perceived difficult in the organic chemistry curriculum by the students in the tertiary institutions, gender difference has no influence on the students' perception of difficult topics in organic chemistry curriculum, school nature has no influence on the students' perception. Findings revealed among other things that Organic chemistry demands too much of molecular structures, the students find it very difficult to understand reaction mechanisms; organic chemistry laboratories are illequipped in the tertiary institutions. However, the researchers suggested that further studies should be conducted on the other areas of chemistry to verify whether such problems are applicable to them and general attention should be given to them.

1. Introduction

Education as a social-economic engineer for national development can only be achieved through an effective/workable curriculum implementation. The National Policy on Education (NPE) perceived education to be an instrument for sound change and effective development for the individual and the nation as a whole. Curriculum is defined as the planned and guided learning experiences and intended learning outcomes, formulated through the systematic reconstruction of knowledge and experience under auspices of the school for the learner's continues and willful growth in personal social competence. However, the topics in the organic chemistry curriculum may be perceived simple or difficult depending on the relative factor of materials, environmental, teachers/students, learning processes and strategies which are incorporated in the curriculum. Chemistry as a subject has many concepts that appear very abstract in nature and they are difficult to understand, [1]. These abstract concepts are important because further chemistry/ science concepts or theories cannot be easily understood if these underpinning concepts are not sufficiently grabbed by the students. Originally, the term organic chemistry referred to the study of chemical compounds present in living matters, but now it is defined in terms of the study of carbon compounds, which exclude simple ones such as oxides of carbon, carbonates, cyanides and cyanates. There are vast number of synthetic and natural organic compounds due to the uniqueness of carbon.

There have been a large number of studies that explore teaching/ learning of difficult topics at different levels of education system and which show many mismatches between scientifically accepted concepts. Students start their study with a set of beliefs above the nature of learning and what they intend to achieve [2]. These beliefs are derived from early school and learning experience as well as their current goals and motive. Right from secondary schools, students perform poorly in organic chemistry. According to [3]; [4] the chief examiners reports for chemistry have branded organic chemistry part of the questions as unpopular to the students and that very few candidates answer questions in that area. The chief examiners reports [3]; [4] specifically stated that "the only organic chemistry question, referring to question 4 of the written section, was the most unpopular and was answered by very few candidates. And unfortunately they transfer the same ignorance to tertiary institutions. In tertiary institutions, chemistry is one of the departments with few students and the students perform poorly. It is in line with this that the researchers tend to investigate the difficulties in teaching/learning of organic chemistry concepts or topics.

[5] carried out a research work on the students' anxiety towards the learning of chemistry in some Ethiopian Universities" Data for the study were obtained by administering a questionnaire to 300 respondents. The data obtained were analyzed using students, whether male or female, urban or rural based, show great anxiety towards the learning of chemistry and the anxiety is higher in female and rural based students than male and urban based students. The cause of student's anxiety as revealed by the study includes redundancy of the curriculum, low awareness of career opportunities, the teachers and their teaching methods and lack of teaching aids/laboratory.

1.1. Statement of the Problem

Often times, students' performance in the chemistry courses both in secondary and tertiary institutions are very poor. This is evident in the number of failures recorded in the course each year [6]. This could be attributed to the method and lack of adequate exposure to the essential principles that enhance better teaching/learning. It could equally be attributed to poor conceptualization of what is being taught due to unavailability or inaccessibility and non-usability of adequate materials which enhances concrete understanding.

However, the problem is that students perform very poor in organic chemistry irrespective of the school, whether polytechnic, college of education or university. The question is why do many students fail chemistry courses?

1.2. The Purpose of the Study

The main purpose of the study was to investigate those topics in the organic chemistry curriculum that the students perceive difficult. Specifically, the study sought to

- I. Find out the organic chemistry topics the students find difficult to understand.
- II. Find out if gender difference influences students perception of difficult topics.
- III. Find out the causes of the perceived difficulties by the students
- IV.Find out the effects of school nature on the perception of difficult topics by the students.

1.3. Research Question

The following research questions were formulated to guide the study:

- a. What are the topics in the organic chemistry curriculum that are perceived difficult by the students in the tertiary institutions?
- b. How does gender difference influences students' perception of difficult topics?
- c. What are the causes of the perceived difficulties by the students?
- d. How does school nature influences the perception of difficult topics by the students?

2. Methodology

The study is a descriptive survey research. The study was carried out in three tertiary institutions in Imo state of Nigeria. They include: AlvanIkoku Federal College of Education, Owerri; Federal polytechnic, Nekede; and Federal University of Technology, Owerri. Imo state is one of the states in Eastern Nigeria. It is made up of twenty seven local government areas and divided into three political zones, namely Okigwe, Orlu and Owerri Zones. The population consisted of the entire final year students of education chemistry as well as department of pure and industrial chemistry of the other two tertiary institutions under study. 251 students completed the questionnaires and the data were subjected to mean statistics. The instrument used for data collection was questionnaire. It consisted of two sections A and B. Section "A" comprises of the bio data, while Section "B" dealt with the questionnaire items proper. The instrument was validated by two experts, one from Chemistry department and the other from department of Research methods, Alvan Ikoku Federal College of Education, Owerri. The four (4) Likert scale type was used and scored as follows: Not Difficult (ND), Slightly Difficult (SD), Difficult

(D) and Very Difficult (VD) for the topics and Strongly Disagreed (SD), Disagreed (D), Agreed (A) and strongly Agreed (SA) for the causes of difficulty. The level of difficulty of a particular topic was determined by the value of means as follows: Means less than 2.5 are said to be easy and the means above 2.5 are said to be difficult. To determine the causes of the perceived difficulties, the data collected were

subjected to mean statistics and scores of the mean less than 2.5 were regarded as accepted and means above 2.5 were taken as rejected.

Research Question One: What are the topics in the organic chemistry curriculum that are perceived difficult by the students in tertiary institutions?

S/N	ITEMS	VD	D	SD	ND	Ν	MEAN	DECISION
	IUPAC Nomenclature of	25	27	88	111	0.51	1.0.6	
1	organic compound	100	81	176	111	- 251	1.86	Easy
2	Structure of Organic	32	44	99	76	251	2.12	F
2	Molecules	128	132	198	76	251	2.13	Easy
2	Organic Reaction	81	104	40	26	251	2.00	Difficult
3	Mechanisms	324	312	80	26	251	2.90	Difficult
4	Isomorism	27	43	79	102	251	1.09	Form
4	Isomerism	108	129	158	102	231	1.90	Easy
5	Staraochamistry	90	106	31	24	251	2.68	Difficult
5	Stereoenemistry	270	318	62	24	231	2.00	Dimeut
6	Spectroscopy	84	97	47	23	251	2.96	Difficult
Ũ	specialscopy	336	291	94	23	201	2.50	Dimoun
7	Alkanes	18	14	122	97	251	1.81	Easy
		72	42	244	97			
8	Cycloalkanes	31	40	56	122	251	1.9	Easy
		124	120	112	122			5
0	Petroleum, Petrochemicals	109	87	40	15	251	3.15	Difficult
9	&Alternative fuels	-436	-261	-80	-15			
10	Alkenes and Dienes	36	42	222	62	251	2.21	Easy
		144	120	222	62			
11	Alkynes	44	38	0/	102	251	2.1	Easy
		1/0	114	134	102			
12	Alkyle Halides	20	43	49	131	251	1.87	Easy
		25	129	1/3	40			
13	Organometallic compounds	100	129	286	40	251	2.21	Easy
		100	30	46	130			
14	Alcohols	180	90	92	130	251	1.96	Easy
		37	67	87	60			
15	Polyhydric Alcohols	148	201	174	60	251	2.32	Easy
16		42	38	88	83	0.51	0.1.6	
16	Ethers and Epoxides	168	114	176	83	251	2.16	Easy
17	Thisle and Thisthese	55	35	89	72	251	2 20	F am.
1/	Thiois and Thiothres	220	105	178	72	251	2.29	Easy
18	Aldebydes and Ketones	42	44	55	110	251	2.1	Facu
10	Aldenydes and Retones	168	132	110	110	231	2.1	Lasy
19	Carboxylic Acids	39	47	74	91	251	2 14	Fasy
17	Carboxylic Acids	156	141	148	91	231	2.17	Lasy
20	Diacids and Substituted acids	40	36	69	106	251	2.04	Easy
		160	108	138	106			
21	Carboxylic Acids Derivatives	26	45	67	113	251	1.94	Easy
	5	104	135	134	113			, in the second s
22	Active methylene compounds	34	41	54	122	251	1.46	Easy
	5 1	136	123	108	122			,
23	Lipids	40	23	54	128	251	1.95	Easy
		184	09	108	128			
24	Amines	33	40	120	110	251	1.63	Easy
		140	138	120	131			
25	Cyan compounds	160	111	45 86	131	251	1.94	Easy
		100	44	53	105			
26	Derivatives of carbon acids	196	132	106	105	251	2.15	Easy
	Nitro alkanes	66	132	37	16			
27	Diazoalkanes& Azide	264	396	74	16	251	2.99	Difficult
	Amino acids, peptides and	125	74	27	25			
28	proteins	500	222	54	25	251	3.19	Difficult
29	Carbohydrates	30	45	67	107	251	1.98	Easy

Table 1. Table of Analysis of the Result of Research Question One.

S/N	ITEMS	VD	D	SD	ND	Ν	MEAN	DECISION	
		120	135	134	107				
20	Aromatic compounds:	86	95	39	31	251	2.04		
30	Benzene and Aromaticity	344	285	78	31	251	2.94	Difficult	
	Directive effects in	59	41	40	111				
31	Electrophilic, Aromatic Substitution	236	123	80	111	251	2.19	Easy	
22	Aromatic Halogen	43	51	34	123	251	2.06	Fear	
52	compounds	172	153	68	123	231	2.00	Easy	
22	Aromatia Sulphurnia Asida	49	51	56	95	251	2.22	Easy	
33	Aromatic Surpharme Acids	196	153	112	95	231	2.22		
24	Aromatia Nitro Compounda	51	43	47	110	251	2.14	Form	
54	Aromatic Nitro Compounds	204	129	94	110	231	2.14	Lasy	
35	Aromatic Amines and	86	95	39	31	251	2.94	Difficult	
55	Diazoniumsalts	344	285	78	31	231	2.74	Difficult	
36	Phenols and Aromatic ethers	35	46	60	110	251	1.63	Fasy	
50		140	138	120	110	201	1.05	Lusy	
37	Aromatic Aldehydes and	40	37	43	131	251	1 94	Fasy	
57	ketones	160	111	86	131	251	1.74	Lasy	
38	Aromatic carboxylic acid and	32	44	99	76	251	2 13	Fasy	
50	their derivatives	128	132	198	76	201	2.15	Lusy	
39	Colours Dyes and Pigments	40	36	69	106	251	2.04	Easy	
57	Colours, Dyes und Figments	160	108	138	106	201	2.01		
40	Polynuclear Aromatic	78	103	40	30	251	2.91	Difficult	
10	Hydrocarbons	312	309	80	30	201	2.91	Difficult	
41	Heterocyclic compounds	66	132	37	16	251	2 99	Difficult	
	neteroeyene compounds	264	396	74	16	201	2.99	Difficult	
42	Uredines and purines	125	74	27	25	251	3 19	Difficult	
.2		500	222	54	25	201	5.17	Difficult	
13	Alkaloids	55	35	89	72	251	2 29	Fasy	
15		220	105	178	72	201	2.2)	Eusy	
44	Perpenis	42	44	55	110	251	21	Fasy	
		168	132	110	110	201	2.1	Lasy	
45	Synthetic polymers	78	103	40	30	251	2.91	Difficult	
45	Synthetic polymers	312	309	80	30	231	2.71	Difficult	

 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29, 31, 32, 33, 34, 36, 37, 38, 39, 43, and 44). This means that they found twelve topics difficult to understand.

Research Question Two: To what extent does gender difference influences students' perception of difficult Topics?

Table 2. Table showing the extent gender difference influences students' perception of difficult Topics.

S/N	ITEMS	SA	А	D	SD	Ν	MEAN	DFECISION
1.	The female students Perform better than the male students in our chemistry classes and Examination	42 (168)	44 (132)	55 (110)	110 (110)	251	2.10	Rejected
2.	The female students shy away from asking and answering questions in our chemistry classes	39 (156)	47 (141)	74 (148)	91 (91)	251	2.14	Rejected
3.	The boys sit separately from the girls as the sitting arrangement in our class	40 (160)	36 (108)	69 (138)	106 (106)	251	2.04	Rejected
4.	The male and female students are not treated equally by our chemistry lecturers in our Department.	26 (104)	45 (135)	67 (134)	113 (113)	251	1.94	Rejected
5.	The teaching method of the chemistry lecturers are better understood by the female students than the male students	34 (136)	41 (123)	34 (108)	122 (122)	251	1.46	Rejected
6.	The female students are given preferential treatment more than the male students in my Department.	32 (128)	44 (132)	99 (198)	76 (76)	251	2.13	Rejected
7.	Only the female students are allowed to Carry out the practical work in our Organic Chemistry practical while the male students observe them.	13 (128)	44 (132)	99 (198)	76 (76)	251	2.13	Rejected

The mean score of the responses from the respondents as regards to influence of gender difference on perception of difficult topics among the students as shown in Table 2 revealed that all the items (1, 2, 3, 4, 5, 6, and 7) were rejected by the respondents with the mean scores of 2.10, 2.14, 2.04,

1.94, 1.46, 2.13, and 2.13 respectively. This showed that gender difference has no influence on the students' perception of difficult topics in the organic chemistry curriculum.

Research Question Three: What are the causes of the perceived difficulties by the students?

S/N	ITEMS	SA	Α	D	SD	Ν	MEAN	DECISION
1.	Organic chemistry demand too much of molecular structures	125 (500)	74 (222)	27 (54)	25 (25)	251	3.19	Accepted
2.	It is difficult to understand reaction mechanism	78 (312)	103 (309)	40 (80)	30 (30)	251	2.91	Accepted
3.	My Organic chemistry lecturer lacks innovation, encouragement resourcefulness	32 (128)	44 (132)	99 (198)	76 (76)	251	2.13	Rejected
4.	Organic chemistry laboratory is ill-equipped in my school.	66 (264)	132 (396)	34 (74)	16 (16)	251	2.99	Accepted
5.	Non participation of students in excursions and field trips hinders the understanding of organic chemistry	125 (500)	74 (222)	27 (54)	25 (25)	251	3.19	Accepted
6.	There are insufficient number of lecturers for teaching and learning of Organic chemistry in my school.	81 (324)	104 (312)	40 (80)	26 (26)	251	2.96	Accepted
7.	Relevant instructional materials necessary to arouse the interest of the teaching and learning of organic chemistry are not used.	77 (308)	89 (267)	46 (92)	39 (39)	251	2.81	Accepted
8.	Time allocated for the teaching and learning organic chemistry curriculum is inadequate.	84 (356)	63 (189)	37 (74)	67 (67)	251	2.73	Accepted
9.	Lack of knowledge of the subject matter affects the understanding of the subject	79 (316)	77 (231)	56 (112)	39 (39)	251	2.78	Accepted
10.	Organic chemistry syllable is too wide.	68 (272)	82 (246)	54 (108)	47 (47)	251	2.68	Accepted
11.	Many organic chemistry teachers do not make use of instructional materials while teaching.	75 (300)	99 (297)	56 (112)	21 (21)	251	2.91	Accepted
12.	I was afraid of organic chemistry even before I started doing it because my friends said it is too difficult.	66 (264)	132 (396)	37 (74)	16 (16)	251	2.99	Accepted
13.	I am scared by organic chemistry practical	125 (500)	74 (222)	27 (54)	25 (25)	251	3.19	Accepted
14.	There are more failures in organic chemistry than passes	32 (128)	44 (132)	99 (198)	76 (76)	251	2.13	Rejected
15.	Organic chemistry is too abstract because we have never seen most of the things taught	37 (148)	67 (201)	87) (174)	60 (60)	251	2.32	Rejected
16.	Students are not exposed to organic chemistry often.	76 (304)	91 (273)	49 (98)	35 (35)	251	2.83	Accepted
17.	We don't have enough organic chemistry teachers in our school	40 (160)	36 (108)	69 (138)	106 (106)	251	2.04	Rejected

Table 3. Table showing the causes of the perceived difficulties by the students.

From the Table 3 above, the mean scores of the responses from the respondents as regards to the causes of the perceived difficulties by students revealed that the respondents accepted items (1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 16) with the mean scores of 3.19, 2.91, 2.99, 3.19, 2.96, 2.81, 2.73, 2.78, 2.68, 2.91, 2.99, 3.19, and 2.83 respectively. However, the items (3, 14, 15, and 17) with the mean scores of 2.13, 2.13, 2.32 and 2.04 were rejected by the respondents.

Research Question Four: How does school nature influence the perception of difficult topics by students?

Table 4. Table showing how school nature influence the perception of difficult topics by students.

S/N	ITEMS	SA	Α	D	SD	N	MEAN	DFECISION
1.	Students in the universities acquire more skill than those in the	33	41	98	79	251	2.11	Rejected
	Polytechnics and Colleges of Education	(132)	(123)	(196)	(79)	231		
2	Students in Polytechnics are more intelligent than students in colleges of	eges of 48		112	41	251	2.41	Dejected
۷.	Education and Universities.		(150)	(224)	(41)	231		Rejected
2	Lecturers in the Colleges of Education are more qualified than their	29	42	108	72	251	2.11	Rejected
5.	counterparts in the Polytechnics and Universities.	(116)	(126)	(216)	(72)	231		
4.	Students in the Universities record more failures in Organic chemistry than	36	42	111	62	251	2 21	Daiaatad
	the students in the Polytechnics and Colleges of Education		(126)	(222)	(62)	231	2.21	Rejected
5.	Polytechnics and Colleges of Education students are more recognized in	44	38	67	102	251	2.10	Paiaatad
	the society than those in the Universities		(114)	(134)	(102)	231 2.	2.10	Rejected

From Table 4 above, the mean scores of the responses from the respondents as regards to the influence of school nature on the perception of difficult topics by the student revealed that the respondents rejected all the items (1,2,3,4, and 5) with the mean scores of 2.11, 2.41, 2.11, 2.21 and 2.10 respectively.

Results of the analysis showed that the students perceived

twelve topics in organic chemistry curriculum difficult. These include; Organic reaction mechanisms, stereochemistry, spectroscopy, petroleum, petrochemicals and alternative fuels, Nitro-alkanes, Diazo-alkanes and azide, Amino acids, peptides and proteins, Aromatic compounds, Aromatic amines and diazonium salts, Polynuclear aromatic hydrocarbon, Heterocyclic compounds and Synthetic Polymers. The study revealed that there are some reasons why chemistry students find some concepts difficult to learn.

According to the students, the causes of poor performance in organic chemistry include the following: Organic chemistry demands too much of molecular structures, Organic chemistry laboratory is ill-equipped, Organic chemistry is too abstract, no enough organic chemistry teachers in schools, Organic chemistry syllable is too wide, there are insufficient number of lecturers for teaching and learning of Organic chemistry in schools, the students are not often exposed to practicals, excursion/field trips, teachers do not take time in explaining the basic terminologies in organic chemistry, etc. This is in line with the findings of [7] who pointed out that lack of qualified chemistry teachers, noisy environment, unavailability of laboratory equipment, students perception of chemistry as a difficult subject with many theories are impediments to the effective teaching of chemistry.

Organic chemistry demands too much of molecular structures. Every known compound in organic chemistry has its own structure. These in turn create fear in students and depreciate their interest. Also, it is difficult to understand reaction mechanism due to numerous structures of the compounds. Organic chemistry lecturers do not lack innovation, encouragement and resourcefulness but, they do not make use of appropriate instructional materials in the teaching and learning of chemistry. Organic chemistry laboratories are ill-equipped in the tertiary schools.

Chemistry is a practical oriented subject, thus the theory and practical aspects of chemistry should go together. Students retain more what they have seen and touched than what they were told. And lack of adequate science equipment makes the study of chemistry un-interesting, difficult and even frustrating [8]. Students exposed to laboratory method are likely to perform well in Chemistry. It can be seen that the reverse is the case when students are not often exposed to laboratories. Nonparticipation of students in excursions and field trips hinders the understanding of organic chemistry. There are insufficient numbers of lecturers for teaching and learning of organic chemistry in some tertiary schools. Relevant instructional materials necessary to arouse the interest of the students are not available for the teaching and learning of organic chemistry. Time allocated for the teaching and learning organic chemistry in the organic chemistry curriculum is inadequate. Lack of knowledge of the subject matter affects the understanding of the subject. Organic chemistry syllable is too wide. Students are afraid of organic chemistry even before they started doing it because their friends said it is too difficult. Some students are scared by organic chemistry practical, this is due to the poor background the students had on chemistry.

According to [9] in [8], poor performance does not connote abnormality in development, but involves those who probably could perform better. Poor performance in chemistry is a pointer to the fact that students have difficulty in learning and mastering the subject and applying these when they are under examination conditions. [10] stressed that academic failure is not only frustrating to the students and the parents, its effects are equally grave on the society in terms of dearth of man power in all spheres of the economy and politics. Tertiary institutions are finding it difficult to enroll sufficient numbers of candidates in chemistry departments because of dwindling numbers of students satisfying the entrance requirements [11]. This can have adverse effects on the advancement of science and technology in the country considering the importance of chemistry in the society. The study also revealed that students' gender and school location have no influence on their perception of difficult topics in chemistry curriculum.

3. Conclusion

It was discovered from the findings that students find some organic chemistry topics difficult such as Organic Reaction Mechanisms, Stereochemistry, spectroscopy, Heterocyclic compounds, etc. They blamed the causes on the following; Organic chemistry demand too much of molecular structures, non use of relevant instructional materials necessary to arouse the interest of the students in the teaching and learning of organic chemistry, Non participation of students in excursions and field trips, etc. If students find some topics difficult, they may find it difficult to pass the course. Based on this, a critical review of the curriculum should be done, bearing inmind the cognitive abilities of the students and the background of the students. Some of the factors that caused the perceived difficult topics in chemistry curriculum included; Organic reaction mechanisms, stereochemistry, spectroscopy etc. Students also complained that organic chemistry demands too much of molecular structures and organic chemistry laboratories are ill-equipped in some tertiary institutions. Hence teachers should re-examine and evaluate their teaching strategies, they should make use of instructional materials while teaching to make teaching and learning interesting. Teachers should endeavor to include activities which can help sustain students' interest in chemistry while planning their lessons so as to carry the students along. Also, textbook writers should adopt approaches (such as the use of simple language, pictures in 3-dimension relevant to the topic being treated among others) which will enable chemistry students have better perception of difficult organic chemistry topics.

Recommendations

Based on the findings, the researchers recommended the followings;

- 1. Appropriate instructional materials should be designed by the curriculum planners and experts for those topics that are perceived difficult by the students.
- 2. The government should assist in equipping the chemistry laboratories at all levels of education.
- 3. The identified difficult subjects should be assigned to qualified lecturers to handle them. This will go a long

way in alleviating the misconceptions the students have over organic chemistry.

4. The school management should sponsor the participation of students in excursions and field trips to facilitate the understanding of organic chemistry.

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