

# Reading Ease of Basic Science Text Materials and Students' Learning Outcome in Junior Secondary Schools

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**ABSTRACT**— *The study examined the reading ease of basic science text materials and students' learning outcome among Year One Junior Secondary Schools in Ekiti State, Nigeria. The study adopted quasi-experimental research design of pre-test, post-test control group on all Year One Basic science students in Ekiti state, Nigeria. 1760 students were purposively selected from 22 Junior Secondary Schools in the three senatorial districts of Ekiti State, Nigeria. The common Basic science text materials used in the schools selected were also sampled. The research instrument used for the study was the Basic Science Vocabulary Test while Flesch Reading Ease Formula was used to determine the reading ease of the text materials. Four hypotheses were tested at 0.05 alpha levels. The data collected were analyzed using t-test statistics, Analysis of Covariance (ANCOVA) and One-Way Analysis of Variance (ANOVA). The study revealed that STAN and Longman text materials were fairly difficult for the intended users. The result also revealed that the group that received an explicit Basic science vocabulary instruction achieved significantly better in the tests than those who received instruction through conventional method. The study further showed that vocabulary knowledge significantly influenced students' level of comprehension of Basic science at the Junior Secondary Schools. Based on the findings of the study, it was recommended that teachers should make effort to teach identified difficult words in the text and be more aware of the vocabulary load and sentence length of the text materials before assigning such to any particular class.*

**Keywords**— Basic Science, Text Materials, Learning Outcome, Flesch Reading Ease Formula, Vocabulary and Comprehension

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## 1. INTRODUCTION

Reading science textbooks is, no doubt, the most important source for students to acquire scientific knowledge which is written in specialized language. It is the only source that provides students with important situation in which learning takes place. Science, according to Cummins (1984), relies heavily on cognitively demanding vocabulary which has been identified as being particularly difficult for students to comprehend. Research has shown that science texts, in general constitute a distinctive field characterized by a complicated, rigid organization, a large number of nominal phrases, sentences dense with information, and complicated syntactic structures (Parkinson, 2000; Gee, 2001 and Fang, 2006). This cognitively demanding organizations coupled with inappropriate instructional strategies of science teaching in schools has made science more difficult to understand by a number of students.

A number of studies has shown that the language used in written science textbooks is often too difficult for students (Baker, 2004; Ayodele, 2009; Yong, 2010 and Ayodele, 2012); exceeds the normal experience of many elementary school students (Merzyn, 1987 and Yong, 2010) most especially for students who learn science in a second language (Doidge, 1997). As second language readers, an extra effort is constantly required by students to decode the main idea of text materials.

Literature suggests that readability of text materials is perhaps one factor, which among others determines what students understand of materials read (Gilliland, 1976; Vacca, Vacca, Cove, Burke, Lenhart and McKeown, 2003; and Johnson and Johnson, 2009). Pikulski (2002) defines readability as the level of ease or difficulty with which a text material can be understood by a particular reader who is reading the text for a specific purpose. The purpose of readability is to produce the best match between intended readers and texts. To help learners select the most appropriate reading materials, readability formulas have proven to be useful in predicting the ease or difficulty of reading material.

In order to combat the challenges posed by text material, students need an estimate of vocabulary knowledge to comprehend the materials designed for them. In a series of studies, vocabulary knowledge has been found to promote reading fluency, boost reading comprehension, improve academic achievement, and enhance thinking and communication (Bromley, 2004; Richek, 2005). Wood (2001) and Lee, Penfield and Marteen-Rivera (2009) have also shown that vocabulary knowledge, as well as the ability to decode words significantly influence reading comprehension of students.

Scanlon (2006) carried out studies on the impact of explicit comprehension and vocabulary instruction on students' achievement using Formative assessment, students' interviews and written work to measure how deeply students understood the concept and if they would be applied to other situation using rubrics, vocabulary charts and response journals on the thirty fifth grade level. Results showed that direct teaching of academic vocabulary provides an academic background knowledge for students to learn more effectively and efficiently and that multiple interventions and strategies with informational texts, written responses and a repetitive exposure to vocabulary words have a positive effect on students' level of comprehension.

It is the opinion of this study that, students need to overcome the challenges faced in the course of reading basic science text materials which are primarily attributed to the scientific terminology entrenched in the language of science through explicit teaching strategies of new concepts encountered in the course of reading the designed text materials for a particular grade level.

## 2. PROBLEM

Despite the researches conducted in recent times, not many have actually dealt with the ease of reading basic science text materials used in schools. Data from Ekiti State Ministry of Education and Technology, Ado-Ekiti, Nigeria and from schools revealed that many candidates have been failing the subject over the years. These poor results could be attributed to difficulties encountered by students in the course of reading. This has necessitated the need to ascertain the reading ease of basic science text materials used in most Schools in Ekiti State. In an attempt to seek solution to this problem of reading by the students, one general question was raised to guide the study:

1. What is the reading ease of the basic science text materials used in Ekiti State?

## 3. RESEARCH HYPOTHESES

- Ho<sub>1</sub>: There is no significant effect of the type of books used by the students on their achievement in basic science.  
Ho<sub>2</sub>: There is no significant difference between the post-test scores of experimental and control groups in basic science as measured by vocabulary test.  
Ho<sub>3</sub>: There is no significant difference between achievement scores in Basic Science text materials as measured by vocabulary test.  
Ho<sub>4</sub>: Vocabulary knowledge of students will not significantly influence their reading comprehension in Basic Science text materials.

## 4. METHODS

The research design for this study is a quasi- experimental research design of pre-test, post-test control design. The population of the study consisted of all the Junior Secondary School One in Ekiti State, Nigeria. A sample of 1760 students was chosen from 22 Schools using stratified random sampling technique. The two instruments used for the study include Flesch Reading Ease Formula developed by Rudolph Flesch (1948) and Vocabulary Assessment Format according to Coombe, Folse and Hubley (2007). The common basic science recommended text materials based on the text materials used in the schools sampled were also used. The text materials are:

The data used for the study were collected directly from these textbooks. To find out whether students would read the written passage of the selected text materials with ease, Flesch Reading Ease Formula was used to determine the vocabulary loads of the selected passage by counting the number of syllables per word, and the sentence length by counting the number of words per sentence. The formula involved selecting a sample of three 100-words each from each book, counting the number of sentences as well as syllables in each of the three 100-words. The passages used were selected from near the beginning, middle and towards the end of the textbooks and the Flesch Reading Ease Formula:  $FRE = 206.835 - (1.015 \times ASL) - (84.6 \times ASW)$  was applied. Where, ASL is the average sentence length Table(the number of word divided by the number of sentence), and ASW is the average number of syllables per word (the number of syllables divided by the number of words). Flesch Reading Ease Formula rating is based on 100-point scale, from 0-

100, with 0 corresponding to the very difficult reading and 100 corresponding to the very easy reading. Table 2 provides interpretation of Flesch Reading Ease Scores.

**Table 1:** Title and the Authors of the Materials used.

Title of the books	Author (s)	Publishers
Nigerian Basic Science Project, (NBSPP), UBE Edition, Book 1.	Science Teachers Association of Nigeria (STAN)	Heinemann Educational Books Nigeria Limited
Evans Basic Science: A New Approach. UBE Edition, Book 1	Adewale, J.C, Adenuga, I. J; Igwe, I. O; Iroegbu, T. O and Nwachukwu, C. U.	Evans Brothers Nigeria Limited.
Basic Science: An Integrated Science Course for Junior Secondary Schools. UBE Edition, Book 1	Ndu, F.O. C, and E. O. Somoye	Longman Nigeria Limited.

**Table 2:** Flesch Reading Ease Interpretation

Reading Ease Score	Description
0 – 29	Very difficult
30 – 49	Difficult
50 - 59	Fairly difficult
60 - 69	Standard
70 - 79	Fairly easy
80 - 89	Easy
90- 100	Very easy

In order to test the vocabulary knowledge of the students, Multiple Choice Question Format in line with Coombe, Folse and Hubley (2007) format was used. The format is widely used to assess learning at the recall and comprehension levels of the students. The format is adopted because it is a reliable test as there is only one correct answer and it is easy to mark. The test consisted of 25 sentence completion items extracted from the books which require students to read the sentence and then write in the correct response. The test items were validated by tests experts, while the reliability of the test was ensured by using Cronbach Alpha and a coefficient of .81 was obtained. Pre-test was given to the experimental and control groups, then the experimental group was taught based on the topics selected; the unfamiliar terms identified in the passage were deeply explained. The control group was also taught using conventional technique, but the unfamiliar terms were not explained.

The above tests were administered on the students during the school lesson hours in the middle of the third term with the assistance of the subject teachers in the selected schools. The test was timed for 45 minutes. The post-test was administered after the third week of the experiment. In all, the study took four weeks and the data collected from the study were collated and analyzed using inferential statistics such as, student's t-test statistics, Analysis of Covariance (ANCOVA) and Analysis of Variance (ANOVA) and all the hypotheses raised were tested at 0.05 Alpha level.

## 5. RESULTS

### Descriptive Analysis

#### Question 1: **What is the reading ease of the basic science text materials used in Ekiti State?**

In answering this question, Flesch's interpretation of readability data was used to interpret the reading ease scores computed for the respective text materials (see table 2).

**Table 3:** Readability data of the Basic Science Text Materials showing the Readability Scores, Average Sentence Length and the Average Syllable per Word using Flesch Reading Ease Formula.

Text Materials	Reading Scores	Ease	ASL	ASW	Remarks
STAN	57.63		13.81	135.36	Fairly difficult for JSS Year One Students.
LONGMAN	59.20		19.03	128.60	Fairly difficult for JSS Year One Students.
EVANS	65.42		11.71	146.60	Standard for JSS Year One Students.

Table 3, above, revealed the readability scores for the three basic science text materials used in Ekiti State as: STAN (57.63), Longman (59.20) and Evan (65.42), while Average Sentence Length (ASL) per text material were given as STAN (13.81), Longman (19.03) and Evan (11.71), Average Syllables per Word (ASW) as indicated in the table are STAN (135.36), Longman (128.60) and Evan (146.60). The Nigerian Basic Science Projects Book One, published by Science Teachers Association of Nigeria was found to be fairly difficult for JSS Year One Students. Longman Basic Science for Junior Secondary School Book One published by Ndu, F. O. C, *et al*; was fairly difficult for JSS Year One Students while Evans Basic Science: A New Approach Book One published by Adewale, *et al* was standard for the JSS Year One Students in Ekiti State. Generally speaking, the difficulty level of the books could be attributed to the long word-length per sentence in the textbooks coupled with polysyllabic words. All these could responsible for the complexity experience by the students in the course of reading the textbooks.

### Hypothesis 1

Ho<sub>1</sub>: There is no significant effect of the type of books used by the students on their achievement in basic science.

This hypothesis was formulated and tested by subjecting the data generated to Analysis of Covariance (ANCOVA) and the result is presented in table 4 below.

**Table 4:** Summary of Analysis of Covariance (ANCOVA) showing the significant effect of type of books used in schools on students' learning outcome in Basic Science.

Source	Variable	SS	Df	MS	F <sub>c</sub>	F <sub>t</sub>	Sig.
<b>Corrected Model</b>	Pretest	5678.606	2	2839.303	4.403	3.96	.014
	Posttest	2617.946	2	1308.973	4.507	3.96	.011
<b>Intercept</b>	Pretest	417001.861	1	417001.861	632.188	3.96	.000
	Posttest	528479.282	1	528479.282	1.820E3	3.96	.000
<b>Type</b>	Pretest	5678.606	2	2839.303	4.304	3.96	.014
	Posttest	2617.946	2	1308.973	4.507	3.96	.011
<b>Error</b>	Pretest	578483.546	877	659.616			
	Posttest	254717.576	877	290.442			
<b>Corrected Total</b>	Pretest	584161.152	879				
	Posttest	257335.522	879				
<b>Total</b>	Pretest	1102506.250	880				
	Posttest	968443.750	880				

Result is significant at  $P < 0.05$  level of significance.

Table 4 above revealed that the F - calculated was 4.304 and 4.507 for both pre-test and post-test respectively and F - table was 3.96. This implies that the varieties of basic science text materials used in Ekiti State Junior Secondary Schools have a significant effect on the reading achievement of students. Hence, the null hypothesis 1 was rejected.

### Hypothesis 2

Ho<sub>2</sub>: There is no significant difference between the post-test scores of experimental and control groups in Basic science as measured by vocabulary test.

**Table 5:** t-test comparison of the post-test scores of experimental and control groups in Basic Science as measured by vocabulary test.

Variable	N	Mean	SD	t <sub>c</sub>	t <sub>t</sub>	df	Result
Experimental group	880	21.07	38.19	16.37	1.96	878	Significant
Control group	880	4.21	7.64				

Result is significant at  $p < 0.05$ .

From table 5, the result showed that at  $p < 0.05$ , t-calculated was 16.37, df was 878, and t-table was 1.96. The result showed that there was a significant difference between the post-test scores of experimental and control groups in basic science as measured by vocabulary test. The result further showed that students taught using explicit vocabulary achieved significantly better in basic science than those taught using conventional technique. Hence, hypothesis 2 was rejected.

### Hypothesis 3

H<sub>03</sub>: There is no significant difference between achievement scores of students in basic science text materials as measured by vocabulary test.

The hypothesis was formulated and tested by subjecting the data generated to One-Way Analysis of Variance (ANOVA) and the result is presented in table 6 below.

**Table 6:** Summary of One-Way Analysis of Variance (ANOVA) on the students' achievement in basic science as measured by vocabulary test.

Variable	SS	MS	df	F <sub>c</sub>	F <sub>t</sub>	Result
Btw group	505095.79	126273.948	2	1048.160	2.99	Significant
Within group	105715.39	120.818	877			
Total	610811.18		879			

Result is significant at 0.05 level of significance.

From table 6, F-calculated was 1048.160; F-table was 2.99 at 0.05 level of significance, the result is significant. The analysis of the table showed that there was a significant difference between the reading achievement scores of students in basic science text materials as measured by vocabulary test. Therefore, the null hypothesis 3 was rejected.

**Hypothesis 4:** Vocabulary knowledge of students will not significantly influence their reading comprehension in basic science text materials.

**Table 7:** Analysis of Variance between vocabulary knowledge and reading comprehension level of students in Basic Science.

Variable	SS	MS	df	F <sub>c</sub>	F <sub>t</sub>	Result
Btw group	423560.00	211780.00	2	754.61	2.99	Significant
Within group	246129.12	280.649	877			
Total	669689.12		879			

Table 7 shows that  $[F(2, 879) = 754.61; p < 0.05]$ . This implies that reading comprehension of students is significantly influenced by the amount of vocabulary knowledge acquired in basic science. That is, the level of vocabulary knowledge has a direct and positive influence on achievement of students. Thus, the null hypothesis 4 which states that vocabulary knowledge of students will not significantly influence their reading comprehension in basic science text materials is rejected, which indicates that vocabulary knowledge have a positive and direct influence on achievement of students in basic science.

## 6. DISCUSSION

From the findings, it was revealed that, Nigerian Basic Science Project. Pupil's Textbook and Longman Basic Science for Junior Secondary School are fairly difficult and far above the reading comprehension level of the intended readers while Evans Basic Science for Junior Secondary School Students, Book 1, is appropriate and match the reading level of the intended readers. The study also showed that varieties of basic science text materials used in Ekiti State Junior Secondary Schools have a significant effect on the reading achievement of students. The findings also showed that, significant difference existed between the post-test scores of experimental and control groups in basic science students as measured vocabulary test. The result is not a surprise because of the intervention of teachers in teaching the identified difficult words in the passage of the text materials to the experimental group. This finding is in accord with the findings of Scanlon (2006) who showed that multiple interventions and strategies with informational texts, written responses and a repetitive exposure to vocabulary words have a positive effect on students' level of comprehension. The finding also indicated that, vocabulary knowledge have a positive and direct influence on achievement of students in basic science. The finding is also in agreement with the findings of Bromley (2004) and Richek (2005) whose studies revealed that vocabulary knowledge promote reading fluency, boost reading comprehension, improve academic achievement, and enhance thinking and communication.

## 7. CONCLUSION AND RECOMMENDATIONS

The findings of the study indicate that pre-teaching the vocabulary of basic science text materials by the teachers improves students' level of comprehension and enhances their learning outcome. It is recommended that teachers should make an effort to teach identified difficult words in the text to the students at all times and be more aware of the vocabulary load and sentence length of the text materials before assigning such to any particular class.

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