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EXPLORING THE READABILITY OF A CLIMATE CHANGE TEXT

BY

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ABSTRACT

The twentieth first century has been bedeviled with life- threatening challenges, one of which is climate change. Education has been identified as one of the tools that can reduce the consequences of climate change. One of the ways Nigerian universities teachers can convince students to join the campaign to save the earth is by writing easy- to read Climate Change textbooks. Drawing inspiration from the reader response theory and adopting a descriptive survey design method, this study investigated the readability of a text 'Climate Change and Its Institutional Framework' in order to ascertain whether second and third year students of Alex Ekweme Federal University, Ndufu Alike Ebonyi State would find the text readable. The results revealed that long sentences, lexical density, heavy nominalization, lack of sufficient background and academic language made the text have a poor readability rating. The result of this study has implications for climate change materials and textbook writing in higher education.

Keywords: Exploration, Readability Rating, Textbooks, Climate Change, University Education.

Introduction

Textbooks remain indispensable resources at all levels of education worldwide despite the proliferation of the electronic media (Bansiong, 2019). In Nigeria, the frequent shortened academic school calendar occasioned by striking university teachers and the lack of free access to the internet make textbooks more significant to Nigerian students.

Climate change is one of the most challenging phenomena facing world leaders today. Since Nigeria has been described as one of the ten most vulnerable countries in the world when it comes to climate change, and because education has been identified as an effective tool that can mitigate the dire consequences of climate change (Kwauk& Winthrop, 2021). University teachers must explore the subject of climate change as they write textbooks.

In spite of the widespread belief that students can play a key role in reducing the effect of climate change and despite the imminence of the threats posed by climate change, many Nigerian students are unaware of what climate change is all about (Akpomai & Vipene, 2016Olusola&Adedeji, 2016).

Before university students can become familiar enough with the climate change narrative to engage in its mitigation, the textbooks written to capture the challenges facing the environment has to be "not too hard, not too easy. Just right". University teachers must constantly remind themselves that climate change is fraught with technical terminologies, which need to be deliberately explained in plain language.

The case for easy-to-read Climate Change textbooks becomes even more imperative in the light of the fact that many Nigerian students are reluctant readers. (Labo-Popoola, 2018; Anyira & Udem, 2020 and Otache,2020).Research and experience have also demonstrated that most Nigerian students read more self-selected books than school-imposed texts ((Nnamani,2018) and read more books for pleasure than books for academic purposes (Osakwe, 1999).

It is against this background that this study explored the readability of a climate change text in order to discover whether university students found the text easy or challenging. Two research questions guided this study:

Research Questions:

1. Is the Climate Change text within the readability level of the study population?
2. Which lexical features made the text easy or difficult for the study population?

Conceptual Framework

Dubay (2014) defines readability as the "ease of reading created by choice of content, style, design and organization that fit the prior knowledge, reading skill, interest and motivation of the audience." Readability researches reveal that predominantly multi syllabic words, long sentences, nominalization, lexical density and academic vocabulary contribute to text complexity. The reader's limited vocabulary and insufficient background contribute to the difficulty of texts. If Nigerian students are reluctant readers and if they are unfamiliar with the subject of climate change, logic demands that such a population would require easy to read climate change texts in order to motivate them to read.

Theoretical Framework

This study aligns with the reader response/ transactional theory which canvasses the view that a piece of writing does not exist until it is read and experienced by the reader and that it is the relationship between the text and the reader that gives new perspectives to a text regardless of the structure of the text or what the author had in mind.

Literature Review

Most studies carried out by Nigerians center on the readability of science textbooks recommended for secondary schools. While a few of these textbooks were found to be readable, majority were discovered to be difficult for the intended readers. For example, Olatayo & Alabi (2016) investigated the readability of *Evans Modular English Course for Primary Schools 6* with a focus on the lexical and cultural contents of the text. Using lexicaland cultural density tests, the

authors discovered that the lexical density of the text was extremely low and so would not pose difficulty to the readers but the cultural contents of the book were predominantly foreign and therefore could contribute to text difficulty.

Olagoke (2015) compared the textbook readability and student comprehension level of Senior Secondary School Biology books in Ekiti State, Nigeria and discovered that all the textbooks are difficult and far above the reading comprehension level of students.

Nunoo, K.N Francis, et al (2020) used the Flesch Readability Ease and Flesch-Kincard Readability formulas to investigate the readability levels of the main Integrated Science textbook used in Junior Secondary Schools in Ghana. They discovered that the textbook was difficult for many students except those who received assistance. In Nigeria, there seems to be little interest in the readability analysis of textbooks used for Higher education. NurHidayatillah & YettiZainil (2020)investigated the readability of a textbook used in a Semantic and Pragmatic course in University Negeri, Indonesia. They sought to find a correlation between students' low scores and the readability of the textbook used for the course. The authors used written questionnaires, online readability measurement, website and notes taken during interviews to investigate three pages from three randomly chosen chapters of the text. They found the text was difficult.

Gyasi and Slippe (2019)investigated three textbooks used by Year1-3 Distance Learning Diploma students of the University of Cape Town. Passages were selected from each textbook for readability analysis. The Flesch Reading Ease and the Flesch–Kincaid grade level indexes were used to compute readability scores of the texts. The results revealed that the average word per sentence was between 22 -25 for all the three books. Thus the texts were generally between 'fairly difficult' and 'difficult' to read.

In spite of the challenges low readability poses to readers, it is important to note that text complexity does not always spell doom to learners. In the United States, for instance, the Common Core State Standard (CCSS) Initiative oversees increasing the levels of the difficulty of texts used in early grades. They argue that this prepares students to cope with college and their future careers (Kern, 2014).Similarly, Benjamin & Schwanenflugel (2010) discovered that text difficulty helped prosodic performance and intonation of children learning to read. Their study showed that when children were reading aloud a difficult text, they paused more between words, which tended to reflect the grammar of the complex sentences. Again the children's intonation was more adultlike when the text was difficult.

The present study would contribute to the body of knowledge on efforts to mitigate climate change in developing countries as well as the readability of higher education textbooks by examining the readability profile of a climate change chapter "Climate Change and its Institutional Framework" published in , *Operational Meteorology (Institutional Dimension),a* text written by Virginia Okwu- Delunzu and used by Nigerian university students.

Method of Data Collection

The survey research design was used in this study. A sample population of one hundred and ninety-nine second and third year students of Alex Ekweme Federal University, Ndufu, Abakaliki was used for this study. The students were from the Departments of Linguistics, Music, French, Biochemistry, Geology, Bio Technology and History and were involved in the Language Enhancement Program of the university. Four tests were used in this study. First the text was analyzed to identify lexical, grammatical and syntactic features that could influence the readability of the text. Next the Flesch Readability formula was applied to the text. Then a cloze test based on the text was administered to second and third year students. Finally, the same respondents were made to answer a two- item questionnaire requiring them to tick the factor that contributed most to the ease or difficulty of the text.

To ascertain the lexical and grammatical features that could influence readability, the types of sentences, number of nominalizations and lexical density of the sentences were counted manually.

The Flesch Readability formula was applied to the climate change text in this way:
A.No of words=100
B.No of syllables= 163
C.No of sentences =4
B DIVIDE BY A= 1.63X84.6=137.898
A divided BY C=100 dived by 4 =25x 1.015=
Reading Ease=206.835- (1.015x25) – (84.6X 1.63).

While the grammatical analysis and Flesch formula assessed textual features that could cause text complexity, the cloze test was used to discover the level of interaction between the Climate Change text and the readers, a transaction which could aid or hinder comprehension.
To prepare the cloze test, one hundred words were counted from the beginning, middle and end of the chapter. The first and last sentences of each section were left intact to give the readers sufficient background. Then every seventh word was omitted in every sentence. Fifty gaps were created in all.(See Appendix 1).

Result

In this part of the paper, the analysis of data is presented. The first research question sought to discover the extent whether the Climate Change text was within the readability level of the study population.

The Flesch Readability formula revealed that the climate change text has a readability score of 97%. Based on this score, the climate change text is within the readability of the study population.

The cloze test however revealed that the students performed poorly in the test as nobody out of one hundred and ninety –nine students scored up to 43% in the cloze test. This means that based

on the cloze test, the climate change text is above the readability level of the study population. This shows that the Flesch readability Ease formula and cloze test gave contradictory results, which is not uncommon.

The second research question that guided this study sought to discover the lexical features that made the text easy or difficult to read?

Long sentences

The linguistic analysis revealed that even though the average number of words per sentence was 25, as many as 92, 75 and69 words made up some single sentences in the text. Below is an example:

> The ocean is a fundamental part of the climate system, some changes in it occurring at longer timescales than in the atmosphere, as it has hundreds of times more mass and thus very high thermal inertia, with effects such as the ocean depths still lagging today in temperature adjustment from effects of the Little Ace Age of past centuries, Short –term fluctuations (years to a few decades) such as the El Nino South oscillation, The Pacific decadal oscillation, The North Atlantic oscillation and the Artic oscillation, represent climate variability rather than climate change.

Lexical density

Lexical density also contributed to the low readability of the climate change text. A sentence packed with far more content words than grammatical words has heavy lexical density. In the sentence above, for instance, while grammatical words are 25, the lexical words are 67.

Nominalization- adds number to table.

Sentence Structure

An analysis of the types of sentences used in the Climate Change text revealed the following:

S/No	Sentence Types	Number
1	Simple Sentences	298
2	Compound Sentences	78
3	Complex sentences	101
4	Compound Complex	16

The analysis shows that the majority of sentences used in the text were simple sentences.

Discussion

The focus of this study was to investigate whether the Climate Change chapter of the university textbook, *Operational Meteorology (Institutional Dimension*)

Was within the readability level of second and third year students of Alex Ekweme Federal University, Ndufu Alike, Ebonyi State

The Flesch Readability formula revealed that the climate change text had a readability of 97%, a result which is contrary to the results of the three other tests the text was subjected to. For

example, the result of the cloze test showed that the students found the text difficult as only 2% of the respondents scored up to 35% in the test.

Again, even though the average length of the sentences in the texts is 25 words per sentence and most of the sentences were simple sentences, they still posed challenges to the study population because many of the simple sentences the text were long. Simple sentences are not necessarily short. Long sentences contribute to text difficulty because by the time the reader gets to the end of the sentence, they have forgotten issues raised at the beginning of the sentence.

Again the heavy presence of nominalization in the simple sentences contributed to the low readability of the simple sentences. Nominalization is the process writers use to turn adjectives or verbs into nouns when they describe a process. Verbs and adjectives are easier to understand than nouns. For example, sentence 2 is easier to understand than Sentence 1.

Sentence 1:"Sentence **2**:
Writers of scientific texts frequently use nominalization because it helps 'in packaging and sophistication that makes scientific writings acceptable by the academic community' (Jalilifar, Kaidan & Don, 2018). Aside from long sentences and nominalization, lexical density is another factor that contributed to the low readability of the Climate Change text. According to Halliday and Martin (1993) cited in Vinho (2018) , lexical density refers to the " density of information in any passage of text, according to how tightly the lexical items have been packed into the grammatical structure'' Lexical items refer to meaning carrying words such as nouns, verbs, adjectives and adverbs while grammatical words refer to pronouns, prepositions, articles and conjunctions.

From the students' responses to the questionnaire, 90% of the respondents opined that lack of background knowledge made the cloze test extremely difficult for them to fill correctly. Next to background knowledge was the use of technical words.

If Climate change will be taught in Nigerian universities, it is likely to be introduced in the first year, the level at which courses outside the students' areas of specialization are taught. If the second and third year students of a Federal university found the climate change text difficult to understand, first year students would find the same text more difficult. This implies that teachers should deliberately employ writing strategies that will make the text easy to understand. The academic language employed in writing the Climate change text equally contributed to the low readability of the text. In other to be accepted by the academic community, University teacher soften write journal articles in line with prescribed standards. This language which may be accessible to professionals is e not easily understood by students. This view is validated by Toks who has noted that:

> some proponents of authentic classroom language models have argued that the problems with many textbooks are that they are actually contrived and artificial in their presentation of language

Below is a climate change text written for American students. The breezy style makes the reading experience more fun

Next extreme weather ----- by climate change is putting companies -----their supply chains at risk. And ------- smart CEO likes that type of -------.

Plus businesses are realizing that carbon ----- future isn't just about making sacrifices. ---- fact, it holds huge opportunities ----- growth and leadership.

Why are companies -------- their corporate carbon footprint? What's in ---- for them?

Test Results:

Research Question 1:

Is the climate change text within the readability level of the study population?

Table 1: Mean performances for the cloze test

Report

Clozetestresult

Mean	N	Std. Deviation	Minimum	Maximum	Median
18.5578	199	7.04068	4.00	42.00	18.0000

From the SPSS output above, it is seen that the mean or average performances is 18.56. The median score is also 18. 46.7 percent of the study population scored below the median and mean score (see the table 2 below) which is almost half of the study population. The maximum score is 42 and is below the 50 percent mark pass mark. This implies that none in the study population got up to the pass mark of 50. It can be concluded that the climate change text is not within the readability level of the study population. (Note: Decision is subject to what your pass mark is. You can adjust)

Research Question 2: Which lexical features made the text easy or difficult for the study population?

Table 2: Percentage distribution of the cloze test result

Clozetestresult

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.00	2	1.0	1.0	1.0
	6.00	4	2.0	2.0	3.0
	8.00	8	4.0	4.0	7.0
	10.00	13	6.5	6.5	13.6
	12.00	11	5.5	5.5	19.1
	14.00	33	16.6	16.6	35.7
	15.00	3	1.5	1.5	37.2
	16.00	18	9.0	9.0	46.2
	17.00	1	.5	.5	46.7
	18.00	17	8.5	8.5	55.3
	20.00	22	11.1	11.1	66.3
	22.00	17	8.5	8.5	74.9
	24.00	15	7.5	7.5	82.4
	26.00	9	4.5	4.5	86.9
	27.00	1	.5	.5	87.4
	28.00	8	4.0	4.0	91.5
	30.00	6	3.0	3.0	94.5
	32.00	4	2.0	2.0	96.5
	34.00	4	2.0	2.0	98.5
	36.00	2	1.0	1.0	99.5
	42.00	1	.5	.5	100.0
	Total	199	100.0	100.0	

Conclusion

This study sought to find out whether the climate change text was appropriate for Second and third year students of Alex Ekweme Federal University Udufu, Ebonyi State. The findings revealed that the climate change textbook was difficult due to long sentences, high lexical density, and the high use of nominalization. On the part of the students, their lack of background knowledge of climate change contributed to the low readability of the Climate Change text. The findings of the study will guide university teachers to write localized, readable climate change textbooks for Nigerian university students by providing a lot of background knowledge and using culturally relevant contexts and conversational vocabulary as against academic vocabulary.

References

Akpomi, M & Vipene, J. (2016*)*.Promoting the Knowledge of ClimateChange (CC) Amongst Nigerians: Implications for Education Manager *Journal of Education and Practice 7*,(32).

Anyira, I. E &Udem, O. K.(2020).Effect of Social Media Addiction onReading Culture : A Study of Nigerian Students *Library Philosophy and Practice* (e-journal) https://digitalcommons.uni.edu/libprac/4170

School Students' Performance *Reading Comprehension Journal of Applied Research (*AJAR) 6, (2) , 79-94 http://www.ajaroonline.com

Bangay, C.(2010). Education Responses to Climate Change and Quality: Two Parts of the Same Agenda? *International Journal of Education Development* 30 (4): 335- 450

Bansiog, A. J. (2019). Readability, content and mechanical feature analysis of selected commercial science textbooks intended for the third grade Filipino learnersAbstracthttps://doi.org/10.1080/2331186x.2019.1706395)

Gyasi, W. K. and Slippe, D. P.(2019). Readability of English Language Textbooks for diploma students of the University of Cape *Town. International Journal of Research Studies in Language Learning* 8. (1) 107-115.

Jalifar, Alireza, Zhila Heidari Kaidan & Alexanne Don. (2018).Nominalization in Academic Writing: A Cross-disciplinary Investigation of Physics &Applied Linguistics Empirical Research Articles. *Iranian Journal ofApplied Language Studies.* Vol. 10, 2.

Kern, Diane. (2014).Common Core-less? A Critical Review of the Common Core State Standards Research. *New England Reading Association Journal* Vol. 50, (1).

Kwauk, C.& Winthrop, R. (2021)Unleashing the Creativity of teachers and students to Combat Global Climate Change: An opportunity for Global leadershipwww.brooking.edu

Labo-Popoola, S.O. (2018).Reading Habits Amongst University Undergraduates: Implications for Academic Performance. International *Journal of Learning and Development* 8, (2).

Mbajiogu, N.M (2021) Open Science Schooling (OSS): The Panacea for Mitigation and Adaptation to Climate Change for Sustainable Development, A Lead Paper Presented at the Alex Ekweme Federal University Ndufu-Alike International Conference on Climate Change and Education for Sustainable Development Held between 4-7 May 2021.

Nnamani, O. (2018). Providing Reading Choices in an English Language Classroom at ESUT: A Survey *Research in English and Applied Linguistics*15, 189-202 .

NurHidayatillah & YettiZainil (2020).The Readability of Students' Textbook Used in Semantics and Pragmatic Course in English Language Education Program of UN*P*https://doi.org/10.24036/jelt.v9il.107848

Nunoo,K.N Francis et al . (2020). How can we take up science courses? Readability of levels of Junior High School Integrated Science textbook in Ghana *Journal of Humanities and Social Sciences* 25, (8) Series 6

Olatayo,O. F. &Alabi, S. A.(2016)Lexical and Cultural Indices into the Readability Level of Evans Modular English Course for Primary Schools 6*International Journal of Advanced Research* 2,(2).

Otache I.(2020)Poor Reading Culture in Nigeria: The Way Forward. Abstract *African Journal of Social Sciences & Humanities Research*,3 (4)

Osakwe, N.(1999)The Nature of Students' Reading Problem at the Tertiary Level in AbeB. Lawal, Onukaogu E, Jegede, T. (eds.) *Literacy and Reading Nigeria, ,138- 148.*

Okwu-Delunzu, V. U. (2014) *Operational Meteorology (Institutional Dimension)* Enugu: Chengo Publishers.

Pontius Plaven-Sigray, Graville James Mtheson, Bjom Christian Schiffler & William Hedley Thompsom. (2017)*The readability of Scientific texts is decreasing over time*https://doi.org//10.7554/elife.277725.001.

Rottensteiner, Sylvia (2010). Structure, function and readability of new textbooks in relation to comprehension *Procedia Social and Behavioural Sciences*2 Taiwo, A., Ajiboye, E&Kayode-Adedeji, T .(2016) Strategic Communication for Climate Change Awareness and Behavioural Change in Ado- Odo/Ota Local Government in Ogun State*. African Population Studies* 32, (1), 4057-4067 http:// aps.ac.za

To, Vinh (2018). Linguistic Complexity Analysis: A Case Study of Commonly-Used Textbooks in Vietnam. Sage Opendoi: 10.1177/215824401878586

Tok, Hidayet (2010). TEFL Textbook evaluation From Teachers' Perspective in *Educational Research & Review* Vol 5 (9) Pp. 508-517.

Appendix 1-Cloze Test

The researcher wants to find out whether students would find these extracts from a university textbook easy or difficult. Kindly fill each gap with the exact word deleted or a suitable substitute. There are 50 spaces in all.

Provide the required information before filling the gaps.

Male: Female: Department: Year of Study:

A. Science has made enormous in roads in understanding climate change and its causes, and is beginning to help develop a strong understanding of current and potential impacts that will affect people today and incoming decades. This understanding is crucial because it--

---- decision makers to place climate change ---- the context of other large challenges------ the nation and the world. There -----still some uncertainties, and there always-------- be in understanding a complex system ------ Earth's climate. Nevertheless there is a -------- credible body of evidence, based on------- lines of research, documenting that climate ------ changing and that these changes are ------ large part caused by human activities.------ much remains to be learned, the-----phenomenon, scientific questions, and hypotheses have ----- examined thoroughly and have stood firm----- the face of serious scientific debate ------ careful evaluation of the alternative explanations'

Flooding, --------, sea level rise, heat waves, and------- intense and frequent storms have changed ----- way we think of planning in ------ of transportation and infrastructure. Those who manage the nation's natural resources need the most current climate information.

B. Geoengineering refers to deliberate, often global–scale, manipulations of the climate system. Two categories of reengineering are most------ within scientific and policy discussions: solar ----- management (offsetting human-caused warming due -------- greenhouse gas emissions by reflecting incoming---- back to space) and carbon removal ------sequestration (extracting carbon dioxide from the ----- and storing it deep in the ground or ocean.

Geoengineering could potentially help ------- greenhouse gas concentrations in the atmosphere,--------- the warming influence of increasing greenhouse -----concentrations, address specific climate change impacts, ------- offer desperation strategies in the event -----abrupt, catastrophic, or otherwise unacceptable climate ----- impacts become evident. Geoengineering could also ----- new sources of risk because attempts ------engineer the earth system on a ----- scale could lead to unintended and --------e consequences.

Research, observations and scientific contents assessments, and technology development can help reveal risks and opportunities associated with the climate system and support decision making with respect to climate change risks management.

C. Given the growing awareness about climate change sensibility of the society across a wide range of socio-economic sectors and increased focus on the need for adaptation and risk management that is implemented at the local level and requires climate information and services available at the global and regional, national and local scales, the objectives of the refocused WCP are :

To improve the understanding of climate ------- for determining the predictability of climate, ------ its variability and change, identifying the ------ of human influence on climate and------- the capacity for climate prediction and --------,

*To promote comprehensive observation of the ------ climate system and facilitate the effective ------ and management of climate data and the monitoring, including the detection and assessment ------climate variability and changes from global ----- local scales;

*To enhance and promote ------ availability of and access to user- targeted-----services, especially prediction, by providing an ----- framework and establishing the operational elements ------- production and delivery systems for climate -----;

*To foster the effective application of climate knowledge and information for the better management of the risks of climate change variability and change into planning, policy and practice and the provision of the required climate services;

Questionnaire

1. How would you rate the readability level of the extracts?

A.Very Easy B. Easy C.Very DifficultD. Difficult

2. What do you think is responsible for the ease or difficulty of the text?

A. Many Short sentences B. Many long sentences C.Many familiar words D.Many technical words E. Lack of background knowledge of topic

Appendix 2-Cloze Test Result

1	24
2	18
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26	6
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28	20
29	10
30	14
31	18
32	10
33	12
34	8
35	10
36	8
37	14
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39	20
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41	18
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