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EVALUATIONOFTHE READABILITY OF BASIC SCIENCE TEXTBOOKSIN USE IN JUNIOR SECONDARY SCHOOLS INENUGU STATE, NIGERIA

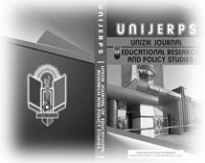
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Abstract

The study investigated the readability of Basic Science textbooks used in teaching Junior Secondary School Students in Enugu state, Nigeria. The study adopts an evaluation research design method. Thirty three Basic Science textbooks for JSS 1-3 were purposively selected from sixty recommended Basic Science textbooks. One research question and one null hypothesis were formulated to guide the study. The instrument used to collect data was Flesch-kincaid readability test. The data were interpreted by using percentage. The researchers selected 99 passages from the 33 Basic Science textbooks used for testing the readability. The validity of the instrument was tested by a group of experts in Measurement and Evaluation and Science Education. The reliability was calculated using Cronbach's Alpha coefficient with an overall value of 0.92. Flesch-kincaid readability test was administered in terms of determining the readability level of the reading samples in the textbooks. In addition, Flesch's interpretation readability scores relative to Nigerian schools were used to determine the mean readability scores for each Basic Science textbook. The researchers' recommend that authors of Basic Science textbooks should put a mechanism in place to review the textbooks periodically as it is done with curriculum.

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Keywords: Basic Science, Evaluation, Readability, Textbook, Secondary School

Introduction

The 9-year Basic Education Curriculum (BEC) according to Adeniyi (2007) was nationally and internationally applauded when it was developed in 2007 and its implementation started in 2008. The Nigerian Educational Research and Development Council (NERDC) recognized the shift towards an increasingly global economy which demands flexibility, openness of mind and the ability to think critically. The NERDC saw that there was need to review, restructure and re-align the then existing curricular for Junior Secondary Schools (JSS) to fit into the 9-year Basic Education programme (Adeniyi, 2007). The Basic Science curriculum for Junior Secondary School (JSS) is meant for the current 6-3-3-4 (now 9-3-4) system of Education in Nigeria. It is intended to provide new Basic Science course for three years to all junior secondary school students. By implication, it is expected to satisfy the needs of the society through the relevance and functionality of its contents, method, processes and application.

With the introduction of the new Basic Science curriculum, Basic science teachers are expected to deliver the curriculum objectives through appropriate teaching approaches and strategies. Therefore the workability of any curriculum depends on its effective delivery which involves the students, the teacher, teaching methods and other materials like textbooks as well as evaluation of the textbooks' conformity with the curriculum. Textbook can be regarded as study aids, consisting of a textbook and may or may not have workbook and teacher's handbook (Mikk, 2000). Each of these set fulfilsa specific purpose. Workbooks are designed to contain exercises and assignment questions and may even provide learners with space to answer the questions. Learners can give written answers to questions in a single traditional textbook which they have or answer the questions in a separate book or inside the booklet.

Textbooks form part of the larger group of educational media and is categorized under printed media. Other forms of printed media include teachers' guide,

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learner workbooks, atlases, dictionaries, magazines, newspapers, charts and posters (Mahlaba, 2006). Textbooks, like any other book that publishers print, are pieces of merchandise; the ultimate objective of their production is for commercial success (Lawrence, 2011). Most publishers published textbooks in order to make money. Ani (2016) contended that textbooks usually consist of a number of chapters with texts of different lengths that deal with various topics. There may be a different theme for every chapter and sometimes there are few activities or exercises. In some cases, textbooks and the workbooks are joined together in the same book, but sometimes they are represented by two separate books. Some textbooks are sometimes accompanied by other materials such as CDs, cassettes, and a teacher's guide. All of these additional materials are of course taken into account in the selection of a textbook. Textbooks and their contents stand as vehicle for positive change in educational system. This indicates that textbooks play an important role for obtaining information about the likely teaching and learning practices of a particular school, programme or institution (Richards, 2001). Hence, for the proper implementation of any school curriculum such as Basic Science, textbook is an essential component of the educational system. This indicates that textbooks are heavily utilized by teachers and learners.

Evaluation is a matter of judging the fitness of something for a particular purpose. It is used to connote the process of making value judgments or taking decisions about events, objects or their characteristics (Nworgu, 2015). It is the systematic process of making a value judgment of educational attainments and possibilities of individual enterprises from which the attainments were made. Nworgu goes on to say that the value judgment is based on the quantitative and qualitative information collected through measurement and non-measurement assessment techniques like observation, self-report and rating techniques.

Evaluation of textbooks is also considered to function as a kind of educational judgment. Evaluation of textbooks can be carried out to help a publisher or an institution to make decisions, to help in developing and selecting textbooks, to find out if the

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book being used meets the needs of the students and to carry out a research project (Tomlinson, 2003). Therefore evaluation of the readability of Basic Science textbooks is considered as one of the means for regulating and standardization of the textbooks to maintain their quality across the nation. Hence in the selection of a new Basic Science textbook, it is important to conduct an evaluation to ensure that the text is suitable (Taylor, 2008). The idea of evaluating textbooks is seen by some, to be clearly linked to the selection of textbooks. The evaluation helps the selection, which serves as an important decision making process. Tomlinson (2003) noted that it is very important for evaluators to develop their own evaluation criteria so as to effectively assess the suitability of a textbook with a particular group of learners. These criteria should consider the following steps:

- The first step is a consideration of relevant contextual factors and the gathering of information analysis of the material (assessing textbook fitness with the curriculum).
- The second step is a close evaluation using checklist method which should require careful tailoring "to the needs of the learners and the teaching context and the need for periodic updating recognized" (McGrath, 2002).
- The final step is the decision making phase which can be reached through a careful and systematic approach that addresses the question of validity and reliability.

The pedagogical values and suitability of the Basic Science textbook should be continuously evaluated using all of the above three stages. Therefore for adequate evaluation of Basic Science textbooks, the cyclic process should be adopted; hence there is need to assess Basic Science textbooks in order to facilitate selection and suitability of the Basic Science textbooks in use in Nigerian junior secondary schools. Regardless of which stage the textbook is evaluated, the process of textbook selection and evaluation is based on evaluators' opinions and facts about the textbook. However, evaluation of Basic Science textbook in use in Nigerian secondary schools remains an important process, since through textbook evaluation, teachers can know the fundamental merits and drawbacks of a particular Basic Science textbook. This

will help to select the most appropriate Basic Science textbook for the learners. The main issue in selecting Basic Science textbook is to search for its readability.

Readability is an important criterion under which a text can be evaluated; its measures are primarily based on factors such as the number of words in the sentences and the number of letters or syllabus per word. Important features that are commonly measured are word length and sentence length, which enable the determination of ease in reading. Readability scores are then provided to readers after being examined on understanding the text given. There are many types of readability measures developed to determine the readability of a text. According to Ani, (2016), these include: According to Ani, (2016) the Flesch developed by Flesch (1964), the fog index developed by Gunning (2003), the cloze procedure developed by Taylor (1956) and the Fry's scale developed by Fry (2002). This study adopted the Flesch technique which uses 100word samples to measure average sentence length and number of syllables. This technique guided the construction of Basic Science textbooks such that the readability conforms to the intended class level. The readability level of the recommended Basic Science textbooks for JSS 1, 2 and 3 using Flesch-Kincaid formula embedded in Microsoft office word 2010. The Basic Science textbooks evaluated include:

1) NERDC Basic Science for Junior Secondary School
2) Basic Science for Nigerian Junior Secondary Schools by Jegede, O.J. et al
3) Basic Science for Universal Basic Science by Ugwa, M.C. et al
4) New Edition Junior Secondary Basic Science by Ashiakpa, A.
5) Basic Science for Junior Secondary Schools UBE Edition by Bajah, S.T. et al
6) STAN Nigerian Basic Science Project New Edition by STAN
7) UBE Edition Basic Science. An Integrated Science Course for JSS by Ndu, F.O.C. et al
8) Comprehensive Basic Science for Secondary Schools by Onoh, C.E.C. et al.
9) Model Basic Science for Junior Secondary Schools by Okolo, K.N.
10) Basic Science for Junior Secondary Schools Upper Basic by Agbasimalo, N.E.

11) Simplified Basic Science UBE Edition by Abani, L.C.

Several studies have been carried out in which textbooks are evaluated from various perspectives. Emereole and Rammiki (2004) evaluated physics textbooks used in Botswana secondary while Omiko (2010) evaluated Senior Secondary School Chemistry textbooks in use in Nigerian secondary schools. There seems to be no research that focuses on the evaluation of the readability of Basic Science textbooks written for the junior secondary schools. Evaluation of the readability of Basic Science textbooks used in secondary schools in Enugu State, Nigeria becomes imperative in the effort to improve teaching and learning as well as help teachers to select good teaching materials for Basic Science.

Textbooks need to be critically evaluated to see whether they are meeting the expected goals of the National Policy on Education (FGN, 2004) and at the same time to see whether Basic Science textbooks are in conformity with the new Nigerian Educational Development and Research Centers NEDRC curriculum. Textbooks, therefore, take on a very important role in a Basic Science class, and it is important to select a good textbook. Textbook is often considered the main source of information and the most common teaching and learning materials.

In order to address these inadequacies in Basic Science textbooks, NERDC came up with an agenda to ensure that school textbooks met the curricular standards that are in line with the approved National Book Policy in education sector. The National Textbook Policy stipulates the need to equip schools with standardized texts based on a revised curriculum and also textbooks used by both JSS and SSS should be reviewed after a specified period. The recent introduction of the revised Basic Science curriculum has provided a natural platform for evaluation of the readability of Basic Science textbooks in use in Nigerian Secondary schools. It is on this ground that the researchers deemed it necessary to evaluate the readability of Basic Science textbooks in use in Nigerian secondary schools.

Purpose of the Study

The main purpose of this study is to evaluate the readability of Basic Science

textbooks in use in secondary schools in Nigeria. Specifically, this study aimed at evaluating the adequacy in the readability level of the recommended Basic Science textbooks in use in Nigerian secondary school.

Research Question

The following research question guided the study:-

1. Are the readability scores of each of the Basic Science textbooks used in Nigerian secondary schools adequate?

Hypothesis

The following hypothesis was formulated to guide the study and tested at 0.05 level of significance.

Ho1: There is no significant difference among the readability scores of JSS 1, 2 and 3 Basic Science textbooks in use in Nigerian secondary schools.

Methodology

An evaluation research design was adopted for this study. Evaluation design is the type of design, which seeks to ascertain, or judge the value of a programme or resources by careful appraisal determined by a pre-stipulated standard (Okolo, 2011). According to Ali (2006), evaluation design is the type of design that makes value judgment on programmes and projects based on certain predetermined criteria. This study adopted evaluation design because the study gathered information and put it together with set criteria to make judgment regarding the strength and weakness, merits or worth of an educational innovation and materials such as Basic Science textbooks. Hence the researchers find this design useful in this study because it involves making value judgment on the readability of Basic Science textbooks in use in Junior Secondary Schools in Enugu State.

The study was carried out in Enugu State Nigeria. Enugu state is located within the South East zone of Nigeria. The State is made up of seventeen (17) Local Government Areas which were divided into six education zones. The Zones are Agbani zone (Enugu South, Nkanu East, Nkanu West), Awgu zone (Aninri, Awgu, Oji-River), Enugu zone (Enugu East, Enugu North, Isi-Uzo), Nsukka zone (Igbo-Etiti, Nsukka, Uzo-Uwani), Obollo-Affor (Udenu, Igbo-Eze North, Igbo-Eze South) and Udi zone (Ezeagu, Udi). There were many schools and as a

result many publishers and many Basic Science textbooks flooded the market. The area was chosen because to the best knowledge of the researchers, no such study had been done in this area since the review and restructuring of the then existing Basic Science curriculum for junior secondary schools.

The population consists of all the 60 recommended Basic Science textbooks in use in Enugu State secondary schools that were approved for teaching of Basic Science in Junior Secondary Schools in Enugu state by the state Ministry of Education (2012-2015) sessions. Also included in the population were a total of 899 Basic Science teachers in junior secondary schools in Enugu State Nigeria (Enugu State Ministry of Education, Enugu State Annual School Census Report, 2014). The sample size of this study comprised of 33 recommended Basic Science textbook. The researchers used purposive sampling technique to draw eleven (11) recommended Basic Science textbooks each from JSS1, JSS 2 and JSS 3. This is because these Basic Science textbooks are thematic and spirally arranged and therefore whatever affect JSS 1 Basic Science textbook may equally affect JSS 2 and JSS 3 textbooks of same author. However, 33 Basic Science teachers made up of 11 JSS 1, 2 and 3 Basic Science teachers each were purposively selected to serve as research assistants. The criteria for selecting the Basic Science teachers was on the ground that the teachers have been teaching Basic Science for more than five years and as a result have used different Basic Science textbooks in teaching.

The readability of the textbook was determined using Flesch-Kincaid Readability Formula. The formula involved choosing sample of three 100-words, counting the number of sentence as well as syllables in each of the three 100-words. The 99 passages used were selected from near, middle and towards the end of the textbooks and the Flesch Reading Ease Formula: FRE = 206.835 – (1.015 x ASL) - (84.6 x ASW) was applied in the reading age of the pupils, which was calculated for each of the series using the following formula: (0.39 x ASL) + (11.8 x ASW) – 11.59 years. The researchers subjected the instrument to face validation. To do this, the researchers submitted the purpose of the study, research questions, hypothesis and initial draft of the instrument to two

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experts in the department of Science Education from Enugu State University of Science and Technology, and two experts in Measurement and Evaluation from University of Nigeria, Nsukka (UNN) and Nnamdi Azikiwe University (NAU) respectively. These experts after scrutinizing the instrument, made very important and useful suggestions and corrections, which were reflected in the final modification of the instrument. The selected passages used for trial testing were used to find the internal consistency of the instrument using Cronbach alpha technique. An internal consistency reliability estimate of 0.92 indicating that the selected passages had a high degree of reliability and satisfactory for use in this study.

Two paragraphs of about 100 words were selected from beginning, middle and towards the end of the book in each textbook for the calculation of readability index. A standard and simplified version of Flesch-kincaid formula embedded in Microsoft office word 2010 was used to assess the readability. Alternatively, to find out the number of syllables (NY) in the 100 words paragraphs, independent clauses can be counted as complete sentences. Numbers, equations and symbols were counted as they were read aloud (Nworgu & Harbour-Peters cited in Ani, 2016). The followings were obtained from each of the 100 words paragraphs: Number of words (NW), Number of sentences (NS), Number of syllables (NY), the average sentence length (ASL) which was obtained by dividing NW by NS and the word length (WL) which was obtained by counting the number of syllables per 100 words. The processes involved in computing the Flesh's readability scores according to Obodo as cited in Ani, 2016 is by the use of this formulae- RS=WL-ASL. The mean of the readability scores for each Basic science textbooks was determined and interpreted using the Flesh's interpretation readability scores relative to Nigerian schools.

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Presentation of results

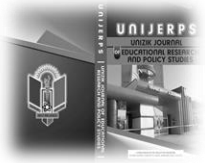
The results are presented based on the research question and hypothesis that guided the study.

Research Question 1: Are the readability scores of each of the Basic Science textbooks used in Nigerian secondary schools adequate?

Table 1: Readability Scores of each of the Basic Science textbooks used in Nigerian secondary schools.

Textbook	JSS 1	JSS 2	JSS 3
NERDC Basic Science for Junior Secondary School by Ivowi, U.M.O. et al	68. 37	68.4	53.93
Basic Science for Nigerian Junior Secondary Schools by Jegede, O.J. et al	92.27	75.2	62. 6
Basic Science for Universal Basic Science by Ugwa, M.C. et al	59.8	55. 57	19.8
New Edition Junior Secondary Basic Science by Ashiakpa, A.	69.43	58.33	42.93
Basic Science for Junior Secondary Schools U B E Edition by Baja, S.T. et al.	73.5	63.2	44.87
STAN Nigerian Basic Science Project New Edition by STAN	66.43	57.9	59.57
UBE Edition Basic Science. An Integrated Science Course for JSS by Ndu, F.O.C. et al	75.33	58.03	42.33
Comprehensive Basic Science for Secondary Schools	56.3	56.17	53. 3

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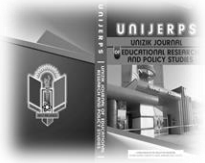
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by Onoh, C.E.C. et al.			
Model Basic Science for Junior Secondary Schools by Okolo, K.N.	65.47	60.43	51.7
Basic Science for Junior Secondary Schools	62.67	73.13	41.33
Simplified Basic Science UBE Edition by Abani, L.C.	61.8	61.2	44.2

The results presented in Table 1 on the readability scores of each of the eleven Basic Science textbooks evaluated showed that the readability scores of all the Basic Science textbooks are adequate for JSS 1 students based on Flesch-Kincaid guideline, except for Basic Science for Universal Basic Science by Ugwa et al and Comprehensive Basic Science for Secondary Schools by Onoh et al whose readability scores are fairly difficult for JSS 1 students. However, for the readability score of JSS 2 Basic Science textbooks, six textbooks obtained adequate readability score appropriate for JSS 2 students based on the Flesch-Kincaid guideline. Those textbooks include NERDC Basic Science for Junior Secondary School, Basic Science for Nigerian Junior Secondary Schools by Jegede et al, Model Basic Science for Junior Secondary Schools by Okolo, Basic Science for Junior Secondary Schools Upper Basic by Agbasimalo, and Simplified Basic Science UBE Edition by Abani. Moreover, it is surprising to note from Table 1 that only Basic Science for Nigerian Junior Secondary Schools by Jegede et al contained adequate readability score for JSS 3 based on the Flesch-Kincaid guideline. The remaining ten Basic Science textbooks obtained readability scores that are fairly difficult as well as difficult for JSS 3 students.

Hypothesis 1: There is no significant difference among the readability scores of JSS 1, 2 and 3 Basic Science textbooks used in Nigerian Secondary School.

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Table 2: Analysis of variance of difference among the readability scores of JSS 1, 2 and 3 Basic Science textbooks used in Nigerian Secondary Schools.

Source	Type III Sum of Squares	Df	Mean Square	F	Significance
Corrected Model	2680.256[a]	2	1340.128	14.619	.000
Intercept	15877.004	1	115877.004	126.075	.000
Class Level	2680.256	2	1340.128	14.619	.000
Error	2750.083	30	91.669		
Total	121307.343	33			
Corrected Total	5430.339	32			

R Squared = .494 (Adjusted R Squared = .460)

Table 2 shows significant difference among the readability scores of JSS 1, 2 and 3 Basic Science textbooks ($F(2, 33) = 14.619$, $P < .05$). Hence, the null hypothesis is rejected. Therefore, there is significant difference among the readability scores of JSS 1, 2 and 3 Basic Science textbooks in use in Nigerian secondary schools.

Discussion of findings

Based on the analysis of data in the study, the following findings emerged: Table 1 dealt with the readability scores of each of the eleven Basic Science textbooks evaluated. It showed that the readability scores of all the Basic Science textbooks are adequate for JSS 1 students based on Flesch-Kincaid guideline except for Basic Science for Universal Basic Science by Ugwa et al and Comprehensive Basic Science for Secondary Schools by Onoh et al whose readability scores are fairly difficult for JSS 1 students. It was noticed that in the readability score of JSS 2 Basic Science textbooks, six textbooks obtained adequate readability score appropriate for JSS 2 students based on the Flesch-Kincaid guideline. Those textbooks include; NERDC Basic Science for Junior Secondary School, Basic Science for Nigerian Junior

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Secondary Schools by Jegede et al, Model Basic Science for Junior Secondary Schools by Okolo, Basic Science for Junior Secondary Schools Upper Basic by Agbasimalo, and Simplified Basic Science UBE Edition by Abani. Moreover, it is surprising to note from Table 1 that only Basic Science for Nigerian Junior Secondary Schools by Jegede et al contained adequate readability score for JSS 3 based on the Flesch-Kincaid guideline. The remaining ten Basic Science textbooks obtained readability scores that are fairly difficult as well as difficult for JSS 3 students. However, the test of result reveals that there is significant difference among the readability aspect criterion of JSS 1, 2 and 3 Basic Science textbooks used in Nigerian secondary schools.

From the result, it is discovered that all the Basic Science textbooks are adequate and can be easily understood by 11-15years students which fall under JSS 1-3 students based on Flesch-Kincaid guideline, except for Basic Science for Universal Basic Science by Ugwa et al and Comprehensive Basic Science for Secondary Schools by Onoh et al whose readability scores are fairly difficult but can be equally understood by 12- 15years JSS 3 students. These findings were consistent with Ani, (2016) findings that although, the prescribed Basic Science textbooks falls within the level of the students, yet most of the students read at frustration level. Furthermore, they agree with the findings of Okolo (2011) finding that respective levels are two years higher than the recommended levels. However, Comprehensive Basic Science for Secondary Schools JSS 1-3 by Onoh et al is the most difficult to read followed by Basic Science for Universal Basic Science by Ugwa et al. However, the other nine Basic Science textbooks are less difficult to read and easily understood. Hence, there is significant difference among the readability score of JSS 1-3 Basic Science textbooks in use in Nigeria secondary schools.

Conclusion

Quality textbooks should be written in a language that is readable to the learners. This study explores the fact that some Basic science textbooks approved by the state government for teaching and learning Basic Science in junior secondary schools are not readable.

However, Basic Science textbook authors should review the language structure and terminologies to enhance the readability of Basic Science textbooks.

Recommendations

Based on the findings of this study the following recommendations have been made.

a) Authors of Basic Science textbooks should put a mechanism in place to review the textbooks periodically as it is done with curriculum.
b) Students and teachers should use recommended Basic Science textbooks to enhance effective teaching and learning of scientific concepts.
c) Basic Science teachers and supervisors should be consulted when selecting the Basic Science textbook material, and they should participate in making any modifications or improvements concerning the textbooks.
d) Government and other stakeholders in education should organize and sponsor on a regular basis appropriate workshops, seminars, and in service trainings geared towards helping serving Basic Science teachers on how best to teach Basic Science meaningfully to their students.
e) Recommendation of Basic Science textbooks should not be based on the reputation of the publishers and the lobbying abilities but should be based on some more objective criteria that relate to the textbook quality with the students as the principal focus.

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