

IDENTIFICATION OF CHEMISTRY TOPICS THAT ARE DIFFICULT TO TEACH AND LEARN IN SENIOR SECONDARY SCHOOLS CHEMISTRY SYLLABUS

Nnamdi B. Emendu, Ph.D

*Department of Chemistry,
Nwafor Orizu College of Education, Nsugbe,
Anambra State.*

And

Ebere R. Emendu

*Department of Geography and Metaonology,
Nnamdi Azikiwe University, Awka,
Anambra State.*

Abstract

The study identification of chemistry topics those are difficult to teach and learn in senior secondary schools chemistry syllabus. The researcher looked at the West African Examination Council (WAEC) syllabus and adopted the chemistry content of the syllabus for investigation. Survey design was used. Structured questionnaire was used to collect data. The validation was done and the reliability was calculated to yield 0.75. The study was done in Anambra State. 110 teachers and 1, 200 students were sampled from the teachers and students in Anambra State respectively. Four research questions were answered and one hypothesis was tested. The findings showed that there are many topics that are difficult to teach and learn by chemistry teachers and students in secondary schools. Some approaches were discovered as being appropriate for the teaching of chemistry in secondary schools. Some recommendations were made.

The place of chemistry in the development of a country cannot be over-emphasized. The role of Chemistry has been discussed by many scholars at different levels of learning (Emendu 2007). The introduction of chemistry into the senior secondary schools shows the need to have a good foundation to the study of chemistry. There is need for us to study Chemistry in order to understand the way matter behaves and reacts under different conditions, and to device ways in which it can be used to improve our life (Ojokuku, 2012). The curriculum researchers in Nigeria such as

Ezeliora (2002) and Jimoh (2002) have revealed the non – challant attitude of students and teachers in senior secondary schools towards certain concepts in the chemistry syllabus. The Nigerian Educational Research and Development Council (NERDC), 2005 received the senior secondary school chemistry curriculum in Nigeria in other to carry both the teachers and students along towards achieving the objectives of teaching and learning chemistry.

The chemistry syllabus was well structured in that all the concepts are so relevant to our society. The study of chemistry enables those who study it to acquire certain scientific skills as well as thinking scientifically. Chemistry is also seen as embodiment of other basic sciences (Emendu 2007). Udogu (2010) described Chemistry as a body of knowledge which stands in a central position among the basic sciences from which technologists draw their scientific principles to create wonders. Ali and Aigbomian (1991) have been observed that many Nigerian secondary school science teachers fear chemistry because they lack basic process skills; they are also incapable of managing the science laboratory activities of the students they teach. They discovered that many teachers are not covering their o'level syllabus.

Some scholars in science education curriculum studies Ali (1992), Abdullahi (1992), Akinsola and Igwe (2002), Mari (2007) and Agewole, Ogimi, Obika, and Yetunde (2008), have expressed the view that many teachers have phobia towards teaching concepts of chemical combination and reaction, plant anatomy and physiology, genetics and ecology in the prescribed scheme of work for the Senior Secondary Certificate Examination of West African Examination Council (WAEC) and National Examination Council (NECO). The consequence of this phobia is mis-conception of the chemical expressions with the resultant effect of poor performance in the prescribed examinations. The appreciation of this problem in teaching and learning of Chemistry has necessitated a study of identification of chemistry topics that are difficult to teach and learn in senior secondary schools. The researcher looked into the West African Examinations Council, Regulations and syllabuses for The West African Senior School Certificate Examination (WASSCE).

Statement of the Problem

The study sought to investigate the topics that are difficult to teach and learn by the teachers and students in the senior secondary school chemistry curriculum. Sometimes it is difficult to determine the reasons for the teacher's difficulty in teaching chemistry probably the approach may be the reason.

Purpose of the Study

The purpose of this study is to identify the chemistry topics in the senior secondary school chemistry syllabus that are difficult to teach by teachers and difficult to learn by students.

Specifically the aim is to:

1. Find the reason for the difficulty in teaching and learning of chemistry by teachers and students.
2. Determine the approach that is suitable in teaching and learning of chemistry in secondary school.

Area of the Study

The study was carried out in Anambra State.

Research Questions

1. What topic in the senior secondary school chemistry do teachers find difficult to teach?
2. What topics in the senior secondary school chemistry are difficult for students to learn?
3. What are the probable reasons for teachers difficulties in teaching areas identified?
4. What are the approaches that can be used to teach the topics in senior secondary chemistry syllabus for better understanding among the student?

Hypothesis

There is no significant different between the areas identified as difficult to reach by teachers and the areas identified to difficult to learn by students.

Method

The design of this study is a survey. It is a survey because it is concerned with investigating events in their most natural settings and without manipulating of the variables. A survey is a study which seeks to document and describe what exists or the present status of existence or absence of what is being investigated.

Population and Sampling

The population of the study consisted of all the Chemistry teachers and students in all the government owned secondary schools in Anambra State. One hundred and ten secondary schools chemistry teachers were randomly chosen from government owned secondary schools in the Anambra State. One thousand two hundred students were randomly selected from the same school.

Validation of Instrument

The research instrument was given to three experts from the Department of Science Education, Nnamdi Azikiwe University Awka for validation.

Reliability

Ten chemistry teachers and fifty chemistry students were given the questionnaire in Enugu State. The reliability of the item was determined by using test-retest method. The reliability coefficient of .75 was obtained when person product of correlation coefficient was used.

Method of Data Collection

The instrument used for data collection is a self structured questionnaire. This is structured into two parts. Section A and B sought information on personal data on the respondent, while section B has 2 parts, part 1 sought information on difficult content areas of the chemistry syllabus from the teachers and students. Part 2 sought information on the possible solution to the difficult content areas. A four point rating scales of great extent, moderate extent, little extent and no extent was provided for them to make their responses.

The researcher personally distributed the questionnaires to the chemistry teachers and chemistry students for their responses and also collected them from the respondents. The method ensured that the entire questionnaire was returned.

Method of Data Analysis

Mean and standard deviation were used in answering the research questions while the t-test statistics were employed in testing the hypotheses formulated for the study. The score were rated at 0.00 – 2.49 as Not difficult (ND), Not a reason (NR), 2.50-4.00 as Difficult (D), Reason (R).

Hence, below 2.49 is not difficult (AD),not a reason, (NR) not approach (NA) while above 2.50 is taken as difficult (D), Reason(R), Approach(A).

Results

Research Question 1: What content areas of the senior secondary school chemistry do teachers find difficult to teach?

Table 1: Mean Rating of Content Areas of the Senior Secondary School Chemistry the Teachers Find it Difficult to Teach

| S/N | ITEM | Teachers | | |
|-----|---|----------|------|---------|
| | | X | SD | Remarks |
| 1 | Introduction to Chemistry | 0.80 | 0.55 | ND |
| 2 | Structure of the Atom | 0.90 | 0.80 | ND |
| 3 | Standard separation Techniques for mixtures | 1.00 | 0.50 | ND |
| 4 | Periodic chemistry | 1.20 | 0.48 | ND |
| 5 | Chemical bonds | 1.40 | 0.66 | ND |
| 6 | Stoichiometry and chemical reactions | 1.75 | 0.72 | ND |
| 7 | States of matter | 1.52 | 0.32 | ND |
| 8 | Energy and Energy changes | 1.30 | 0.39 | ND |
| 9 | Acids, bases and salts | 1.40 | 0.50 | ND |
| 10 | Solubility of substances | 0.77 | .61 | ND |
| 11 | Chemical kinetics and Equilibrium system | 0.80 | .62 | ND |
| 12 | Redox Reactions | 2.58 | .56 | D |
| 13 | Chemistry of carbon compounds | 2.80 | .60 | D |
| 14 | Chemistry, Industry and the Environment | 3.00 | .61 | D |
| 15 | Basic Biochemistry and synthetic polymers | 2.80 | .56 | D |
| 16 | Non metals and their compounds | 2.50 | .55 | D |
| 17 | Metals and their compounds | 2.60 | .48 | D |

From table 1, it shows that the content areas of the senior secondary school chemistry the teachers find difficult to teach include; Redox Reactions; Chemistry of Carbon compounds; Chemistry, industry and the Environment; Basic Bi-Chemistry and synthetic polymers; Non metals and their compounds, and metals and their compound. This is because the respondent ranked them above 2.50., the rest were simple to teach.

Research Question 2: What content areas of the Senior Secondary school chemistry are difficult for students to understand?

Table 2: Mean Rating of Content Areas of the Senior Secondary School Chemistry the Students Find Different to Learn

| S/N | ITEM | Students | | |
|-----|---|----------|------|---------|
| | | X | SD | Remarks |
| 1 | Introduction to Chemistry | 1.20 | .52 | ND |
| 2 | Structure of the Atom | 1.56 | .60 | ND |
| 3 | Standard separation Techniques for mixtures | 1.20 | .62 | ND |
| 4 | Periodic chemistry | 1.80 | .59 | ND |
| 5 | Chemical bonds | 1.78 | .70 | ND |
| 6 | Stoichiometry and chemical reactions | 2.65 | .72 | D |
| 7 | States of matter | 2.08 | .56 | ND |
| 8 | Energy and Energy changes | 3.15 | 0.65 | D |
| 9 | Acids, bases and salts | 2.00 | 0.62 | ND |
| 10 | Solubility of substances | 2.00 | .48 | ND |
| 11 | Chemical kinetics and Equilibrium system | 2.55 | .50 | D |
| 12 | Redox Reactions | 2.65 | .56 | D |
| 13 | Chemistry of carbon compounds | 3.00 | .60 | D |
| 14 | Chemistry, Industry and the Environment | 3.44 | .70 | D |
| 15 | Basic Biochemistry and synthetic polymers | 3.52 | .62 | D |
| 16 | Non metals and their compounds | 3.50 | .72 | D |
| 17 | Metals and their compounds | 3.10 | .66 | D |

From table 2, it shows that the content areas of the senior secondary school chemistry the students find difficult to learn include; stoichiometry and Chemistry Reactions; Energy and energy changes; Chemical kinetics and Equilibrium system; Redox Reactions, Chemistry of Carbon Chemistry; industry and the Environment; Basic Biochemistry and synthetic polymer; non metals and their compound; metals and their compounds. This is because the respondents rated them above 2.50.

Research Question 3: What are the possible reasons for teachers difficulties in teaching areas identified?

Table 3: Mean Rating of Possible Reasons for Teachers' Difficulty in the Identified Content Area of Chemistry Syllabus

| S/N | CONTENT | MEAN | SD | REMARK |
|-----|--|------|------|--------|
| 1 | No enough time | 2.45 | 0.66 | NR |
| 2 | Too much work load | 3.62 | 0.72 | R |
| 3 | Lack of suitable chemistry textbooks | 2.35 | 0.85 | NR |
| 4 | No access to industrial site. | 3.10 | 0.63 | R |
| 5 | No access to industrial worker | 3.15 | 0.75 | R |
| 6 | Poor preparation | 3.80 | 0.71 | R |
| 7 | Lack of relevant instructional | 3.52 | 0.82 | R |
| 8 | material. | 3.66 | 0.68 | R |
| 9 | Poor remuneration / motivation of teachers | 2.16 | 0.77 | NR |
| 10 | No access to internet. | 3.72 | 0.70 | R |
| 11 | Students lack of interest. | 3.20 | 0.72 | R |

Table 3 shows the reasons why the teachers /students are finding some topics in the chemistry syllabus difficult to teach and learn. From the result, it shows that too much work load; no access to industrial site, no access to industrial worker, poor preparation, lack of relevant instructional material, poor remuneration/motivation of teachers, no access to internet and students' lack of interest are possible reasons for the difficulties in teaching and learning of chemistry in secondary schools. While no enough time, and lack of suitable chemistry textbooks are not reasons for the difficulty teaching and learning of chemistry.

Research Question 4. What are the approaches that can be used to teach the topics in senior secondary chemistry syllabus for better understanding among the student?

Table 4: Mean Rating of the Approaches that can be Used to Teach the Topics in Senior Secondary Chemistry Syllabus for Better Understanding Among the Student

| S/N | TEACHING APPROACH | MEAN | SD. | REMARKS |
|-----|------------------------------|------|------|---------|
| 1 | Use of Home work/Assignments | 2.28 | 0.57 | NA |
| 2 | Guided discovery | 3.50 | 0.50 | A |
| 3 | Field trip/excursion | 3.00 | 0.51 | A |
| 4 | Conventional lecture | 1.72 | 0.62 | NA |
| 5 | Discussion | 2.85 | 0.53 | A |
| 6 | Cooperative learning | 2.96 | 0.52 | A |
| 7 | Practical activities | 3.15 | 0.55 | A |
| 8 | Concept mapping | 2.80 | 0.54 | A |
| 9 | Inquiry approach | 3.10 | 0.52 | A |
| 10 | Demonstration | 3.15 | 0.59 | A |
| 11 | E – learning | 3.25 | 0.47 | A |

Table 4 revealed that the use of guided discovery, field trip/Excursion, Discussion, cooperative learning, practical activities, concept mapping, inquiry approach, Demonstration and e – learning are approaches that can be used to teach the topics in the senior secondary school chemistry curriculum for the behavior understanding among the students to a great extent while use of home work/Assignments as well as conventional lecture can be used to a little extent.

Hypothesis

Ho₁:- There is no significant difference between the areas identified as difficult to teach by teachers and the areas identified as difficult to understand by students in senior secondary chemistry syllabus.

Table 5: t-test Analysis of Teachers and Students Mean Rating of Difficult Areas to Teach and Learn Respectively

| Source | N. | \bar{x} | SD | df | t-Cal | t-Critical |
|----------|------|-----------|------|------|-------|-------------|
| Teachers | 150 | 2.60 | 0.76 | 148 | 1.95 | Not |
| Students | 1200 | 3.60 | 0.80 | 1198 | | Significant |

From table 5, the calculated t (1.48) is less than table critical value of 1.96. Therefore, the hypothesis of no significant difference in the opinion of teachers and students in teaching and understanding of the identified areas in the syllabus is upheld.

Discussion of Findings

The results of the findings shows that teachers find it difficult to teach six (6) topics out of seventeen (17) major topics while the students find it difficult to learn eight (8) topics out of seventeen (17) topics in the chemistry syllabus. The most difficult theme to teach and learn is the chemistry is industry. This is the area Government of Nigeria (2013) in her National Policy on Education emphasized on objectives of senior secondary chemistry curriculum which among others is to show chemistry and its link with industry, everyday life, benefits and hazards, to provide a course which is complete for pupils not proceeding to higher education, while its at the same time a reasonably adequate foundation for a post secondary chemistry course.

Hence Farrant (1980) held that learning is the process by which we acquire and retain attitudes, knowledge, understanding, skills and capabilities that cannot be attributed to inherited behavior patterns or physical growth. Farrant tried to list different types of learning as: affective, cognitive, psychomotor, deductive and inductive. This time what we require in chemistry is psychomotor learning which has to do with the development of skills which require different co-ordination between our brains and muscles, especially when we read and write or carry out physical skills. It is the teacher that does it. Hornby (2010) described teacher as to give lessons to students in school.

The teacher teaches while the student learns. Farrant (1980) emphasized that teaching and learning are opposite sides of the same coin, for a lesson is not sought until it has been learned.

The syllabus is packaged with content that leads to self-actualization by students. In addition, the syllabus content focuses on practical activity with emphasis on locally available materials. This is to imbibe the learners with the spirit of enquiry. The syllabus is effectively implemented, will enable the learner achieve his/her maximum potential in the subject of chemistry and its various applications. No matter how professionally qualified a Chemistry teacher is without available working equipment and materials he cannot translate his competence into reality (Ihuarulam, 2008)

Ugwu (2008) emphasized the teachers' weakness in chemistry to include: Lack of practical skills, Poor classroom control and management, Lack of in-depth subject and entrepreneurial skills, Inability to communicate effectively in English language, Lack of professions', Poor attitude to work, Poor computer skills. From the research it is shown that too much work load, no access to industrial site, no access to industrial workers, poor preparation, lack of relevant instructional material, poor remuneration/introduction of teachers, no access to internet and students lack of interest are possible reasons why the teachers and students are finding it difficult to teach and learn same chemistry topics in the chemistry curriculum.

The findings on the approaching to be used in teaching the topics in the senior secondary chemistry curriculums revealed that guided discovery, field trip/Excursion, discussion, cooperative learning, practical activities, concept mapping, inquiry approach, demonstration, e-learning all help to promote teaching and learning of chemistry. Also the use of home work/Assignments and conventional learning of chemistry in the secondary school do contribute in the teaching and learning of chemistry.

Conclusion

From the results of the researchers, it can be seen that many of the topics in the senior secondary school chemistry syllabus are difficulty to teach and learn by teacher and students. There are many reasons of the difficulty but the teachers should try to use many approaches to solve the problem.

Recommendations

Based on these findings, the following recommendations were made:

1. Chemistry teachers should be sponsored to workshops and conferences.
2. The chemistry curriculum for senior secondary schools should be restructured to fit the present demand of the nation.
3. Appropriate strategies will be used in teaching chemistry in senior secondary schools.

References

- Abdullahi, A. (1982). *Science Teaching in Nigeria*. Ilorin: Atoto press ltd.
- Akinsola, M.K & Igwe I.O.(2002). The Relative Effect of Metacognitive strategy of framing on students' achievement in selected different chemistry concepts. *Journal of STAN*, 37, 1 & 2, 20-28.
- Ajewole A.G, Ogimi A.M, Obiku M & Yetunde A.V.(2008). Curriculum Development in Science Technology and Mathematics Education in Secondary schools: Global Challenged and possible remedies. *49th STAN Annual Conference proceedings*, 18-22.
- Ali, A & Aigbomian D (1991). Level of content competence in pupils attended by prospective B. Sc (Physics Ed) and other pupils Teacher for teaching senior secondary school physics in Nigeria. *Journal of the Science Teachers of Association of Nigerian*. 27, (1), 63-72.
- Ali, A (1992). Methods and Materials for Science Teaching. *Journal of Science Teacher Association of Nigeria*, 34 (1 & 2)
- Emendu, N.B (2007). Origin and evaluation of scientific Thought. In Mendu N. N; Okuma A, P & Nzomiwu, N.R. (eds). *Readings in National Science for University Studies Enugu: Frefabage*. Investment. 98-118.
- Ezeliora B (2002). *Relating Chemistry Teaching to Local practice for sustainable Science Education*. *STAN Proceedings of the 43rd Annual Conference and Inaugural conference of CASTIVE AFRICA*, 263-265.
- Farrant J.S. (1980). *Principles and Practice of Education*. London: Morrison and Gbb ltd.
- Federal Ministry of Education (2013): *National Policy of Education*. Lagos: NERDC press
- Hornby A.S. (2010). *Oxford Advanced Learners' Dictionary*. Oxford: University press.
- Ihunarulun A.I (2008). Chemistry Teachers perception of Availability and State of Resources for Curriculum Development in Kano State, *49th STAN Annual conference proceedings*, 148-152.

- Jimoh, A.T. (2002). Sustaining Technological Development in Africa: The Position of Analytical chemistry in Nigerian secondary schools. *STAN proceedings of the 43rd Annual conference and Inaugural conference of CASTIVE AFRICA*. 266-289.
- Mari J.S. (2008). The role of teachers in implementation of chemistry curriculum. *49th STAN Annual Conference Proceedings* 153-156
- Nigerian Educational Research and Development Council (NERDC, 2005). *Senior Secondary School Education Curriculum Chemistry for SS 1-3*. Abuja: NERDC.
- Ojokuku, G.O(2012) *Understanding Chemistry for schools and Colleges*. Zaria: Press-on cheneresouivces.
- The West African Examinations Council (2014) *Regulations and syllabuses for The West African Senior School Certificate Examination (WASSCE)*. Lagos: WACE International Office.
- Udogu M.E (2010). Effective Chemistry Teaching and Learning. in Ezeagbor G.I & Chikaobi P.C (eds.) *Towards effective Science Teaching for Tertiary Institutions*. Onitsha: lincel publishers pp 141-153.
- Ugwu A. (2008) Current issues on implementation of Senior Secondary School Science curriculums in Nigeria. *STAN 49th Annual conference proceeding*, 23-26