



Open access Journal

International Journal of Emerging Trends in Science and TechnologyIC Value: 76.89 (Index Copernicus) Impact Factor: 4.219 DOI: <https://dx.doi.org/10.18535/ijetst/v4i4.04>

Identification of the Areas of Students Difficulties in Chemistry Curriculum at the Secondary School Level

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Abstract

This study focused on identification of difficult chemistry topics on the secondary school curriculum. Three research questions and one hypothesis guided the study. A structured questionnaire was used to obtain data from fifty students by simple random sampling technique. Frequency and mean were used to answer the research questions. The results obtained indicated that eight topics out of eighteen topics listed in the chemistry curriculum are difficult. The results also revealed that there is a relationship between the students' interests and the topics they considered difficult and that there is a significant difference between the topics considered difficult by the male and female students. Based on the findings of this study, the researcher made a number of recommendations, including; training and refresher courses for chemistry teachers, employment of professionally qualified chemistry teachers, use of discovery approach in teaching chemistry, among others.

Introduction

The development and greatness of any country to a large extent depend on how the country has been able to provide quality and functional education to her citizens. Education is the training given to the child/individual to enable him/her becomes useful and contributory member of his society. Azegba (2010) observed that education has to be in all aspects of life that will guide the behaviour of man. Science Education is the education that involves Science and Technology. A nation is classified as developed or underdeveloped as a result of her level of scientific and technological development. Omiko (2005) and Azegba (2010) were of the same opinion when they observed that a developed nation is the one that has attained a high standard in science and their applications which is technology. Any country that cannot provide standard and effective science education to her younger generation is still underdeveloped.

Chemistry is a branch of science which deals with the study of matter, its compositions, properties and reactions. It has the following branches, biochemistry, pure chemistry, analytical chemistry, organic chemistry petroleum chemistry, polymer chemistry, food-chemistry, physical chemistry, inorganic chemistry. These branches of chemistry are very useful in the development of a nation. Therefore if any country wants to join other developed countries of the world, that country had to work hard towards implementing effective science Education in their school system. This implies that it has to ensure optimal realization of the quality indices in science education courses in the colleges of Education and Faculties of Education in the Universities. By providing all the necessary instructional materials in science Education, a bright future is assured in that nation's march towards scientific and technological excellence (Chibuogwu and Anacke, 2008; and Azegba, 2010).

The focus on science Education can be better appreciated when one realizes that the mission of science education is not limited to the acquisition of a body of knowledge about nature. It goes further to encompass the utilization of such knowledge in solving the myriads of problems that confront mankind.

Teaching and learning of science in Nigeria presently is bedeviled with a lot of problems. The shortage of qualified scientists, technologists and science teachers are considered as some of the critical limiting factors in the effective application of science and technology in developing countries such as ours. Other limiting factors include; low enrolment in schools, negative attitude towards teaching and learning of science, low level of mathematics skills and the difficult nature of science itself. Among the above mentioned factors that militate the development of science in Nigeria, this study focused on the difficult nature of chemistry as a science. In the chemistry curriculum for secondary schools in Nigeria, some of the topics are considered difficult by the teachers and Students. Omiko (2013) observed that a topic is considered difficult if an academically average chemistry student performs poorly on it after evaluation even though the teacher has put in his best during the course of instruction. Azegba (2010) observed that in difficult topics, students ask questions and the answers from the teachers do not seem to clarify them. In such topics, the teacher finds it difficult to complete instruction on them within the time limit conclusively.

Teaching and learning are two words that are commonly used in Education sector. It is a known fact that the quality of teaching given to the learner by the teacher affects the quality of learning taking place in the learner (Omiko, 2008). According to Akpan (1998), students face a lot of difficulties in doing mathematics due to language and curriculum factors as well as teacher characteristics and societal attitudes leading to poor performance in the subject.

Other causes of difficulties in chemistry may include the abstract nature of the topics and lack of good background in some chemistry concepts like: valence, electronic configuration and balancing of chemical equations. In some cases both the chemistry teachers and students tend to shy away from difficult topics often the teachers claim that such topics, are beyond the students and therefore not required at their level. The consequence is poor performance which scares them away from science.

Statement of the Problem

Results of past West African Examination Council (WAEC) and General Certificate of Education (GCE) Examinations have indicated poor performance in science subjects especially in chemistry. This poor performance of students in chemistry causes a lot of concern among stakeholders in education. Some of the stakeholders in education have tried to assert that one of the major reasons for this has been the inability of the chemistry teachers to identify and stress, through effective teaching, the areas of students difficulties in the subject. It is suspected that lack of proper understanding of chemistry concepts accounts for students low performance in the subject.

The problem is: what contents or major areas of the secondary school certificate chemistry do students perceive as being difficult in the chemistry curriculum at the secondary school level of Education?

Purpose of the Study

The main purpose of this study was to identify the areas or topics in the secondary school chemistry curriculum which students consider difficult. Specifically this study aimed at:

- 1) Identifying the content areas in the chemistry curriculum at the secondary school level, which the students find difficult.
- 2) Determining the influence of sex on the chemistry concepts (topics) which students perceived difficult.

Significance of the Study

The result of this study is very significant to the students, teachers and the Nigerian nation. With the discovery of the topics which the students find difficult in the secondary school chemistry curriculum, the teachers being the seat of wisdom in teaching and learning processes would improve on their teaching methodology while teaching those topics and this would increase the performance of the students. The findings of this study can motivate the teachers to go for conferences, seminars or a training course on the identified topics which the students consider difficult. This will not only enrich the knowledge and competence of the teachers but also help them to teach their students perfectly.

Research Questions

The following research questions guided the study;

- 1) What topics in the secondary school chemistry curriculum do students find difficult?
- 2) Are there any differences in the topics perceived as difficult by males and those perceived by females?

Hypothesis

There is no significant difference in the perceived difficulty in the secondary school chemistry topics between male and female students.

Methodology

Design of the Study

The research design is a descriptive one. This is because the study aimed at collecting and presenting information obtained from the students responses to the questionnaire distributed to them to fill. It is also an ex-post factor research as the researcher took into consideration the influence of independent variable such as sex on the chemistry topics perceived difficult as this cannot be manipulated. The researcher considered two groups in this study: males and females.

Area of the Study

The research was conducted at government secondary school, Afikpo North Local Government Area of Ebonyi State of Nigeria.

Population of the Study

The population comprises of all the secondary school students offering chemistry and are qualified to seat for the May/June Senior Secondary School (SSS) Certificate Examination, 2010 in Afikpo North Local Government Area of Ebonyi State.

Sample and Sampling Techniques

Fifty (50) students that registered for the senior secondary school certificate examination at Government Secondary School, Afikpo formed the sample of this study. The students were randomly selected to maximize the possibility of every student being sampled out.

Instrument for Data Collection

The instrument used for data collection was a structured questionnaire known as chemistry content-difficulty-scale (CCDS). It was prepared on a format containing five responses (5 points-scale), ranging from five-to-one. The respondents responded on the given items, example indicate how difficult or easy you find/perceive each topic on the five-point scale provided by ticking (x) in the appropriate column. If there is any area you have not studied, tick (x) against it in the column indicated, "not studied" NS

Content Difficulty Scale

Topics Area	Not studied (NS)	Very Difficult (VD)	Difficult (D)	Easy (E)	Very Easy (VE)
Atomic Structure					
Nuclear Chemistry					

Validation of the Instrument

The instrument was validated by two experts in measurement and evaluation and one expert from chemistry education.

Reliability of the Instrument

Test-re-test method of reliability was used to determine the reliability of the instrument. The

instrument was administered to a set of students. The test was repeated after a period of two weeks to the same group of students and a correlation coefficient of the two results was used to test the stability. A coefficient of 0.7 was obtained.

Method of Data Analysis

The data collected from the students were collated for analysis. Information collected from the rating scale using (CCDS) was descriptively analysed using frequency and mean.

Results

The results of the data analysis were placed in tables according to the research questions

Research Question 1

What topics in the secondary school chemistry curriculum do students find difficult?

To provide answer to this question, the responses of chemistry students to items 1-18 were analyzed and using frequency and mean statistics and placed in table one

Table 1: Frequency and mean Distribution for Chemistry Topics Students Find Difficult

S/N	Items	Not studied (NS) 5	Very difficulty (VD) 4	Difficult (D) 3	Easy (E) 2	Very Easy (VE) 1	FX	Mean
1.	Separation techniques of mixtures	0	5	13	22	10	113	2.26
2.	Particulate nature of matter	0	7	10	24	9	115	2.30
3.	Atomic structure	0	11	15	15	9	128	2.56
4.	Chemical combination	0	10	9	14	11	106	2.12
5.	Periodic table of elements	0	12	20	5	13	131	2.62
6.	Gaseous state and gas laws	0	8	17	15	10	123	2.45
7.	Acids, bases and salts	0	6	13	20	11	114	2.28
8.	Acid-base titration	50	0	0	0	0	114	2.28
9.	Qualitative analysis	10	20	5	9	1	155	3.10
10.	Types of reactions	0	7	10	18	15	111	2.22
11.	Electro chemical series and electrolysis	0	15	16	15	10	130	2.60
12.	Rates of chemical reactions and energy effects	5	19	7	13	6	154	3.00
13.	Organic chemistry	5	10	10	15	10	135	2.70
14.	Non-metals and their compounds	15	15	17	10	3	209	4.18
15.	Metals and their compounds	10	20	1	14	5	166	3.32
16.	Applied chemistry	30	9	6	3	2	152	3.04
17.	Nuclear chemistry	15	17	13	4	1	191	3.82
18.	Astronomical chemistry	40	5	3	2	0	233	4.66

The items with mean values of 3.00 and above correspond to items 8, 9, 12, 14, 15, 16, 17 and 18 these are the chemistry topics which students find difficult. Such topics are as follows

8 = acid-base titration

9 = qualitative analysis of chemical reactions

12 = rates of chemical reactions and energy effects.

14 = non-metals and their compounds

15 = metals and their compounds

16 = applied chemistry

17 = nuclear chemistry

18 = astronomical chemistry

Research Question 2

Are there differences in the topics perceived as difficult by males and those perceived by females?

Table 2: Frequency and Mean Distribution of Chemistry Topics Perceived as Difficult by Males and Females Students

Items	Males							Females						
	NS	VD	D	E	VE	FX	Mean	NS	VD	D	E	VE	FX	Mean
1	0	3	14	8	6	76	2.53	0	2	5	8	4	43	2.15
2	0	4	14	6	5	79	2.63	0	2	4	10	4	40	2.00
3	0	7	9	9	5	78	2.63	0	4	6	6	4	50	2.50
4	0	10	9	5	7	84	2.60	0	6	4	5	4	50	2.50
5.	0	7	3	12	8	69	2.30	0	5	7	2	5	50	2.50
6.	0	5	9	10	6	73	2.43	0	3	7	6	4	49	2.45
7	0	4	12	8	7	75	2.50	0	2	5	8	4	43	2.15
8.	30	0	0	0	0	150	5.00	20	0	0	0	0	100	5.00
9.	6	12	5	3	1	100	3.33	4	8	2	4	0	66	3.30
10	0	4	11	6	9	79	2.63	0	8	3	8	4	50	2.50
11.	0	11	7	4	6	79	2.63	0	8	3	8	3	61	3.05
12.	3	9	8	2	3	82	2.73	2	3	5	5	3	50	2.50
13.	3	3	10	4	5	70	2.33	2	7	6	5	5	71	3.55
14	6	4	6	7	2	80	2.67	9	11	10	4	1	128	6.40
15.	3	7	7	1	3	69	2.30	7	13	0	7	0	101	5.05
16.	18	4	2	2	1	117	3.90	12	5	4	1	1	95	4.75
17.	5	7	2	5	0	69	2.30	10	10	8	2	2	120	6.00
18.	19	1	0	2	1	104	3.46	21	4	1	1	0	126	6.30

For the males, the following items have mean of 3.00 and above, items 8, 9, 16 and 18. They correspond to the topics perceived difficult by the male students while the females perceived the following items as difficult, 8, 9, 11, 13, 14, 15, 16, 17 and 18 with means above 3.00, hence the female students perceive these topics difficult.

The items both the male students and female students perceive as difficult are items 8, 9, 16 and 18. These four items correspond to the relationship between the areas perceived difficult by male and the female students.

Discussion of the Results

The discussions of the results are based on the research questions already presented above.

Research Question 1: What topics in the secondary school chemistry curriculum do students find difficult?

The students identified a number of chemistry topics whose mean scores are 3.00 as difficult. These topics are listed above and below table 1 many reasons could be responsible for students difficulties in those topics identified, firstly, it is possible that poor foundation in chemistry could account largely for students inability to understand certain chemistry topics.

Lack of proper understanding of basic concepts and principles in chemistry militate against the students understanding of some chemistry topics. For instance, thorough understanding of the concepts and principles in chemistry militate against the students understanding of chemical combination, also understanding of the mole concepts and ability to represent the chemical composition of compounds with chemical formula are pre-requisite to understanding of oxidation, reduction and electrolysis. Therefore, inadequate cognitive structure could be the reason students find topics like atomic structure, rates of chemical reaction and energy effect difficult.

Secondly, it is possible that inadequate or lack of proper mathematical skills limit students understanding of certain chemistry topics. Among the topics found difficult by students as a result of this are quantities aspects of chemical reaction, rates of chemical reactions and energy effects, etc. this is in agreement with Ali (2004), who indicated that even with the best of science students, majority have difficulty in basic mathematical tasks essential for studying and understanding science.

Another reason which immensely reduces students understanding of chemistry is the teacher factor.

Some chemistry teachers use methods that are inappropriate to teach certain topics. Science teaching in many schools in Nigeria has degenerated to simple story telling, expository and “talk and chalk”. To this end, many teachers do not use appropriate and local examples to arouse students: interest which is a major motivating factor in the study of chemistry and learning in general. By and large, most teachers are not dedicated and committed to their duties and hence do not make adequate improvisation when necessary in the course of instruction.

Other reasons which may be responsible for students difficulty in the study of chemistry are inadequate science laboratory, inadequate supply of relevant science apparatus, incidences of large classes and overcrowding in the classes, absence of support from laboratory assistant and lack of adequate professional preparation (Baja, 1999).

Research Question 2: Are there differences in the topics perceived as difficult by males and those perceived by females? Male students identified four chemistry topics as difficult while female students identified nine chemistry topics as difficult. Both the male and female students are not in agreement in the eight topics identified by both students.

The four chemistry topics identified as difficult by male students were also identified as difficult by the female students. It was seen that female students found item (1) which is separation techniques easier than the male students. This is because it is not tasking to the female students who are much more exposed to the domestic chores of mixing and separating, such as separation of rice from its chaff and stone, or separation of melon seeds from their chaff among others.

Recommendations and Conclusion

It is the view of the researcher to recommend some probable solutions which may be of help to the classroom teacher or the education administrators. In the first place in-service training and refresher courses like workshops, conferences,

organized lectures, etc are recommended for all the categories of teachers of secondary schools.

The curriculum of teacher colleges should be restructured to prepare teachers properly in tackling the difficulties that militate against optimum learning of chemistry and other subjects by students of secondary schools.

In particular the chemistry teachers should be re-oriented, so that they become capable of handling the newly introduced chemistry topics in the senior secondary syllabus including those difficult topics. Workshops, conferences and organized lectures on the current issues in chemistry should periodically be organized at both state and local government levels and attendance made compulsory to all chemistry teachers. Chemistry teachers should also subscribe to professional journals relevant to their knowledge of trends in chemistry.

Secondly, only professionally qualified chemistry teachers should be employed to handle the chemistry teaching and learning in our secondary schools. These are the set of people versed not only in the knowledge of the subject matter of chemistry but more importantly in the methodology of instruction. Teachers should also device better methods of teaching that are geared towards discovery approach so as to generate students interest in chemistry and therefore motivate them through active participation. For instance, teachers should use local examples as much as possible while teaching to make the subject relevant to the needs and life experiences of the students. Also use of resource persons where appropriate is necessary.

The chemistry teachers should be resourceful enough to be able to improvise instructional materials that will help to stimulate students' interest in learning and make the subject matter of chemistry more concrete.

It is also advocated that government should recommend and encourage the use of chemistry textbooks that are indigenous to our setting in the secondary schools. In other words government

should ensure that chemistry textbooks written by qualified local authors are in use in the schools. This will ensue that the illustrations and examples are heartily drawn within the reach of the students. This measure will help to sensitize students to the relevance and usefulness of chemistry in solving man's scientific and social-economic problems. It is hoped that if these recommendations are strictly adhered to by all concerned including teachers, students, government, etc the incidence of difficulty in learning chemistry will be reduced to the barest minimum in our educational system.

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