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Assessment of the Readability of Selected Mathematics Texbooks in Secondary Schools on Delta State of Nigeria.

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Abstract

This study focused on the assessment of the readability of selected mathematics textbooks in secondary schools in Ukwuani and Ethiope East local Government Area of Delta State, Nigeria. The study employed survey research design. Three senior secondary mathematics textbooks selected were selected and used for the study. The sample comprised of three hundred (300) SS2 and SS3 students purposively selected from thirty (30) government and private owned secondary schools in Ukwuani and Ethiope East Local Government Area of Delta State. The instrument used is the Students' Questionnaire on the Readability of Mathematics Textbooks (SQRMT). The data obtained were analyzed with descriptive statistics-percentages and mean. Three research questions were raised to guide the study. The result revealed that: the three selected mathematics textbook conform to the approved guidelines for senior secondary school mathematics curriculum in Nigeria, there are several examples and exercises in the three selected mathematics textbook for students to work with, the three textbooks were found to be readable in terms of the ability of the students to read and understand the contents of the textbook. It was recommended that the readability of mathematics textbook should be determined before they are recommended for use in the secondary schools. Teachers should ensure that the textbooks they are to select contain several examples and exercises as well as ensuring that the material fits wellinto the program.

Keywords: mathematics, Readability, Textbooks, Guidelines, Secondary School.

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Introduction

Textbooks are very important tools in the teaching and learning process. According to Aggarwal (2001) as reported by UNESCO (1970) publication in preparing manuscripts that classroom teaching activities depend heavily on the textbook especially in the institutions where the teachers are not well qualified. A good textbook is considered as one major tool in the educational advancement of a nation and consequently national development. Textbooks are relevant to education and can be effective when used as a basis for planning a course according to topics. It is important to know that a textbook helps a teacher to provide an organization of structure for his course work.

In Nigeria, the need to re-examine both what to teach in science and how to teach it led both institutional and professional bodies to identifying themselves with national efforts towards curriculum in sciences. According to Yore (1991), science textbook have a pervasive influence in school science education. One of the goals of science education is to prepare individual for life long science learning. It becomes imperative to examine the extent to which textbooks are designed to facilitate this goal. Science textbooks are the ultimate source of science knowledge in many science classroom to the extent that in many ways, they become the embodiment of science for students.

Mathematics is one of the science subjects upon which technological breakthrough is built and is the pilot on which the wheel of science rotates.life is made more comfortable through the numerous application of mathematics. Nigeria is a developing nation and the importance of mathematics for such a nation cannot be over emphasized. This gives credence to the assertion that the prestige and political power of any nation resides in its level of scientific activities.

Readability is an attribute of a text referring to whether or not it is interestingly and attractively written and easy to understand. Readability is the sum total of all those elements within a given piece of printed material that affect or influence effective understanding which an individual or group of readers have. The factors that define the success of any assessment of the readability of any text are: the attraction and sustenance of the interest and motivations of the reader, the legibility of the print, and the complexity of the words and sentences in relation to the reading ability of the reader (Adeyemi, 2006).

The readability of mathematical text is difficult to ascertain because of the complex nature of mathematic text. According to Hammill (2010), mathematics textbooks are always multimodal, containing text, symbolic notation and graphics. Mary (2010) noted that students need to be able to work simultaneously with all aspects of this multi-semiotic system-national language, the language of mathematics symbolism, and the visual semiotic constructed in the graphs, chart, and diagrams that are integral to mathematical reasoning. Weist (2003), asserted that readability includes all the factors related to reading and comprehending written text. Thus, the readability of a mathematical text then involves the characteristics of a mathematics text that facilitate or inhibit the ability of a reader to comprehend the text.

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Difficult as it may be, estimating the readability of mathematical texts is critically important. If students are to contain any measure of independence as mathematical learners, they must have access to mathematical text pitched at the level of their mathematical reading and reasoning ability. This is why this study seeks to investigate the readability of some selected mathematics textbooks used at the senior secondary school level in Delta State and provide guidelines for studying any mathematics text.

Statement of Problem

The Nigerian educational system is faced by a number of challenges ranging from teacher factors to student factors. These factors may lead to continual dependence on mathematics textbooks. One cannot conclusively say that the readability of mathematics textbooks is determined before they are recommended for use in secondary schools. Hence, this study seeks to assess the readability of some selected textbooks use in Delta State in terms of the context, legibility, illustration, examples and exercises and then provide guide lines for studying any mathematical text.

Research Questions

The following research questions were raised so as to guide the study.

RQ1: Does the structure of the three selected mathematics textbook conform to the approved guidelines for senior secondary school mathematics curriculum in Nigeria?

RQ2: Are there much examples and exercises in the three selected mathematics textbooks for students to work with?

RQ3: Is the readability of the three selected mathematics textbooks within the comprehension level of senior secondary school mathematics student in Delta State of Nigeria?

Research Method

The study employed the survey research design. Three mathematics textbook were selected for this study. The population consist of all mathematics SS 3 students in both the government and private owned secondary school in Ethiope East and Ukwuani local government area of Delta State. A purposive selection was made by the researcher so as to be able to select all mathematics students have been making use of the same textbook series in the selected schools. Thirty schools were selected (15 from each local government area). A total of 300 mathematics students from the thirty (30) schools formed the respondents.

The research instrument developed for the study is the Students'Questionnaire on Readability of Mathematics Textbooks (SQRMT). The instrument was designed to obtain information on the content in terms of language of presentation, illustrations, font or textsize, examples and exercises, complexity of words and sentences. The SQRMT is a 15 (fifteen) item questionnaire rated on a four point scale of unsatisfactory, poor, good and superior.

The research instrument was validated by two educators in the department of curriculum and integrated science, Delta State University, Abraka. The items were modified according to the suggestions made by the two educators. The test-retest approach was used and a reliability index of 0.72 was obtained after conducting a pilot study on 40 students which constitute 13.33% of the sample used.

The data obtained were analyzed with descriptive statistics-simple percentage and mean.

Table 1: Selected mathematics textbooks, authors and year of publication.

S/N	Title	Code	Author (s)	Year of publication
1.	New concept mathematics Book 1, Book 2, Book 3	MT1 MT1A MT2A MT3A	H.NOdogwu et.al	2015 revised Edition
2.	Hidden facts in SSCE mathematics	MT2	M.A Otumudia	2005
3.	New General mathematics for senior secondary schools Book1 Book2 Book3	MT3 MT3A MT3B MT3B	M.F Macrae Et al	2015

Presentation of Results

Research Question 1 (RQ1): Does the structure of the three mathematics textbook conform to the approved guidelines for senior secondary school mathematics curriculum(sssmc) in Nigeria?

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Table 2: comparison of approved guidelines for SSSMC and the contents of the selected mathematics textbooks.

Content Textbooks	**MT1**		**MT2**		**MT3**	
	chapters	**pages**	**chapters**	**pages**	**Chapters**	**Pages**
SSS1						
Algebraic processes	3,7	21	3,4,18	11	4,6,7,10,18	24
Set	5,6	19	9	9	5,8	8
Logical Reasoning	9,10	18	-	-	9	5
mensuration	3,17,18	30	20,21	22	12,15	12
geometry	11,12,13,14	54	22	21	2,16	13
Numerical processes	1,4	44	5	11	1,3,13,19,20	25
trigonometry	15,16	32	13,14,15	32	11,17	14
Statistics	19,20	17	8	11	14	7
Total	19	235	12	117	21	108
Men number of pages		29.4		14.6		13.5
Content of Textbooks	**MT2 Chapter (s)**	**No of pages**	**MT2 Chapter (s)**	**No of pages**	**MT3 Chapter (s)**	**No of Pages**
SS 2						
Algebraic processes	4,5,6,8,9	59	3,7,10,16,17	24	4	18
Numerical processes	1,2,3	26	1,4,18	16	15,11,6	23
trigonometry	12	16	5,9	10	18	23
Geometry	10,11,13	15	2,6,12,15	27	14,19	14
Logical reasoning	7	12	20	4	-	-
probability	18	12	19	7	10	8
Statistics	14,15,16,17	40	8,11,14	14	17	15
Total	18	216	19	102	9	101
Mean number of pages		30.9		14.6		14.4
SS 3						
Numerical processes	1,2,3	39	6,7	11	1,4	15
Algebraic processes	15,5,10,11,12,13	81	4	18	1,7,10,16	37

trigonometry	6	16	15	11	5,9	12
Statistics	19	16	18	24	8,14,19	37
probability	19	5	10	8	11	12
Mensuration	7,8,16	27	21	13	13	5
Geometry	8,9,17	45	15	16	12	18
Total	6	80	8	101	14	136
Mean number of pages		11.4		14.4		

Table 2 reveals that the curriculum topics in senior secondary school mathematics are categorized in different content areas based on the level. The table above shows that the topics in first, second and third year are treated by the three texts. The topics in New Concept Mathematics (MT1) contains more number of pages closely followed by new general mathematics (MT3) and Hidden Facts in Mathematics (MT2). This shows that the structure of the three selected mathematics textbook conform with the approved guidelines for senior secondary school mathematics curriculum of the senior secondary schools in Nigeria.

Research Question 2 (RQ2): Are there much examples and exercises in the three selected textbooks for students to work with?

Table 3: comparison of the number of examples and exercises in the three selected mathematics textbook.

Content of Textbooks	**MT1**		**MT2**		**MT3**	
	Example	**exercises**	**example**	**exercise**	**example**	**Exercises**
SS 1						
Algebraic processes	21	171	52	47	75	170
Set	35	60	26	17	16	83
Mensuration	30	89	43	25	21	113
geometry	34	125	24	16	9	107
Numerical processes	52	150	59	34	81	16
trigonometry	30	59	10	21	22	124
statistics	14	43	40	32	7	40
Logical reasoning	18	59	-	-	8	14
Total	234	756	254	192	239	667
SS 2						
Statistics	44	127	23	18	54	106
Algebraic processes		200	14	39	44	74

Numerical processes	50	301	14	38		
Trigonometry	16	38	16	21	16	57
Geometry	40	142	13	17	12	56
Probability	13	60	13	13	11	32
Logical reasoning	10	13	-	-		
Total	142	763	93	146	137	325
SS 3						
Geometry	31	107				
Numerical processes	50	263	14	40	28	28
Algebraic processes	112	231	28	41	54	106
Trigonometry	13	31	23	40	16	57
Statistics	18	18	20	27	32	61
Probability	7	8	15	43	11	12
Mensuration	28	89	25	15	24	35
Total	259	747	125	206	165	299
	632	2226	472	544	541	1291

From table 3, new concept mathematics (MT1) has more examples (632) closely followed by New General Mathematics (MT3) which has 472 examples in year 1, 2 and 3. Hidden facts (MT2) has the lowest number of examples (541). Also considering the number of problems (exercises) for students to solve, new concept mathematics (MT1) has more exercise (2226) closely followed by New general mathematics (MT3) with 1291 exercises and then Hidden facts in mathematics (MT2) with 544 exercises. This result shows that there are much examples and exercises in the three selected textbooks for students to work with.

Research Question 3 (RQ3): is the readability of the three selected mathematics textbooks within the comprehension level of senior secondary school year 3 mathematics students in Delta State of Nigeria.

Table 4: Readability of the three selected textbooks in terms of reading and comprehension.

S/N	Items	textbooks	Superior	Good	poor	Unsatisfied
1.	The explanation of the terms and method of solution are very clear	MT1 MT2 MT3	35 20 22	45 71 63	19 09 13	0 0 02
2.	The formulars and diagrams are well illustrated	MT1 MT2	47 33	30 62	23 05	0 0

		MT3	28	53	14	0
3.	The size of the type used in the textbooks makes for easy understanding	MT1 MT2 MT3	32 11 15	48 69 81	20 012 04	0 8 0
4.	The examples given in the textbook are arranged from simple to complex	MT1 MT2 MT3	14 19 11	6 81 78	20 0 11	0 0 0
5.	The exercises given at the end of each chapter of the textbooks are arranged from simple to complex	MT1 MT2 MT3	55 43 12	82 55 85	13 02 03	0 0 0

Table 4 reveals the analysis in terms of percentages of the responses of the teachers of the readability of the textbooks. Considering the summary of the average percentages of the student responses reveals that very few students (between 1.67% 11.27%) agreed that three textbooks gives them unsatisfactory and poor ability to read and understand, majority (59.32%) agreed that their ability to read and understand the textbooks are good while a few students (26.47%) agreed that their ability to read and understand the textbook is superior. If the response of the good and superior student are merged together, we have that 78.8% agreed that MT2 is good, 91.6% agreed that MT1 is good while 89.6% agreed that MT3 is good. This indicates that MT1 textbooks is most accepted textbook among the three selected mathematics textbook. Thus the New Concept Mathematics textbook is considered the most readable by the students closely followed by the New General mathematics textbook and then Hidden Facts in mathematics.

Discussion

The study revealed that the three selected mathematics textbooks conform with the approved guidelines for senior secondary schools mathematics curriculum in Nigeria in terms of the contents of the textbooks. The study also indicated that there are much example and exercises in the three are much examples and exercises in the three mathematics textbooks selected. Finally, the study also showed that the three textbooks selected were found to be readable in terms of the ability of the students to read and understand the contents of the textbooks, the text font or type, the exercises, examples and illustrations. This finding is in line with Fawole (1992) who found that the textbooks used in secondary school mathematics in Oyo state of Nigeria are appropriate in terms of the level of the students. It is important to note that the study pointed out that some textbooks are more readable than the other.New Concept Mathematics (MT1) is found to be the most acceptable. This is closely followed by New General mathematics (MT3) and Hidden Facts (MT2) follow in that order.

Summary of Findings

Based on the analysis of the result obtained, the following are the major findings.

- The three selected mathematics textbooks selected conform to the approved guidelines for semi secondary school mathematics curriculum in Nigeria.
- There are much examples and exercises in the three mathematics textbooks selected for students to work with.
- The three textbooks selected were found to be readable in terms of the ability of the students to read and understand the contents of the textbooks.

Conclusion

Based on the research findings the following concluding were made:

- Out of the three selected textbooks, Hidden facts does not contain a particular curriculum content (logical reasoning)
- The three selected mathematics textbooks that are being used in the senior secondary schools in Delta State of Nigeria conform to the approved guidelines for senior secondary schools mathematics curriculum in Nigeria in terms of content.
- The three selected mathematics textbooks selected contain much examples and exercises for students.
- The three selected mathematics textbooks are adjudged to be readable in terms of student's ability to and understand the contents of the textbooks.

Guidelines on How to Study Mathematics Textbook

As a first step to learning mathematics, it is important to realize that mathematics is easier to study in small doses. It is important for learners to understand that mathematics is cumulative in nature with concepts building those previously learned. Mathematics is a do it yourself and task oriented subject. The following guidelines should be helpful to students studying mathematics at the secondary school level.

1) Previewing is very important skin over the reading materials (textbook) so as to get an over view of the section heading and sub-heading, diagrams examples of problems solved and exercises given at end of the mathematics text.
2) Read carefully making sure that you understand each part as you go. Since that mathematics is concept building (cumulative in nature) reading past a concept that is not understood may prove to be a wasted time and effort.
3) As you read, take note of new definition and symbols. It is good to translate abstract formula into your verbal explanation.
4) Pay close attention to derivations and problem. Analyze simple problem in the text, explaining each text in your own word.
5) Close the text and rework example in your own term.

6) Note how the materials relate to previous materials and stop periodically to reside the definition formula yourself.

It is pertinent for student to note that most of the mathematics study time should be spent on problem solving. When solving problem the following should be done.

a) Read through the question to understand it fully.
b) State the unknown in your term and write down every pieces of information that is given.
c) Devise a tentative plan to solve the problem by using the following tactics.
i) Form relationship among all fact given.
ii) Consider formulas or destination that may be relevant.
iii) Relate the problem to a similar textbook examples.
iv) Solve a simpler vision of the problem using smaller number.
v) Check each step of the solution for corrosiveness.
vi) If you find it difficult to understand then ask your teacher for better explanation.

After solving a problem, it is important to analyze the solution. Focus on the process used and check for concept formula and rule applied (method used) then compare the solution with those in the mathematics textbook. Explain each step using your own words as this will sharpen your understanding of the problem and aid further or future study.

Recommendation

Based on the research finding the following recommendation were made:

- The readability of mathematics textbook should be determine before they are recommended for use in secondary school.
- In selecting a textbook, a teacher has to ensure that the textbook contains several examples and exercises as well as ensuring that the material fits well into the program.

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