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Content Coverage and Readability of Biology Textbooks in Use in Nigerian Secondary Schools

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Abstract: This study evaluated the content coverage and readability of biology textbooks in use in Nigerian secondary schools. The study utilized an evaluation design. The study was limited to four major biology textbooks approved and in use in senior secondary schools. The biology textbooks are: (a). Modern Biology for Senior Secondary Schools by Sarojini T. Ramalingam, (b). Essential biology for Senior Secondary Schools by M.C. Michael, (c). College biology for senior secondary schools by G. Idodo-Umeh and (d). Comprehensive Biology for senior secondary school by Chris Nweze. A total of nine hundred and thirty research subjects comprising nine hundred students and thirty biology teachers were used for the study. Two research questions and one null hypothesis guided the study. The research questions were answered using the quantitative model while the hypothesis was tested at 0.05 level of significance using Chi-square test of goodness of fit. The study revealed that three out of the four evaluated biology textbooks covered the content as stipulated by the curriculum but one of the biology textbooks is not readable. Based on the findings the researcher made specific recommendations with respect to the four textbooks.

Key words: Comprehensibility · Curriculum · Topical Coverage · Validity · Nigeria

INTRODUCTION

Science education is crucial to the achievement of socio-economic development of any society and also a critical element in the attainment of Millennium Development Goals (MDGs). Two very distinct demands shape science education program in different countries. The first is the demand for specialist manpower so that societies and economies can keep pace in a world where scientific knowledge is being exploited in a rapidly increasing way. Second is the demand for a more scientifically literate citizenry. Education should, therefore, produce more members of the society who will be able to benefit from personal and social applications of knowledge and will be prepared to support the changes towards sustainable development.

Udeani [1] noted that science has undoubtedly improved the wellbeing of man. The benefits are seen in the areas of telecommunication, computers, space program (satellites space crafts), medicine and health care (including pharmaceutical advances), the study of genetics and breeding (cloning, hybridization, invitro fertilization, embryonic cell research), prevention of diseases, weaponry and military equipment, agriculture, marketing and sales through internet services, environmental sustainability and improved communication.

Education is the best investment and books are the basic tools of education. This is in line with Deshmukh's [2] opinion that textbooks are perhaps the most vital learning material available and used in most schools. Textbooks present a treasure of knowledge to students and also boost students' interest in the subjects. If this instructional material contains any defective knowledge or information, the consequences will be serious on the students and the society in general. A number of science textbooks are not adequate and are unsatisfactory as pointed out by Emerole [3].

Biology is a natural science which examines living things and how they interact with one another and their surroundings. The cardinal objectives of biology education in senior secondary school as stated by Federal Ministry of Education [4] are to acquire:

- Adequate laboratory and field skills in biology
- Meaningful and relevant knowledge in biology

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- Ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture and;
- Reasonable and functional scientific attitude

It is therefore imperative that the contents of biology textbooks should satisfy the requirement of the curriculum and national policy if the objective of creating a scientifically literate society is to be achieved. According to Tugba [5] the study of biology helps students learn to make more informed decisions about their own health, to recognize the importance of agriculture and horticulture and develop skills of environmental management and sustainability. Biology education opens up career opportunities. Large numbers of students enroll in biology when compared to other science subjects because biology is a subject that is central to the studies of science, social science and even art. Students register biology at secondary school level because they regard biology as a soft option. Incidentally, the performances of students in biology at School Certificate Examination as attested by WAEC Chief Examiners Report [6] have not been satisfactory.

Textbooks play important role in the teaching and learning of biology. Science textbooks are the most frequently used instructional material for students and teachers at all level. This is because of their availability and ease of use. Biology textbooks help students to repeat lesson at home or study before the lesson. These text materials therefore should be written with the vocabulary appropriate for the age and level of students using them. Textbooks must be understandable to students, appropriate for self-study and include accurate information. Biology as a subject contains many scientific terms and much abstract knowledge. In order to encourage students understand concepts, prevent memorization and increase their knowledge, biology textbook must contain relevant illustrations that are attractive to students and activities that stimulate critical-thinking skills and scientific inquiry. It is important that textbooks include accurate content aligned with the curriculum requirement because many teachers use them as the curriculum guide. Ozongwu [7] stated that in today's classroom, textbooks serve as a guide and gauge and greatly influence how content is delivered. With the current high level of global technological awareness and emphasis on science education, there is a renewed call for functional science education [8]. To achieve this objective, every effort should be made to establish and apply a wide variety of relevant and contextual appropriateness for the evaluation of the textbooks used in teaching science in classrooms. If biology textbooks exert influence on biology teaching and learning, it becomes necessary that the content and what they convey to the students are factual, accurate and up-to-date therefore, it is important for the authorities in the ministry of education to evaluate the available textbooks critically before approving their use in schools [9]. Authorities should ensure that careful selection of textbooks to be used in senior secondary schools are made and that materials approved closely reflect the needs of the learners, the aims and values of the teaching program. The National Council on Education has directed that that the State Ministries of Education should periodically review and evaluate textbooks used in teaching senior secondary school students to ensure that the books meet the expected standard. When such regular evaluation is not done, it becomes difficult to claim that the approved textbooks have acceptable quality. Evaluation of biology textbooks for use in senior secondary schools should focus principally on topical coverage and readability. The topical coverage index provides estimate of how far the content of the textbooks covers the prescribed syllabus.

Because these indices have not been established for the textbooks in use in Nigerian secondary schools, it becomes critical and very imperatives that the ministry of education be adequately guided in their recommendation of such vital curriculum materials for use in schools. In addition to justifying the usage of the textbooks it is necessary to guide the authors on areas of emphasis during further revisions of the textbooks. This study is a response to these critical needs and is therefore focused on providing a thorough evaluation and unbiased indices of major biology textbooks in use in Nigerian Secondary Schools.

Objectives of the Study: This study evaluated some approved and recommended biology textbooks in use in Nigerian secondary schools. Specifically, the study aimed at finding out whether the four approved biology textbooks**;**

- Cover adequately the prescribed contents of the senior secondary school curriculum.
- Present the texts in a readable manner that will enhance comprehension by the leaner.

Scope of the Study: The research study was carried out in Nigeria. The study is delimited to four major biology textbooks approved and in use in senior secondary schools in Nigeria. The biology textbooks are:

- Modern Biology for Senior Secondary Schools by Sarojini T. Ramalingam,
- Essential biology for Senior Secondary Schools by M.C. Michael,
- College biology for senior secondary schools by G. Idodo-Umeh,
- Comprehensive Biology for senior secondary school by Chris Nweze.

Research Questions: The following research questions guided the study:

- How does the content of each of the approved biology textbooks cover the prescribed curriculum in senior secondary schools?
- What is the readability index of each of the recommended biology textbooks?

Hypothesis

HO_1: The content of each of the recommended biology textbooks in use in the secondary schools in Nigeria does not significantly deviate from the specification of the core curriculum in biology.

Research Method: The study was carried out using evaluation design. Evaluation design seeks to ascertain or judge the value of a program or resource by careful appraisal based on pre-stipulated standard. This study involves gathering of information and weighing it with some set of criteria to make judgment regarding the strength and weakness of recommended biology textbooks.

All the four biology textbooks recommended for use in Nigerian Secondary Schools were used for this study. The researcher selected one senior secondary school from each of the six geopolitical zone of Nigeria through a non proportionate stratified random sampling technique. From each school fifty (50) students offering biology were randomly drawn from each of the streams of SS1, SS2 and SS3. In all one hundred and fifty (150) students were selected from each zone so that for the six zones a total of nine hundred (900) students were drawn for the study. The selection of the students from the classes was achieved through simple random sampling technique. Five (5) biology teachers were drawn from each school making a total of thirty (30) biology teachers from the six schools. In all therefore a total of nine hundred and thirty research subjects (900 students and 30 teachers) were used for the study.

Data were collected with the Quantitative Approach for Evaluation of Science textbooks (QACEST) which was developed by Emerole [3]. The criteria used for this particular study were index of topical coverage and readability index. The cloze tests drawn from the four textbooks were subjected to face validation using specialists in biology and measurement & Evaluation. Three specialists in biology from unity secondary schools were used for the face validation in addition to three specialists in measurement and evaluation from the University of Nigeria. They screened the cloze passages in terms of relevance, appropriateness of terms and suitability of closures.

The cloze passages were also subjected to a measure of internal consistency using the split-half approach. In this case the passages were extended to permit splitting each cloze passage into two. The scores obtained from each half of the test were assessed using the Pearson's approach. A reliability index of 0.93 was obtained.

Data were collected using the Quantitative Approach for Content Evaluation of Science Textbooks and the cloze test. The research questions were answered using the quantitative model formula while the hypothesis was tested at 0.05 level of significance using Chi-square test of goodness of fit.

RESULTS

Research Question 1: *How do the contents of biology textbooks in use in Nigerian Secondary Schools correspond with the content specified in the core-curriculum?*

The data collected on the (ITC) Index of topical coverage were analyzed. The scores of the four biology textbooks were calculated as shown in Table 1

The result of data analysis in Table 1 reveals the topical coverage indices of the texts. Modern Biology for Senior Secondary had topical index of 0.94, College Biology for Senior Secondary had 0.98, Essential Biology for Senior Secondary had 0.89 while Comprehensive Biology for Senior Secondary had 0.86, College Biology for Senior Secondary schools had the highest topical coverage index while Comprehensive Biology for senior Secondary Schools had the lowest topical coverage index.

Research Question 2: *What is the Readability Index of the Biology textbooks in use in Nigerian Secondary Schools?*

Table 1: Indices of topical coverage (ITC) of the Biology Textbooks in use in Nigerian Secondary schools

S/N	Text book	T_t	T_s	S_t	S_s	Index
1	*Modern biology for senior secondary schools*	38	41	84	89	0.94
2	*College biology for senior secondary schools*	40	41	86	89	0.98
3	*Essential biology for senior secondary schools*	36	41	80	89	0.89
4	*Comprehensive Biology for senior secondary school*	34	41	78	89	0.86

Acceptance range = 0.75 to 1.00

T_t = number of topics sufficiently covered by the text

T_s= number of topics in the syllabus

S_t = number of sub-topics sufficiently covered by the text

S_s = number of sub-topics in the syllabus

Table 2: Readability Index of the Biology Textbooks in use in Ebonyi State Secondary Schools

S/No	Textbook	Mean Readability score	Decision
1	*Modern biology for senior secondary schools* by	38.41%	Not Readable
2	*Essential biology for senior secondary schools*	72.42%	Very Readable
3	*College biology for senior secondary schools*	38.41%	Readable
4	Comprehensive Biology for senior secondary school	60.11%	Readable

Acceptance Range => 40% & above

Table 3: Chi-square Table on the Significance of Deviation of the four Biology Textbooks Contents from the Specification of biology Core-Curriculum.

S/N	Textbook			X^2 cal	Alpha	X^2 Crit	Decision
1	Modern biology for senior secondary schools	38 (71.1)	84 (89)	4.70	0.05	7.82	Accept Null Hypothesis
2	College biology for senior secondary schools	40 (41)	86 (89)				
3	Essential biology for senior secondary schools	36 (41)	80 (89)				
4	Comprehensive Biology for senior secondary school	34 (41)	78 (89)				

The data used in answering this research question were obtained from the "Cloze Test of Readability of Biology textbooks" (CTRBT), The mean readability scores of the four biology textbooks evaluated were computed and presented on Table 2.

The result of data analysis in Table 2 reveals that three out of four evaluated textbooks are readable. Modern Biology for Senior Secondary Schools had readability mean score of 38.41%, Essential Biology for Senior Secondary Schools had 72.4%, College Biology for Senior Secondary Schools had 66.29% while Comprehensive Biology for Senior Secondary Schools had readability index of 60.1%.

Hypothesis

Ho_1: *The content of the biology textbooks in use in Secondary Schools in Nigerian of Nigeria do not significantly deviate from the specifications of the core-curriculum in biology*.

The contents of each of the four biology textbooks evaluated in this study were matched with the contents specified in the core-biology curriculum. The frequencies of T_t = Number of topics sufficiently covered by the textbook, T_s = Number of topics in the syllabus, S_t = Number of sub-topics sufficiently covered by the textbook and S_s = Number of sub-topics in the syllabus were subjected to a chi-square test of goodness of fit. The result is presented in the Table 3.

The result in Table 3 reveals a chi-square calculated value of 4.70 and critical value of 7.82 at alpha level of 0.05. Based on the decision rule, researcher accepts the null hypothesis and concludes that the content of four biology textbooks evaluated do not significantly deviate from the specification of the core-curriculum in biology.

Summary of the Result: From the evaluation, it was revealed generally that:

- Three out of the four evaluated biology textbooks covered the content as stipulated by the curriculum. They are College Biology for Senior Secondary Schools with index of 0.98 followed by Modern Biology for Senior Secondary Schools with index of 0.94 and Essential Biology for Senior Secondary Schools that had 0.89. The Comprehensive Biology for Senior Secondary Schools had 0.86.
- Three out of four evaluated biology textbooks are readable for Senior Secondary School students. Essential Biology for Senior Secondary Schools had the highest mean readability score of 72.41%; Modern Biology for Senior Secondary Schools had the lowest mean readability score of 38.4%. It is therefore not readable to the students.

DISCUSSION

The result of topical coverage index of Modern Biology for senior Secondary schools, College Biology for Senior Secondary school, Essential for Senior Secondary school and Comprehensive Secondary Schools were found to be 0.94, 0.98, 0.89 and 0.86 respectively. Considering the minimum acceptance range of 0.79 to 1.00 respectively, the extent to which biology textbooks covered the topics prescribed in the curriculum were high. College Biology provides in-depth coverage of topics and sub-topics. However, it did not adhere to the sequential order of known to unknown. There is also no relationship between chapters. At the beginning of each chapter, Modern Biology usually introduces the topic and subtopics. The explanations of contents of Modern Biology are not elaborate and comprehensive. The topics and subtopics in Essential Biology are not comprehensive enough to permit students a thorough grasp of the concepts.

Result presented in Table 2 reveals mean readability scores of the four evaluated biology textbooks. This result shows that Essential biology for senior secondary schools had the highest mean readability score (72.4) and is very easy to read. Students find it difficult to read and comprehend Modern biology for senior secondary schools. Modern Biology has heavy focus on science vocabulary and uses heavy scientific terminology which is an obstacle to reading comprehension. In addition the font size of the letters is tiny and strenuous to the eye. College Biology, Essential and Comprehensive Biology which used less bogus terminologies are more readable. The language used in Modern biology for senior secondary schools are quite difficult and far above the reading comprehension level of the students. Unless the language structure is reviewed to suit the level of the learners it constitutes an obstacle to learners and consequently dampens their interest in biology.

CONCLUSION

Quality textbooks should have adequate topical coverage and should be written in a language that is readable to the learners. This study exposes the fact that some of the biology textbooks approved for teaching and learning of biology in Senior Secondary schools in Nigerian are not adequate. Modern biology, College biology, Essential Biology for senior secondary schools and Comprehensive biology for secondary school are good in terms of topical coverage and should be recommended for teachers and students of biology. However, authors of Modern Biology should review the language structure and terminologies to enhance the readability of the textbook. Comprehensive Biology should be revised to ensure that the users get maximum knowledge and skills from the text. Based on the findings of the study, the researchers recommend that authors of biology textbooks should periodically evaluate biology textbooks in line with textbook Evaluation Criteria to ensure that the texts attain minimum standards recommended by the Federal Ministry of Education. Ministry of Education should establish a body that should take the responsibility of evaluating biology textbooks before recommendation to the students. As Abonyi and Omiko [10] rightly noted textbooks recommendation should not be based on the reputation of the publishers and their lobbying abilities but should be based on some more objective criteria that relate to textbook quality with the learners as the principal focus.

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