

THE IMPACT OF TEXT READABILITY INDICES IN THE LEARNING OF PHYSICS IN SECONDARY SCHOOLS

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ABSTRACT: *This paper investigated the impact of text readability indices on the learning of Physics in secondary schools. This was a descriptive survey research which was questionnaire based. The population of the study was all public Secondary Schools (Physics Students) in Ado Local Government Area of Ekiti State, Nigeria. A stratified random sampling technique was used to select twenty (20) Physics students each from the five (5) selected secondary schools from Ado Local Government Area of Ekiti State. A total of one hundred (100) Physics students were used as samples for the study comprises of sixty-four (64) male and thirty-six (36) female. Three research questions were generated and were tested at 0.05 level of significance. Among others, the study revealed that; each of the text readability indices plays vital role in Physics reading ability of Physics Students in Secondary Schools. Conclusion and recommendations were also made in this paper.*

Keywords: *Text readability, Physics subject, learning and academic performance.*

INTRODUCTION

The development of country is determined by the type of educational system that operates in that country. In the world today, science and technology have become a dominant culture factors. The contributions that science knowledge and skills have made to economic and industrial progress of our modern society are too obvious to require any documentation Ogungbemi (2005) quoted in Odeleye, et al (2010). At this point however, one only needs to mention the significance and immense contributions of science subjects to medicine and synthesis of a vast number of professions like Architecture, Engineering, Surveyor, Computer, Town and Regional Planning etc.

Science in general is the theory upon which the technology is built, without Science, there cannot be intuition for technology Ogungbemi, (2005) coated in Odeleye et al (2010). Nigeria as a nation needs tremendous improvement in the area of science and

technology. Physics as the life-wire of other science subjects is a physical science subject that serves as the bedrock upon which the science and technology advancement of any nation is built. According to Okpala, Amadi & Iwuoha (1995), Physics is a physical science subject that is concerned mainly with matter as it relates to energy. Similarly, Matthews et al (1973) contends that physics is the study of the interrelationships of matter and energy. Physics has many applications in other fields, for example, in chemistry, biology, medicine, engineering and other related discipline. But unfortunately, as reported by the Planning Research and Statistic Department, Ministry of Education and Technology (Summary of WAEC result 2005 – 200, table 1 below), enrolment and performance of candidates in Physics examination was not impressive and experience of the researchers have also shown that very many students show lack of interest in Physics subject. And among other factors responsible for this ugly trend is text readability problem. With this gloomy situation, it

Table 1: Performance of candidates in senior Secondary Certificate Examination in Physics in Ekiti State, Nigeria (2005-2009)

| <i>Year</i> | <i>No. Registered</i> | <i>A1-C6</i> | <i>D7-E8</i> | <i>Failure</i> |
|-------------|-----------------------|--------------|--------------|----------------|
| 2005 | 3738 | 2156(57.7%) | 1104(29.5%) | 478(12.8%) |
| 2006 | 4157 | 2661(64.0%) | 1004(42.2%) | 492(11.8%) |
| 2007 | 4435 | 2524(56.9%) | 1243(28.0%) | 668(15.1%) |
| 2008 | 3385 | 1274(37.6%) | 797(23.5%) | 1314(38.9%) |
| 2009 | 4662 | 2496(53.5%) | 1336(28.7%) | 830(17.8%) |

Source: Planning Research and Statistics Department, Ministry of Education and Technology, Ado-Ekiti, Ekiti State.

'Reading' is a complex cognitive process of decoding symbols for the intention of deriving meaning (reading comprehension) and/or constructing meaning. It is the mastery of basic cognitive processes to the point where they are automatic so that attention is freed for the analysis of meaning (Online: the free encyclopaedia, 2011).

Life is occasionally defined as a continuous, competitive examination process. So we have compete and face examination in whatever endeavour or task we undertake be it farming, trading, wine taping, teaching, learning of playing. At times we can be our own personal assessor, at other times, somebody else or a group may judge our performance. In a school situation, judgment is done by the teachers/external examiners following prescribed procedures and specifications (Odeleye et al, 2010). The principal motive of every testee is to pass examination, but regrettably reverse is the case in some situations as a result of some factors which may include text readability problem either from the preparation (i.e. reading from the notes/textbook) or instruction to the examination.

Examinations are given periodically during instruction to monitor pupils learning progress and to provide ongoing feedback to pupils and teachers while summative test is given at the end of the course or unit of instruction and the results are used primarily for assigning grade on for certifying pupils' mastery of the instructional objectives (Oluwatimilehin, 2003). In any of these examinations, Students' academic performance is seriously affected by poor text readability.

The term 'readability' refers to all the factors that affect success in reading and understanding a text. These factors includes: the interest and motivation of the reader, the legibility of the print (and of any illustrations) and the complexity of the words and sentences in relation to the reading ability of the teacher. Readability has been defined in various ways, e.g. by Harris, Theodore L. and Richard E. Hodges, eds. (1995), Jeanne Chall & Edgar Dale (1949), G. Harry McLaughlin (1969), William DuBay (2006) and Fry, Edward (2006) as easy reading helps learning and enjoyment. So what we write should be easy to understand. According to Tinker, Miles (1963), readability is the ease in which text can be read and understood. Various factors to measure readability have been used, such as "speed of perception", "perceptibility at distance", "perceptibility in peripheral vision", "visibility", "the reflex blink technique", "rate of work"(e.g. speed of reading), "eye movements" and "fatigue in reading". When writing a textbook, a worksheet or an examination paper, an author is intent on transmitting information to the reader. How well the author succeeds will depend on the readability of the text. If one is not a medical expert, one may find it difficult to read and understand the recommendation/prescription of the medical doctor. Most of the texts written by Professor Wole Soyinka on prose cannot just be read and understood by just anybody who does not have flair for prose! Readability is concerned with the problem of matching between reader and text. An accomplished reader is likely to be bored by simple repetitive texts and while a poor reader may quickly become discouraged by texts which he finds too difficult to read fluently. This is likely

to happen when the text is poorly printed, contains complex sentence structures, long words or too much material containing entirely new ideas.

Purpose of study

The study intended to investigate the impact of text readability indices on the reading and learning of Physics in Secondary Schools in Ado Local Government Area of Ekiti State, Nigeria.

Research Questions

1. Does the *interest and motivation* of the Physics students have impact on their reading ability of Physics texts?
2. Does the *legibility of print* of Physics texts have impact on Physics students' reading ability?
3. Does the *sentence structure* in Physics texts affect students reading ability?

METHODOLOGY

Research Design

The design was descriptive survey. It was designed to highlight the impact of text readability on the learning of Physics in Secondary Schools in Ado LGA of Ekiti State.

Population

The target population for this study comprises of all Senior Secondary class II (SS 2) Physics students in all the Secondary Schools in Ado Local Government Area of Ekiti State.

Sample and Sampling Technique

A stratified random sampling technique was used to select twenty (20) students each from each of five (5) selected Secondary Schools from

Ado LGA of the study area. A total of one hundred (100) students were used as samples for the study comprises of sixty four (64) male and thirty six (36) female.

Research Instruments

Two types of instruments were used for this study. They were:

- a. Two (2) commonly used Physics textbooks in Ado LGA Secondary Schools (i.e. Senior Secondary Physics by P.O. Okeke and others and Essential Physics by J.N. Kolawole.
- b. Questionnaire on students Physics text-reading ability based on the three major text readability parameters namely: interest and motivation of the reader, i.e. the interest that students have in reading Physics textbook and the motivation he received towards the reading either through the teacher, a colleague, parent/guardian etc. legibility of the print (and of illustrations). complexity of words and sentences in relation to the reading ability of the reader. This involves the type (i.e. several type faces are in use by readers e.g. lower case print, upper case print, italics and bold. It also encompassed text layout which include: the size type, the length of the line, the spacing between the lines (the leading) and the weight of print. The reading condition is also a factor under this heading. sentence structure - the longer the sentence, the more ambiguous it is to the reader for good interpretation of it. For example, short sentence needs a reading age less than nine years and longer sentences which contain an adjectival clause, advance arithmetic or polysyllabic words, has a reading age of more than sixteen (Keith Johnson 2011).

Data Analysis

Research Question 1: Does the interest and motivation of the Physics students have impact on their reading ability of Physics text?

Table 2: Chi-square analysis of data on the interest and motivation of the Physics students and their Physics text reading ability

| S/N | Items | SA | A | D | SD | x^2 -cal | x^2 -tab | df | Remark |
|-----|-------------------------------------------------------------------------------------------|----|----|----|----|------------|------------|----|--------|
| 1 | I like reading textbooks more than any other subjects. | 15 | 10 | 30 | 26 | 62.48 | 7.82 | 3 | *S |
| 2 | The back cover and the inner sheets of my physics textbook encourage me to read the book. | 14 | 38 | 40 | 8 | 32.16 | 7.82 | 3 | *S |
| 3 | I used to be encouraged by my teacher to read my Physics textbook. | 25 | 30 | 24 | 21 | 1.68 | 7.82 | 3 | **S |
| 4 | I used to be encouraged by my parent/guardian to read Physics textbook. | 15 | 50 | 25 | 10 | 38.00 | 7.82 | 3 | *S |
| 5 | The colour spectrum of the Physics textbook is always attractive to me | 21 | 41 | 27 | 11 | 18.88 | 7.82 | 3 | *S |

P<0.05, *S=significant, P>0.05, **Significant

A cursory look at Table 2(for items No 1,2,4 & 5 in the questionnaire) reveals that x^2 -cal=62.48, 32.16, 38.00 and 18.88 respectively and while x^2 -tab=7.82 in each case, showing that x^2 -calculated is greater than x^2 -table value at $p<0.05$ and $df=3$ (i.e. x^2 -cal > x^2 -tab) therefore, the result is significant, showing that the Physics students' like reading textbook more than any other subjects, the back cover and the inner sheets of physics textbook encourages them to read the book, Physics students used to be encouraged by their parent/guardian to read Physics textbook and the colour spectrum of the physics textbook is always attractive to the Physics students respectively. But, the result of the analysis of item No 3 in the questionnaire revealed that x^2 -cal=1.68 and while x^2 -tab=7.82 showing that x^2 -calculated is less than x^2 -table value at $p>0.05$ and $df=3$ (i.e. x^2 -cal < x^2 -tab). Therefore, the result is not significant, showing that the students are not encouraged by their teacher to read Physics textbook.

Research Questions 2: Does the legibility of print of Physics texts have impact on Physics students' reading ability?

Table 3: Chi-square analysis of data on the legibility of print of Physics text and students reading ability

| S/N | Items | SA | A | D | SD | X^2 -cal | X^2 -tab | df | Remark |
|-----|---------------------------------------------------------------------------------------------------------------------------|----|--------|--------|----|------------|------------|----|--------|
| 1 | The concepts in the book are bold which makes it attractive in style or reading. | 16 | 2 8 | 2 4 | 32 | 5.60 | 7.82 | 3 | **S |
| 2 | The letter print of the book is fairly clear for me to read. | 14 | 3 0 | 3 4 | 22 | 9.44 | 7.82 | 3 | **S |
| 3 | The line spacing of the letter print of the textbook enables me to read the book very well. | 18 | 4 4 | 2 8 | 10 | 25.7 6 | 7.82 | 3 | **S |
| 4 | I can only read the content very clearly when the light focuses on the pages. | 12 | 4 8 | 1 8 | 22 | 30.2 4 | 7.82 | 3 | **S |
| 5 | Most of the contents in the textbook are printed in lower case (small letter) thereby making it attractive to me to read. | 20 | 1 8 | 4 2 | 20 | 12.3 2 | 7.82 | 3 | **S |

($p<0.05$, *S = Significance), ($p>0.05$, **S = Not significant)

The result in Table 3 (for items No 1 in the questionnaire) reveals that $\chi^2\text{-cal} = 5.60$ while $\chi^2\text{-tab} = 7.82$ showing that $\chi^2\text{-calculated}$ is less than $\chi^2\text{-table}$ value at $p > 0.05$ and $df=3$ (i.e. $\chi^2\text{-cal} < \chi^2\text{-tab}$). Therefore, the result is not significant, showing that the concepts in the book were bold which makes it attractive in style for reading. But for the items No 2, 3, 4 & 5 in the questionnaire, $\chi^2\text{-cal} = 9.44, 25.76, 30.24$ and 12.32 respectively while $\chi^2\text{-tab} = 7.82$ in each case showing that $\chi^2\text{-calculated}$ is greater than $\chi^2\text{-table}$ value at $p < 0.05$ and $df=3$ (i.e. $\chi^2\text{-cal} > \chi^2\text{-tab}$). Therefore, the result is significant, showing that the letter print of the book is fairly clear for the Physics students to read, the line spacing of the letter print of the textbook enables them to read the book very well, the students can only read the content very clearly when the light focuses on the pages and most of the contents in the textbook are printed in lower case (small letter) looks attractive to the students to read respectively.

Research Question 3: Does the sentence structure in Physics texts affect students reading ability?

Table 4: Chi-square analysis of data on the sentence structure in Physics text and students' reading ability

| S/N | Items | SA | A | D | SD | $\chi^2\text{-cal}$ | $\chi^2\text{-tab}$ | df | Remark |
|-----|-------------------------------------------------------------------------------------------------------------------|----|----|--------|----|---------------------|---------------------|----|--------|
| 1 | There is direct definition to the concepts in the textbook to elicit my attention. | 20 | 60 | 1 1 | 9 | 68.08 | 7.8 2 | 3 | *S |
| 2 | Facts and information in the book are within my reading level. | 11 | 56 | 1 9 | 14 | 52.56 | 7.8 2 | 3 | *S |
| 3 | The statements in the book were not always straight forward to enhance my reading. | 20 | 22 | 4 2 | 16 | 16.16 | 7.8 2 | 3 | *S |
| 4 | The vocabulary in the book is made up of foreign scientific concepts and thereby makes it unpleasant for reading. | 12 | 48 | 1 8 | 22 | 20.64 | 7.8 2 | 3 | *S |
| 5 | Most of the mathematical concepts/calculation there in the textbook are difficult for me to understand. | 15 | 53 | 2 0 | 12 | 43.12 | 7.8 2 | 3 | *S |

$P < 0.05$, *S = Significant

Also, a cursory look at Table 4 (for items No. 1, 2, 3, 4 & 5 in the questionnaire) reveals that $\chi^2\text{-cal} = 68.08, 52.56, 16.16, 20.64$ and 43.12 respectively and while $\chi^2\text{-tab} = 7.82$ in each case, showing that $\chi^2\text{-calculated}$ is greater than $\chi^2\text{-table}$ value at $P < 0.05$ and $df=3$ (i.e. $\chi^2\text{-cal} > \chi^2\text{-tab}$). Therefore, the result is significant, showing that there is direct definition to the concepts in the text book to elicit their attention, facts and information in the book are within the students reading level, the statements in the book were not always straight forward to enhance the students easy reading, the vocabulary in the book are made up of foreign scientific concepts and thereby makes it pleasant for reading and most of the mathematical concepts/calculation there in the textbook are difficult for them be easily understood respectively.

Discussion

The results of the study were discussed based on the general questions:

The results in Table 2 (for items No 1, 2, 4 & 5 in the questionnaire) reveals that $\chi^2\text{-cal} = 62.48, 32.16, 38.00$ and 18.88 respectively and while $\chi^2\text{-tab} = 7.82$ in each case, showing that $\chi^2\text{-calculated}$ is greater than $\chi^2\text{-table}$ value at $p < 0.05$ and $df=3$ (i.e. $\chi^2\text{-cal} > \chi^2\text{-tab}$). Therefore, the result is significant, showing that the physics students' likes reading Physics textbook more than any

other subjects and both the back cover and the inner sheets encourages them to read the book. Moreover, Physics students used to be encouraged by their parent/guardian to read Physics textbook and the colour spectrum of the physics textbook was another motivating factor towards reading Physics textbook by the physics students. The result of the analysis of item No 3 in the questionnaire revealed that $\chi^2\text{-cal} = 1.68$ and while $\chi^2\text{-tab} = 7.82$ showing that $\chi^2\text{-calculated}$ is less than $\chi^2\text{-table}$ value at $p > 0.05$ and $df=3$ (i.e. $\chi^2\text{-cal} < \chi^2\text{-tab}$). Therefore, the result is not

significant, showing that the students are not encouraged by their Physics textbook. However, the result in Table 3 (for item No 1 in the questionnaire) reveals that $\chi^2\text{-cal} = 5.50$ while $\chi^2\text{-tab} = 7.82$ showing that $\chi^2\text{-calculated}$ is less than $\chi^2\text{-table}$ value at $p > 0.05$ and $df = 3$ (i.e. $\chi^2\text{-cal} < \chi^2\text{-tab}$). Therefore, the result is not significant, showing that the concepts in the book were not bold enough to enhance their effective reading. But for items No 2,3,4 & 5 in the questionnaire, $\chi^2\text{-cal} = 9.44, 25.76, 30.24$ and 12.32 respectively and while $\chi^2\text{-tab} = 7.82$ in each case, showing that $\chi^2\text{-calculated}$ is greater than $\chi^2\text{-table}$ value at $p < 0.05$ and $df = 3$ (i.e. $\chi^2\text{-cal} > \chi^2\text{-tab}$). Therefore, the result is significant, showing that the letter print of the book were fairly clear for the Physics students to read unlike their response to item No 1 under the same research questions, the line spacing of the letter print if the textbook enables them to read the book very well, the students can only read the content very clearly when the light focuses on the pages and the most of the contents in the textbook are printed in lower case (small letter) looks attractive to the students to read respectively.

The result in Table 4 (for item No 1,2,3,4 & 5 in the questionnaire) reveals that $\chi^2\text{-cal} = 68.08, 52.56, 16.16, 20.64$ and 43.12 respectively and while $\chi^2\text{-tab} = 7.82$ in each case, showing that $\chi^2\text{-calculated}$ is greater than $\chi^2\text{-table}$ value at $p < 0.05$ and $df = 3$ (i.e. $\chi^2\text{-cal} > \chi^2\text{-tab}$). Therefore, the result is significant, showing that there is direct definition to the concepts in the text book to elicit their attention and that facts and information in the book were within the students reading level. But lamentably, the statements in the were not always straight forward to enhance the students easy reading, the vocabulary in the book are made up of foreign scientific concepts and thereby makes it unpleasant for reading and most of the mathematical concepts/calculation there in the text book are difficult for them to be easily understood respectively. This report agree with the findings of (Keith Johnson, 2011).

Conclusion

As a result of findings of this study, it is concluded that “text readability” has significant impaction the reading and learning of Physics students and resultantly, it has a negative effect on their interest in the subject and their academic

performance in Physics subject in secondary schools.

Recommendations

Based on the findings of this study however, it is strongly recommended that secondary school Physics book authors should make their text/write-up to be readable by ensuring legibility of the print and mathematical aspect should be well simplified, sentence structure should not be difficult to aid their learning through reading and enhance their better academic performance in physics subject examinations.

It is also recommended that physics book authors should try as much as possible to use familiar (local) analogy while explaining some Physics concepts in their text.

Furthermore, it is also recommended that Physics subject educators should create enabling environment to foster students’ interest and motivation in the text reading.

Moreover, it is also recommended that instructions to examination questions should be legible and the sentence structure be less ambiguous for candidates’ better interpretation.

Finally, It is recommended that the science book writers should be conversant with various “text readability” formulas to analyse the reading ease of their texts, determining unusual word and the ambiguity of sentence(s) in their text for a particular age bracket of students for better academic performance in schools.

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