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THE PROPORTION OF WAEC/NECO PRESCRIBED SYLLABUSES IN CHEMISTRY COVERED IN RECOMMENDED CHEMISTRY TEXTBOOKS USED IN SECONDARY SCHOOLS IN ENUGU STATE

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ABSTRACT

This study assessed the proportion of WAEC/NECO syllabuses in chemistry covered in recommended chemistry textbooks used in Enugu State. The sample of the study consisted of three main chemistry tests often in use out of five main texts recommended; ten chemistry teachers from the ten schools sampled from thirty-one schools from Enugu zone. Two research questions guided the study. 8-point quantitative model of science textbook evaluation was used to generate and analyze data from both the textbooks and the syllabus. Some of the major findings revealed that: none of the textbooks has a total topical coverage of the target syllabuses; the textbooks are not regularly revised. Based on that, the following recommendations were made among others: the researcher needs to notify the authors of these chemistry textbooks in writing, about the lapses observed from the books and therefore advised, for a proper upgrade. Government should work in collaboration with the chemistry teachers, authors of chemistry textbooks, curriculum developers and even the students, in prescribing chemistry textbooks that has complete content coverage of WAEC/NECO syllabuses with clear and simplified illustrated examples.

Keywords: WAEC/NECO Syllabus, chemistry textbooks, chemistry teacher, topical coverage

Introduction

For sometimes now, the performances of students in the Chemistry Examination have shown considerable deterioration (West African Examination Council (WAEC), 1991-1995 results Otti, (2010) WAEC, (2010-2017),). Chemistry has been characterized for several decades by this poor achievement in school certificate examinations. The statistics of students' performances in senior secondary school certificate chemistry examinations from 1999-2006 (WAEC, 2006, Assim, Bassey & Essien, 2005); WAEC, Chief examiners' report, between, 2001-2012, and 2014-2018, on both theory and objective questions were all used to buttress this point. Their reports on chemistry 3 (practical chemistry) were based on the following: students' inabilities to record observations correctly, give correct inferences, wrong use of terminologies-recording aqueous solution as solid substances, use of unidentified reagents. Report on chemistry 2 (theory) is always on

poor response to chemistry questions, lack of in-dept knowledge on organic chemistry, Bonding, mole concept, electrolysis, types of reaction and balancing of chemical equation. Students either shy away from such questions or answer the questions shabbily.

Specifically, the percentage passes at credit levels WAEC, chemistry, between 1999 to 2006 according to WAEC (2006) indicated 31% credit passes in 1999 and 2000; 36% (2001); 26% (2002); 38% (2004); 51% (2005) and 45% in 2006. Similarly, WAEC chief examiners' reports (2001-2012) indicated that 50% of students who sat for the examinations were able to obtain at least a credit pass in chemistry, in the years 2005, 2006 and 2010 while the remaining years recorded below 50% credit passes. Despite the important role of chemistry in the educational system, and the effort made by researchers to improve performance, students' performance in the subject is still on the decrease. However, Considerable research evidences abound, which have implicated several factors as contributors to this poor performance. Such include: unstable staff, inadequate classroom and equipment, poor knowledge of the subject (Onochie, 2018); inadequate chemistry teachers, materials and motivation (Agogo and Onda, 2014); learning difficulty due to abstract chemistry topics (Onuekwesi, 2015); poor performance of teachers, school and home environment, poor instruction, conceptual difficulty (Aina, 2014; Kalagbo, 2016, and Apper, 2016). Of all these factors listed above, the use of chemistry textbook has much role to play, because it is an effective beacon to academic movement of both the teachers and students.

Every country has peculiar guideline, articulated inform of curriculum for every category of learner and for all levels of education. This according to, Zhang, Logan and Schmidt (2019) define the relevant content topics; procedure and analytical skills deemed important by the society. This curriculum guideline or standard are made functional by the students through the teacher. Teachers are therefore the driving force that helps to make the curriculum realizable, through their commitment, use of adequate resource materials (textbook) as well as effective method employed in the teaching and learning processes. Text books are inevitable teaching and learning resources which according to (Fang, 2014; Mathias, 2014), describes, dictates and convey a message of pedagogical content and practices. It promotes learners' achievement in a school subject, by influencing both the strategies of teaching and sequence of teaching and learning (Digiuseppe, 2014)

Formal Education depends largely on the use of quality textbook. According to Emerole (2008), a good number of science textbook are not adequate and therefore unsatisfactory. The adequacy of science textbooks used at any level of formal education determines, among other factors, the effectiveness of teaching and learning processes by teachers and students. Textbooks may be considered as indispensable tools, which affect desirable behavioral changes in the learner. In the words of Ozongwu (2011), textbooks are

generally very important for many reasons; they serve as guide; as a gauge and greatly influence how content is delivered. In other words, textbook is the main source of information an Individual needs for knowledge update. Many of the curriculums in different levels of Nigerian Schools, are found in their good textbooks (Ugama, Nnachi, Anugwo and Okpara, 2020). Therefore, as there are marginal conceptual changes in the knowledge of science, both the curriculum and textbooks have to be updated with time, so that the right type of book with evident criteria of good quality should be, recommended and effectively utilized by those they are meant for. With that, the rapid changes witnessed in the field of science and technology would have been partly taken care of.

Content analysis has been a major methodological approach for the objective measurement of textbook content (Polikoff, Zhou and Campbell, 2015). There is an argument that textbook content coverage has a substantial relationship to classroom instruction and then indirectly to students' achievement, which has been one of the main rational of the last three decades for standardization reforms in the United State (Polikoff and Porter, 2014). A number of contributions have been made through publications on textbook analysis (Vojir and Rusek, 2019). The analysis has been based on investigating different levels of science textbooks (Dunne, Mahdi & O' Reilly, 2013); representation of scientific methodology (Binns and Bell, 2015); content or content and readability assessments of different science textbooks written in different science subjects at both junior and senior secondary schools' levels.

Evidence of the analysis of different secondary school textbooks are summarized thus: Abonyi, Ogbu, Nnachi, and Ugama, 2018) from their study revealed that the Biology textbooks analyzed, covered the content as stipulated by the curriculum. Similar result was recorded from the evaluation of Basic science and technology textbooks according to (Nwafor and Umoke, 2016), On the contrary, Abonyi and Omiko, (2011), evaluated five chemistry textbooks, and the result revealed, a number of inadequacies, in the areas of topical coverage, learning activities, readabilities and efficiency on instructional delivery. Only three out of five texts evaluated were with acceptable range of topical coverage. Nweze, (2003) in accordance, revealed that none of the chemistry textbooks studied had a total topical coverage of the syllabuses. Thus, textbook that does not support the curriculum content is counter-productive according to, Chukwunenye, Ihekwuaba and Akano, 2018) and as a result slows down the students' attainment of the curriculum objective which will eventually have a far-reaching slowdown effect in the whole society.

Statement of Problem

Series of underachievement by the chemistry students, (a mirror reflection of the chemistry teachers, teaching materials and methods), comments from external examiners report, coupled with lack of valid information by the authors of chemistry textbooks about the

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content of the chemistry textbooks prescribed for use in our schools, as evident in both the background and literature, seemed to have led to inappropriate prescription of chemistry textbooks by the Ministry of Education. Consequently, students and teachers are saddled with unpleasant materials, which result in underachievement, apathy and thus creation of avoidable situation for efficient teaching and learning; lack of skill acquisition in chemistry and in science and technology as a whole. Thus, this study aimed at addressing such problem as: how appropriate are the contents of chemistry texts recommended for use in Enugu state schools?

Purpose of the Study

The study aimed at finding out how adequate is the prescribed chemistry textbooks in use in Secondary Schools in Enugu State. Specifically, the study sought to:

i. Find out the proportions of the contents of WAEC/NECO ordinary level syllabus contained the chemistry textbooks in use in secondary schools in Enugu State.
ii. Examine adequacy of the instructors' perception index of the content of chemistry textbooks in use in Secondary Schools in Enugu State.

Scope of the Study

The scope of this study was delimited to three of the prescribed chemistry textbooks that are mostly available and most commonly used in teaching senior secondary classes in Enugu Education zone of Enugu State. The three chemistry texts under study include: Chemistry for Senior Secondary Schools by STAN; New School Chemistry by Ababio and Chemistry for Senior Secondary Schools, IUPAC Edition by Afolayan. The aspect of the content assessment studied is the extent of topical coverage of the subject matter of the NECO/WAEC syllabus and the chemistry instructors' perception index of the chemistry textbooks in use in Enugu State, Nigeria.

Research Questions

The study addressed the following research questions:

i. What proportions of the contents of NECO/WAEC syllabus are covered in the chemistry textbooks in use in Enugu State?
ii. How adequate are the instructors' perception index of the content of chemistry text books in use in Secondary Schools in Enugu State?

Research Methods

The research design used in this study was the evaluative research design. This design, according to Nworgu (1991), is concerned with decision making relating to the value for the worth of educational materials, methods or programmes based on empirical data. The researcher found this design very useful .

Area of the Study

This study was carried out in secondary schools in Enugu education zone of Enugu State. Enugu State, consists of six educational zones. These are Enugu, Awgu,

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Agbani, Udi, Nsukka and Obollo-Afor zones. Enugu zone consists of three Local Governments namely: Enugu North, Enugu East and Isi-Uzo local Government Area containing nine, ten and twelve schools respectively making a total of 31 public secondary schools in all.

Population of Study

The population of this study includes the five recommended chemistry textbooks that were approved by the National Council on Education in April, 1990. These are:

1. Chemistry for Senior Secondary Schools by STAN
2. New School Chemistry by Osei Yaw Ababio
3. Chemistry for Seniors Secondary Schools, IUPAC Edition by S, A Afolayan. London, macmillan publishers
4. Programmed Instruction in Chemistry for Secondary Schools by I.O. Obidipe
5. New Certificate Chemistry IUPAC Edition by Bajah S T and Caodman.A

Also included in the population were all the chemistry teachers in public schools in Enugu education zone.

Sample and Sampling Techniques

Multi-stage sampling technique was adopted as follows.

Purposive sampling techniques was used to select a total of three Chemistry textbooks that are most commonly used in schools.

Stratified sampling techniques was used to select a total of ten chemistry teachers from ten schools from the three Local Government Area of Enugu zone since the population is in-group. According to Kumaran (1976), the number to be selected from each group is given as:

$n = \frac{n_1 N_1}{N}$, where

n = number of respondents from each group
n_1 = total sample size
N_1 = number in each group.
N = population size of the study

In substituting the number of schools from each of the three local governments in the above formula, the distribution would be as follows: Examples

Schools in Enugu North

$\frac{10\ x\ 9}{31} = 2.9$

Schools in Enugu East

$\frac{10\ x\ 10}{31} = 3.2$

Schools in Isi-uzo

$\frac{10\ x\ 12}{31} = 3.9$

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Therefore, a total of 3, 3, 4 schools were random sampled from the listed local government areas from where the, 3, 3, 4 chemistry teaches were also selected and used respectively.

Method of Data Collection

For content evaluation, 8-point Quantitative Model for the Evaluation of Science Textbooks, developed by Emerole (2008) an updated version of a 5-point quantitative approach for content evaluation of science textbooks developed by Nworgu (2001) (QACEST) was used. 2-points or criteria out :

of the 8-point Quantitative Model were adopted and used for this study. These include; Index of Tropical Coverage (ITC) and instructors' perception index. The Index of Tropical Coverage (ITC) was estimated by analyzing the topics and subtopics of the curriculum or syllabus being represented by Ts and Ss respectively. Similarly, the numbers of topics and subtopics covered by the chemistry textbook were determined by counting and these were represented by Tt and St respectively. The variables were substituted and evaluated using the formula for finding ITC as given below

$$ITC = {}^{1}/_{2}\left\{\frac{T_t}{T_s} + \frac{S_t}{S_s}\right\}, \text{ Where}$$

ITC = Index of topical coverage
T_t = the number of chemistry topics in the syllabus covered by the chemistry textbooks.
T_s = the number of chemistry topics in the syllabus (both covered and not covered)
S_t = the number of sub-topics in the syllabus covered by chemistry textbooks
S_s = the number of sub-topics in the syllabus (both covered and not covered)

Thus, ITC of the maximum value of + 1 means total coverage of all the topics and subtopics. While the minimum value of zero (0) means no coverage of any topic and subtopics in the syllabus.

Instructors' perception index

This provided an estimate to how the instructor perceived the chemistry textbooks' content coverage and how simplified are the illustrated examples and other instructional activities. The chemistry teachers' perception rating scale (CTPRS), an aspect of an 8- point model was modified according to the demands of the textbooks and used.

Method of Data Analysis

The 8-point model was used for data analysis. Only 2 out of the 8 criteria were adopted from the 8- point model. They include, index of topical coverage and instructors' perception index. Chemistry teachers' perception rating scale (CTPRS) was used to determine how relevant the textbooks are to the teachers in terms of content coverage, instructional objectives and simplified exercises.

Research Question 1: What proportions of the contents of NECO/WAEC syllabus are covered in the chemistry textbook in use in secondary schools in Enugu State?

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Index of topical coverage for the three texts were analyzed and presented in the table below.

Table 1: Index of the Topical Coverage of the Three Chemistry Text Investigations.

Textbooks	T_t	T_s	S_t	S_s
Ababio	18	19	68	74
STAN	15	19	64	74
Afolayan	16	19	70	74

$$I.T.C = {}^{1}/_{2}\left\{\frac{T_t}{T_s}+\frac{S_t}{S_s}\right\}$$

Where

T_s = Number of topics in the curriculum or syllabus covered by the text.

T_s = Number of topics in the curriculum or syllabus

S_t = Number of sub-topic in the curriculum/syllabus covered by the text

Ss = Number of sub-topics in the curriculum or syllabus

By using the above stated formula, the I.T.C. for the three text books are computed thus:

$$Ababio = {}^{1}/_{2}\left\{\frac{18}{19}+\frac{70}{74}\right\} = 0.95$$

$$STAN = {}^{1}/_{2}\left\{\frac{15}{19}+\frac{64}{74}\right\} = 0.83$$

$$Afolayan = {}^{1}/_{2}\left\{\frac{16}{19}+\frac{70}{74}\right\} = 0.89$$

The I.T.C. for the three chemistry textbooks as shown in the analysis of the data from table 1 above were 0.95, 0.83, and 0.89 for Ababio, STAN, and Afolayan respectively. This implied that Ababio covers 95%, STAN covers 83% and Afolayan 89% of the topics and sub-topics for WAEC/NECO syllabuses in chemistry.

Research Question 2: How adequate are the instructors' perception index of the content of chemistry text books in use in Secondary Schools in Enugu State?

The data used in answering this question was generated from chemistry teachers' perception rating Scale. (CTPRS) The instrument was developed by Emerole and Rammiki, (2008) and adopted for use

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Table 2. Mean and total mean rating of the teachers' perception of chemistry textbooks

S/NO	CSSS (STAN)	NSC (ABABIO)	CSSS (AFOLAHAN)
1	3.60	4.4	3.82
2	3.46	3.92	3.74
3	2.92	3.78	3.25
4	3.48	4.70	3.78
5	3.00	3.86	3.32
6	3.20	3.88	3.50
7	3.50	4.42	3.44
8	3.48	3.93	3.62
9	3.08	3.96	3.64
10	3.06	4.65	3.83
11	2.66	3.55	3.45
12	3.22	3.58	3.50
13	3.60	3.80	3.74
14	2.86	3.68	3.39
15	3.62	3.68	3.84
Total mean =3.24		3.99	3.59

Range of acceptance of value is 3.00 -5.00.

Table 2 shows the mean rating of chemistry teachers' perception on the items for each of the chemistry textbooks. The result indicated that the total mean scores for CSSS, NSC and CSSS are 3.24, 3.99 and 3.59 respectively. The values are all within the acceptable range of 3.00-5.00. From the values again NCS (Ababio) is shown to have the highest mean rating followed by CSSS (Afolayan) and lastly CSSS (STAN). The textbooks were all found very useful to the teachers.

Discussion of Results

The result revealed that none of the textbooks had a total coverage of the target syllabus. The ITC of NSC (Ababio), CSSS (Afolayan), and CSSS (STAN) and as shown in Table 1 are 0.95, 0.89 and 0.83 respectively. This implied that Ababio has 95%, STAN 83% and Afolayan 89% content, coverage of the topics and sub-topics of the chemistry syllabus for the SSCE/NECO examinations. The results showed an appreciable high ITC for the texts but not the total coverage of the topics and sub topics in the syllabus. The finding from this present study is in agreement with the similar and previous works of Nweze, (2003), Abonyi & Omiko, (2011), Umoke & Nwafor (2015), who found out from the evaluation different textbooks in their different fields that,inadequacies existed in the texts in the areas of content coverage, therefore, none of the textbooks has a total topical coverage of the syllabuses. A textbook according to Chukwunenye, Ihekwaba & Akano (2018), that does not support the curriculum content is counter-productive and as a result hinder students' attainment of curriculum objectives. On the contrary, Abonyi, et al (2018), Nwafor &

Umoke, (2016), their studies, revealed that the Biology textbooks, and Basic science and technology texts evaluated, appropriately covered the contents as stipulated by the core curriculum thereby disagreeing with the findings from the present study.

Summary of findings

The findings revealed that none of the chemistry textbooks studied had complete coverage of all the chemistry topics in the WAEC/NECO syllabuses. The Index of topical coverage for the three textbooks studied namely: NSC (Ababio, CSSS (Afolayan), CSSS (STAN) were 0.95, 0.89 and 0.83 respectively. This implied that NCS (Ababio), CSSS, (Afolayan) and CSS (STAN) had 95%, 89% and 83% content coverage of all the topics and sub-topics of the WAEC/NECO Chemistry syllabuses. Similarly, the findings from the mean rating of the teachers perception of chemistry textbooks revealed that NCS (Ababio)(3.99) is shown to have the highest mean rating followed by CSSS (Afolayan)(3.59) and lastly CSSS (STAN)(3.24). The textbooks were all found useful to the teachers. From the values, it is very obvious that the textbooks need to be revised. The impression of teachers about the books was not very impressive let alone the students.

Conclusion

From the findings of this study, the following conclusions can be drawn:

i. It is very obvious that a single chemistry textbook will not be 100% adequate in all the criteria.
ii. None of the textbooks studied, have a total topical coverage of the target syllabus, though, their ITC scores are appreciably high.

Recommendations

Anchored on the finding of this study, the following recommendations are made:

i. The researcher needs to notify the authors of these chemistry textbooks in writing, about the lapses observed from the books and therefore advise them, for a proper upgrade.
ii. Government should work in conjunction with the chemistry teachers in prescribing chemistry textbooks that has complete content coverage of WAEC/NECO syllabuses with clear and simplified illustrated examples.
iii. The authors of chemistry textbooks should often revise their textbooks with a view to introducing new concepts. They should also break down their textbooks into levels to accommodate different levels of the students.
iv. The textbooks should be properly evaluated by the relevant authorities in collaboration with the chemistry teachers, specialists and possibly authors and publishers, before recommending them to any level of the students. While recommending textbooks

attention should first of all be paid particularly to the topical content coverage as stipulated in the syllabus. Making sure that all the contents and sub contents are adequately and comprehensively represented.

v. The authors of chemistry textbooks should make frantic effort to download research reports from previous and recent reports from textbook evaluation studies so as to identify the deficient areas and follow up accordingly.

Summary of the study

This study was designed to determine the proportion of WAEC/NECO prescribed syllabuses in Chemistry covered in recommended chemistry textbooks used in Secondary Schools in Enugu State

This was prompted by the consisted poor performance of students in school certificate examinations in chemistry. The main purpose of this study was to find out the adequacy of the prescribed chemistry textbooks in use in secondary schools in Enugu State in terms of topical coverage and instructors' perception indices. Content analysis of the recommended chemistry textbooks was done using the QACEST procedures. It was found out that the textbooks had between 80%-95% content coverage and are quite recommendable but still need to be upgraded further. Based on the finding, recommendations were made on how the qualities of chemistry textbooks and the teachers are improved.

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