ASSESSMENT OF THE DIFFICULT AREAS OF THE SENIOR SECONDARY SCHOOL 2 (TWO) CHEMISTRY SYLLABUS OF THE NIGERIA SCIENCE CURRICULUM

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ABSTRACT

The senior secondary two chemistry course content of the Nigerian science curriculum was assessed using 10 (ten) selected secondary schools in North Central Nigeria, to determine areas of difficulty, magnitude and reasons for such perceived difficulty. Correlation between the students' perceived difficulty and their achievement in a test and the relationship between the students' sex and their perceptions of difficulties were also examined using a difficult rating scale questionnaire and a chemistry achievement test. Percentage mean score, mean difficulty indices, person-product-moment correlation and the t-test methods were used for the analysis of the data collected. A total of 10 (ten) out of the 24 (twenty-four) topics identified were perceived as difficult. There was no significant relationship between students' perceived difficulty and their achievement. Reasons given for the perceived difficulty included unfamiliarity with the ideas, confusing language, ideas too demanding, insufficient explanation and practical work, topics too mathematical and lack of interest among both sexes. Based on these findings, a critical re-assessment of the curriculum was advocated, bearing in mind the cognitive abilities of /and chemistry (science) background of the students. Proper training and re-training (refresher) of teachers was recommended so as to ensure that teaching staff are qualified. Authors of chemistry textbooks should consider the cognitive levels of students of the different levels for choice of suitable vocabulary (language). Teachers should re-examine and evaluate their present teaching strategies so as to be effective and should stop using abstract terms or concepts in the class. Practical work should be emphasized for the acquisition of laboratory skills. The government/proprietors should give priority to equipping the laboratories and improving the teaching and learning environment. Students need counseling, encouragement and enlightenment in order to motivate them in the study of Chemistry. (*AJCE, 1(1), January 2011*)

INTRODUCTION

Chemistry is one of the science subjects upon which technological break-through is built and is the pivot on which the wheel of science rotates. Chemistry is very important and helpful in fields such as medicine, agriculture, transportation, housing, industries, etc. Life is made more meaningful with chemical product such as drugs, cosmetics, paints, soap, fertilizers etc. In addition, various careers exists in chemistry in the health sector, food processing industries, extractive industries, petroleum and petrochemical industries among others (1).

Nigeria is a developing nation and the importance of chemistry for such a nation cannot be over emphasized. This is in line with the assertion that the prestige and political power of any nation reside in its level of scientific activities (2).

The United States of American had undertaken reforms in its science curriculum development (3) which led to Chemical Bond Approach (CBA), Chemical Education Material Study (CHEM STUDY) and the Physical Science Study Committee (PSSC) in conjunction with other physical sciences. Similar curricular reforms had also been carried out in other countries (4). The successes of these reforms in Britain and United States are often linked with the curriculum packages that had evolved. These packages adopted different approaches, and emphasis was laid on content and how the content could be commensurate with the cognitive level of the students.

In Nigeria, the need to re-examine both what to teach in science and how to teach it led both institutional and professional bodies to identify themselves with national efforts toward curriculum reform in sciences (5). For example, the Science Teachers Association of Nigeria (STAN) had taken initiative in the science curriculum development. Thus in 1968, the federal ministry of education and the Comparative Education Study and Adaptation Centre (CESAC), set up curriculum development committee in each of the following subjects biology, chemistry and physics. These bodies, including the National Education and Research Council (NERC) made immense contribution toward improving science education. All these have not only modernized science teaching, but stimulated interest among Nigerian youths, science educators and government in science related courses. Thus the government tried to popularizes and encourage the teaching of sciences in schools through positive incentives like giving priority to science courses in scholarship and in-service awards, building and commissioning of science equipment production centers, special science allowances to science teachers and the building of universities of technology, colleges and science schools.

It is worthy to note that members of STAN still meet from time to time to review and asses progress made so far, and organize workshops, seminars, conferences, etc to enlighten members (science teachers especially) about new development and research studies carried out in the sciences and science education in general.

STATEMENTS OF THE PROBLEMS/PURPOSE OF THE STUDY

The crux of the matter is that most of the few students who choose to offer sciences in our secondary schools are noted for having problems learning the sciences especially chemistry since its introduction (6). Poor performance, according to Jegede and Okebukola (7), is unhealthy to a nation whose aversed goal is to make significant changes and advancements in science and technology. To Eke (8), poor performance does not connote abnormality in development, but involves those who probably could perform better. Though caused by many variables such as teacher and students characteristics, examination patterns and science equipment, poor performance in chemistry is a pointer to the fact that students have difficulty in learning and mastering the content and applying these when they are under examination conditions.

Though several factors have been identified for students' poor performance in the sciences and efforts made toward tackling some during seminars, conferences and workshops, the students' performance is still not encouraging as expected. The identification of areas of difficulty in the chemistry and hence, science syllabus is therefore important. This study was set to identify those areas that pose some problems or difficulties to students in the senior secondary 2 (two) chemistry syllabus in Nigeria.

RESEARCH DESIGN, POPULATION AND SAMPLING TECHNIQUE

This research was a case study survey designed to identify students' perceived difficulties in the learning of the senior secondary two chemistry in secondary schools of Plateau State, north central Nigeria. A case study, according to Piwuna (9), is the study of the characteristics of an individual, class, liquid, school or community.

The population composed of students offering chemistry as one of the subjects at the senior secondary school level. The schools cut across voluntary agency and government-owned secondary schools and colleges in the state. The students in the final class, senior secondary three, were used because they had completed the senior secondary two and were therefore, familiar with the course content.

The research sample used was made up of three hundred students drawn from 10 (ten) schools from three local government areas of Plateau state. The student sample included students of mixed ability and age. Apart from categorizing the students into males and females, there was no other grouping of any kind.

A total of 10 (ten) secondary schools were selected from the over 200 secondary schools in the four local government areas used for the study using the random sampling technique. The schools are those that offered sciences especially chemistry at the senior secondary school certificate level.

Thirty students were selected from each of the ten schools by the random sampling method to take part in the study.

RESEARCH INSTRUMENTS

Two research instruments were used for the study. These were:

i. Difficulty rating scale

ii. Chemistry achievement test (CAT) designed by the researcher.

The difficulty rating scale consisted of two parts, the background information which seeks information about the students like name of school, sex, age, etc, and a two-part checklist. In the checklist, the senior secondary two chemistry topics were listed. Each topic was followed by columns where students were to indicate the magnitude of its difficulty by ticking: Not difficult [1], Slightly difficult [2], Undecided [3], Decided [4], Very difficult [5]. The students also indicated the reasons for the difficulty in columns provided by ticking. The topics were numbered accordingly and included: Periodicity of elements [1], Stoichiometry of chemical reactions [2], Volumetric analysis [3], Types of chemicals [4], Redox reactions [5], Balancing of redox reactions [6], Electrode potential and electrochemical cells [7], Preferential discharge of ions [8], Laws of electrolysis [9], Energy and chemical reactions [10], Chemical equilibrium in reversible reactions [11], Water harness and treatment [12], Solubility [13], Hydrogen preparation, properties and uses [14], Oxygen preparation, properties, compounds and use [15], Chlorine and its compounds [16], Sulphur and its compounds [17], Nitrogen and its compounds [18], IUPAC nomenclature of organic compounds [19], Alkenes preparation properties and use [20], Alkenes preparation, properties and uses [21], Alkynes preparation, properties and uses [22], Alcohol preparation, properties and uses [23], Rates of chemical reactions [24].

The CAT consisted of a 30-item objective test covering the entire senior secondary two chemistry course content constructed by the researcher. Each item consisted of five options lettered A-E out of which only one was the correct and acceptable answer. Both Face and Content validity of the instruments were carried out with professional chemical educators participating.

Data obtained from respondents were analyzed by calculating the mean difficulty index for each topic.

PRESENTATION OF DATA

The data were treated to descriptive analysis and the difficult indices computed for the twenty-four topics. This was to determine the areas of difficulty. The student scores in the achievement test was also computed and presented.

The raw scores for difficult topics for female and male students are shown in Tables 1 and 2 respectively. Table 3 shows the percentage difficulties of the topics while the percentage scores and difficulty indices of the difficult topics are presented in Table 4. The students' reasons for perceived difficulty in the subject and the reasons for perceived topic difficulty in chemistry in percentages are shown in Tables 5 and 6 respectively. All the tables are in the appendix.

DISCUSSION OF RESULTS

The results of this research revealed that the secondary school chemistry students considered some topics of the senior secondary two chemistry course content difficult to learn. These topics included;

Types of chemical reactions, Redox reactions, Balancing redox reactions, Electrode potential and electrochemical cells, Laws of electrolysis, Chemical equilibrium, Reversible reactions, Solubility, Sulfur and its compound, IUPAC nomenclature of organic compounds, alkynes

The identification of these topics were similar to the works of Folayan (10), Adisa (11), Asom (12) and Adzape (13), who identified certain topics in the chemistry syllabus as difficult to students. This research, however, found that only a few topics were considered difficult compared to the total course content for senior secondary two. This could be due to a more careful curriculum plan. The students did not perform well in the achievement test, a reverse of what was expected since they did not experience too much difficult with the topics. The low performance may be attributed to the fact that they were not informed in advance to prepare for the test. Tables 4,5 and 6 showed that there was no significant relationship between the students' perceived difficulties in learning the chemistry course content and their achievement, a finding similar to that of Ochima (14), but different from those of Piwuna (9) and Akpan (15).

While the male students considered certain topics such as balancing of redox reactions, laws of electrolysis, sulphur and its compounds as difficult, the females did not. The female students considered topics such as types of chemical reactions, preferential discharge of ions, energy and chemical reactions, chemical equilibrium in reversible reactions and nitrogen and its compounds as difficult which the males did not. Both considered some topics difficult.

It was discovered that most female chemistry teachers were unable to teach the topics, the respondents claimed; usually they do not want to spend extra time after school for practical and avoid topics that are mathematical.

Ranking first is the lack of practical work as teachers are reluctant in conducting practical works. This agrees with Ajeyalemi (16) and Adamolekun (17). Lack of practical work can also be attributed to lack of the basic facilities in the schools such as laboratories. Abdullahi (2), Piwuna (9) and Adeyegbe (18) observed that insufficient explanation by the teachers can be attributed to misconception by the teachers of some topics, failure to possess a sound academic and professional knowledge of the subject, the use of wrong methods and lack of interest in the job. The above all point to the teacher as one of the factors contributing to student's perceived difficulty in learning chemistry.

The cognitive demand of the course content came up as another major reason for student's perceived difficulty in chemistry. Many of the general principles have mathematical bases and most of the concepts are abstract. These findings agree with those of Akinmade and Adisa (19), Akpan (20) and Adzape (13). As Okoli (21) noted, most of the topics in the O' level chemistry syllabus are for students with above average ability, while some are broad, uninteresting and boring.

The research identified the language and vocabulary of chemistry with the attendant confusion of names especially from the IUPAC nomenclature as one of the factors responsible for the difficulty in learning chemistry.

This finding aggress with Adzape (13) and Akpan (22) and Akpan's (15) finding. Akpan (15) has remarked that the language difficulty has contributed to students declining performance in chemistry examination.

IMPLICATIONS OF THE FINDINGS AND RECOMMEDATIONS

The researchers in consonant with Adeyegbe (23), Akpan (15) and Adzape (13) noted that most of the topics perceived as difficult by the students are abstract in nature. A careful method of approach is therefore required to teach the inherent principles of such topics. The researchers recommend that examples rather than precepts should be used. Chemistry teachers should utilize to students' advantages examples which abound around and among us. The use of local examples and teaching aids to illustrate principles and concepts, especially in practical works, needs no further analysis or emphasis. This also reduces costs. The abstract nature of the subject can further be reduced when teachers avoid using highly technical words except where unavoidable as when considering IUPAC names. Chemistry teachers should ensure that the students have adequate background knowledge of each topic. As suggested by Akpan (15), teachers should use reagents which in reactions, result in very sharp but contrasting colorful products. Such would increase the student's interest in the subject. Practical work should be emphasized and the students should be made to acquire laboratory skills as this will equip them better.

A challenge is hereby thrown to authors and curriculum planners. Authors of chemistry texts and other materials should take into account the level of cognition of the students at the different levels and come up with indigenous textbooks commensurate with the secondary level chemistry education. This will make it possible for local examples to be identified and incorporated into these textbooks. Moreover, if the textbook experiences are investigation oriented, it will generate greater interests in these areas and direct attention to challenges for research and exposition.

Curriculum planners on their part should ensure that the chemistry curriculum is made purposeful enough to awaken the inner resources of our students (youths) and not just a mere device for mass production. It should provoke educational experiences and be sensitive to higher needs of the individuals (students).

The curriculum- however well planned, developed and interpreted-will come far short of our hopes unless it is applied by teachers who are themselves the product of its philosophy. Science teachers should be professionally screened and trained so as to equip them for the effective performance of their duties.

Government and proprietors should increase teacher's salaries and incentives especially to science teachers in the form of science allowance, reducing the burden on teachers by supplying schools with the basic chemistry equipment. This, and the employment of laboratory technicians, will curb the frustrations teachers face and improve on students' understanding. Above all, chemistry teachers in the secondary schools should re-examine and evaluate their teaching strategies, and resort to modern and effective strategies. Such teachers should develop not only a new set of attitudes, but also new professional skills and habits.

With positive attitude, students will choose to study chemistry because of the interest they have. They need to have a good background in chemistry and science in general. Scientific concepts and processes would not appear strange to them if they are introduced to them in the primary school. Our industries can make toys that can impact toddling age to bring science closer to children and make it real to their life. Finally there is a need for the counseling of students who opt for chemistry right from their senior secondary one. They need to know the relevance of the subject, how to study it and the attitude necessary. They need to know that a lot is expected from them in terms of hard work, dedication and even resources for successful completion of the course (study).

CONCLUSION

This study revealed that there are no significant differences between male and female students in the perceptions of content difficulties, reasons for perceived difficulties and their achievement in a test. One may expect such a result as there is usually no sex discrimination in the admission exercises into the secondary schools. The low performance of the students on the achievement test may be due to the fact that they did not read (prepare) for such a test as they were taken unaware, not necessarily due to the perceived difficult topics.

Though this study has found out that there is no significant relationship between students' perceived difficulties and their achievement, it should be noted that statistical significance is not necessarily the same as practical significance.

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Appendix

Table 1: Raw scores for difficult topics (female students only)

TOPIC	ND	SD	U	D	VD	TOTAL	N	X
1	28	58	81	76	80	323	119	2.71
2	31	64	54	88	80	317	119	2.66
3	34	46	75	84	80	319	119	2.68
4	10	38	84	148	125	405	119	3.40
5	07	44	60	172	135	418	118	3.50
6	22	56	81	92	90	341	109	3.88
7	20	36	66	136	75	333	119	3.89
8	19	48	75	120	105	367	119	3.08
9	27	68	84	72	60	311	119	2.61
10	18	46	57	120	120	361	114	3.17
11	21	50	27	132	155	385	119	3.23
12	20	62	81	76	110	349	119	2.93
13	10	38	105	112	125	390	117	3.33
14	38	62	27	88	95	310	119	2.60
15	27	76	72	72	60	307	119	2.58
16	30	82	57	68	55	292	118	2.47
17	23	58	31	88	90	340	119	2.86
18	15	48	90	140	75	368	119	3.09
19	13	42	99	116	115	385	119	3.23
20	35	62	48	68	90	323	117	2.76
21	23	72	60	72	110	337	119	2.83
22	15	44	75	116	140	390	119	2.28
23	25	80	57	80	70	312	118	2.64
24	31	54	87	72	70	314	119	2.64

Table 2: Raw scores for difficult topics for male students

TOPIC	ND	SD	U	D	VD	TOTAL	N	X
1	59	92	33	96	130	410	166	2.47
2	36	114	30	112	175	465	166	3.80
3	34	122	105	68	50	379	155	2.41
4	35	98	75	144	105	457	166	2.75
5	32	52	78	160	210	532	166	3.20
6	30	24	81	172	260	567	164	3.46
7	28	66	63	108	250	515	159	3.24
8	57	70	72	72	160	431	166	2.60
9	18	40	60	204	285	607	166	3.66
10	44	112	84	72	100	412	66	2.48
11	30	88	102	128	130	478	66	2.88
12	40	106	120	68	80	414	155	2.49
13	41	46	33	160	200	480	166	3.09
14	63	78	33	144	85	403	166	2.43
15	44	98	21	112	190	465	166	2.80
16	60	62	42	168	85	417	164	2.54
17	35	40	105	168	170	518	166	3.12
18	38	90	51	92	190	461	161	2.86
19	41	48	45	132	265	531	166	3.19
20	45	88	42	112	145	432	160	2.70
21	42	84	69	164	90	449	166	2.70
22	30	72	54	200	160	516	166	3.11
23	47	54	57	104	235	497	166	2.99
24	58	100	06	116	135	415	166	2.50

Table 3: Percentage difficulties of topics

LEVEL Of DIFFICULTY	number	percentage	average difficulty indices
Difficult topics	10	41.67	3.16
Non-Difficulty topics	14	58.33	2.69
Total	**24**	**100**	

Table 4: Percentage scores and difficulty indices of difficult topics

topic	% pass in achievement	% difficulty index
Type of chemical reactions	30	60
Redox reactions	35	67
Balancing of redox reactions	16	64
Electrode potentials and electrochemical cells	20	63
laws of electrolysis	20	64
Chemical equilibrium in reversible reactions	31	60
Solubility	27	64
Sulphur and its compounds	23	60
IUPAC nomenclature of organic compounds	26	64
Alkynes	36	64

Table 5: Student's reasons for perceived difficulty in chemistry in percentage

REASONS		PERCENTAGE	TOTAL
Teacher-related factors	1 2 3	12 9.55 12.44	33.99
Curriculum-related factors	4 5 6 7 8 9	8.60 10.10 9.10 10.10 9.34 6.20	53.44
Student-related factors	10 11	6.64 5.94	12.58

Table 6: Reasons for perceived topic difficulty in chemistry in percentage

	TOPIC	REASONS (%)										
		1	2	3	4	5	6	7	8	9	10	11
4	Types of chemical reactions	27	4.5	23	7.6	5.6	9.7	1.5	10.7	1.5	0.01	7.6
5	Redox reactions	10.8	19.1	3.3	16.1	13.6	7.9	15.5	5.3	0.03	1.6	6.3
6	Balancing redox reactions	18.5	14.6	4.2	5.9	13.6	16.7	8.7	4.8	5.2	0.03	7.3
7	Electrode potential and electrochemistry	15.1	12.1	18.7	10.9	6.2	4.7	14.4	4.3	3.9	3.9	5.8
9	Laws of electrolysis	9.9	6.7	17.0	7.7	8.6	5.4	6.1	9.6	18.9	3.8	6.1
11	Chemical equilibrium	17.3	13.1	8.0	8.8	7.1	8.0	11.8	7.2	4.6	7.1	6.8
13	Solubility	13.8	10.6	12.6	4.8	11.2	7.8	10.3	4.8	14.0	4.6	5.1
17	Sulphur and its compounds	8.9	5.7	11.7	8.5	16.7	6.3	6.0	17.0	1.8	9.9	7.4
19	IUPAC nomenclature of organic compounds	12.9	7.6	3.6	14.3	10.3	4.9	14.9	12.9	3.6	8.3	6.3
22	Alkynes	10.9	6.8	13.3	6.8	8.9	12.1	15.3	8.5	2.4	7.6	6.8