

Analyses of the readability and students' comprehension levels of Biology textbooks frequently utilized in upper secondary schools across Kwara, Nigeria

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ABSTRACT

This research focused on evaluating the readability and understanding levels of Biology textbooks frequently utilized in upper secondary schools across Kwara, Nigeria. The population consisted of all biology textbooks used by senior secondary school students and all students who study biology in Kwara State, Nigeria. A purposive sampling technique was utilized to select a sample of 3 textbooks from those recommended by the Kwara State Ministry of Education and Human Capital Development. Additionally, a total of 252 students (84 from senior secondary school one, 84 from senior secondary school two, and 84 from senior secondary school three) were selected using stratified sampling. Two instruments were employed: the Biology Textbook Readability Test (BTRT), an online readability calculator, and the Cloze Test of Readability for Biology Textbooks. The findings revealed that most of the textbooks were difficult and above the grade level for which they were designed. Furthermore, the textbooks were found to be confusing for the designated users. Based on these findings, it is recommended that biology textbooks be structured in a manner that aligns with the characteristics of the designated users. This entails writing textbooks with simpler words, reduced.

ARTICLE INFO

Received : Apr. 27, 2024

Revised : Aug. 22, 2024

Accepted : Sept. 25, 2024

KEYWORDS

Readability, Comprehension, Comprehension levels, Biology textbooks, Kwara, Nigeria

Suggested Citation (APA Style 7th Edition):

Inujo, O.O., Bello, G., & Bello, Z.A. (2024). Analyses of the readability and students' comprehension levels of Biology textbooks frequently utilized in upper secondary schools across Kwara, Nigeria. *International Research Journal of Science, Technology, Education, and Management*, 4(3), 120-131. <https://doi.org/10.5281/zenodo.13859417>

INTRODUCTION

The study of biology, as the foundation of life sciences, is crucial not only for understanding life processes but also for addressing pressing health and environmental challenges. However, the effective learning of biology in senior secondary schools is heavily influenced by the readability of textbooks and students' comprehension of the content. Readability, which refers to the ease with which a reader can understand written text, plays a significant role in shaping students' engagement with the material and their overall academic performance (Michael, 2012).

In the context of secondary education, textbooks serve as primary learning resources, making their readability a key factor in ensuring that students can grasp complex biological concepts. Studies have shown that when textbooks are not appropriately matched to students' reading levels, it can hinder comprehension, leading to poor academic outcomes (Fajembola & Ohazurike, 2012). Therefore, analyzing the readability of biology textbooks is essential to determine whether they are accessible and effective in aiding students' understanding.

Moreover, comprehension is a critical aspect of learning, as it involves not just reading but also processing and internalizing information. Poor comprehension skills can create barriers to learning, particularly in subjects like biology, where scientific language and concepts are often dense and abstract (Butler & Nesbit, 2008). This study examines the readability of biology textbooks frequently used in upper secondary schools in Kwara, Nigeria, and evaluates how well these textbooks correspond to students' comprehension abilities. By examining these factors, the study aims to highlight potential gaps and recommend ways to improve biology education through better-designed instructional materials.

Instructional materials, particularly textbooks, play a pivotal role in shaping students' learning experiences and academic success. They not only ignite students' curiosity but also facilitate comprehension, retention, and application of knowledge (Urom, 2010). Furthermore, access to textbooks, along with laboratory resources and other learning materials, significantly influences students' performance in biology examinations, underscoring the importance of adequate educational resources (Dinah, 2013).

Despite the centrality of textbooks in the educational landscape, challenges persist, particularly concerning readability and comprehension. For many science students, reading remains a formidable obstacle, hindering their ability to engage with academic content effectively (Abimbola, 1991; Duyilemi, 2004; Fatoba, 2014). Readability, characterized by the ease of reading resulting from writing style, is a critical determinant of a textbook's accessibility and utility (Ziriki, 2009). Similarly, comprehension, defined as the construction of meaning from written text through an exchange of ideas, is essential for meaningful learning experiences (Harris & Hodges, 1995).

Taking these factors into account, this research aims to explore the readability and comprehension levels of biology textbooks frequently utilized in upper secondary schools in Kwara, Nigeria. By examining the accessibility and effectiveness of these instructional materials, the research aims to provide valuable insights for educators, curriculum developers, and policymakers to enhance the quality of biology education in the region. Through a comprehensive analysis of textbook readability and comprehension, this study endeavors to contribute to the ongoing efforts to improve educational outcomes and promote scientific literacy among students.

Problem of the Study

The declining performance standards of senior secondary students in Biology examinations continue to raise concerns among educators and stakeholders, highlighting the urgent need for viable solutions. A key contributing factor to this challenge is the inadequacy of quality instructional materials in the field of biology. Despite the pivotal role of textbooks in shaping students' learning experiences, the suitability and effectiveness of these resources remain uncertain.

Previous research endeavors, undertaken by scholars such as Ayodele (2014) and Okafor (2009), have attempted to address this issue through various analyses aimed at evaluating the fitness of biology textbooks. However, these studies have predominantly relied on either readability formulas or the Cloze Test to assess the readability of textbooks (Fatoba, 2015; Odume, 2014; Sibanda, 2014; Zamanian & Heydari, 2012; Okafor, 2009). While these approaches have provided valuable insights, they may offer limited perspectives on the overall readability and comprehensibility of instructional materials.

Therefore, the present study seeks to fill this gap by adopting a comprehensive approach that combines both readability formulas and the Cloze Test. By employing these complementary methods, the research aims to provide a more nuanced understanding of the readability levels and students' comprehension levels of biology textbooks commonly used in senior secondary schools in Kwara State, Nigeria. Through this multifaceted analysis, the study endeavors to offer actionable insights for educators, curriculum developers, and policymakers to enhance the quality and effectiveness of biology education in the region. By addressing the pressing need for high-quality instructional materials, this research contributes to the broader goal of improving educational outcomes and fostering scientific literacy among students.

Purpose of the Study

The primary objective of this study was twofold: first, to analyze the readability of biology textbooks, and second, to assess the comprehension levels of students using these textbooks in senior secondary schools across Kwara State, Nigeria. By examining both the readability and comprehension aspects of biology textbooks, the research aimed to provide a comprehensive evaluation of the suitability and effectiveness of instructional materials in facilitating student learning experiences. Through this analysis, the study sought to identify potential areas for improvement in textbook design and content to better meet the diverse needs of students and enhance their understanding of biology concepts. Ultimately, the findings of this study aimed to inform curriculum developers, educators, and policymakers about the strengths and weaknesses of existing biology textbooks and offer insights for the development of more accessible and student-friendly instructional materials.

Research Questions

To guide the study, the following research questions were formulated:

- i. What are the readability levels of Biology textbooks widely used in senior secondary schools in Kwara State?
- ii. Do the readability levels of Biology textbooks exceed the designated users' reading grade levels?
- iii. What is the comprehension level of Biology textbooks extensively used in upper secondary schools across Kwara State?

These questions were designed to assess the readability and comprehension levels of Biology textbooks, with a specific focus on their alignment with the reading abilities of senior secondary school students in Kwara State, Nigeria.

Literature review

Biology stands as a crucial subject in the Senior Secondary education curriculum, essential for understanding the mechanisms of life. However, it's evident that many students face challenges comprehending the subject due to the complexity of the materials provided. The significance of providing biology texts at an accessible readability level cannot be overstated, especially considering the diverse linguistic backgrounds of students.

Research conducted by various scholars underscores this issue. Baker (2004), Ayodele (2009), Yong (2010), and Ayodele (2012) have all noted that the majority of biology textbooks are excessively difficult for

students, particularly those learning in a second language. Additionally, Letsoalo (1996) and Doidge (1997) found that the language used in African science textbooks, including those used in Nigeria, often surpasses the comprehension levels of many pupils.

Studies further reveal the disparity between the readability levels of biology materials and students' reading abilities. Heppner, Heppner, and Leong (1997) discovered that the assigned reading materials in Brunei Darussalam were significantly more challenging than the students' reading capacities. Similarly, Soyibo (1996) observed similar difficulties among Caribbean students with biology textbooks.

Efforts to mitigate these challenges have shown promise. Wright (2006) successfully enhanced comprehension by rewriting sections of a biology textbook to a lower readability level. Abanami (1982) highlighted the need for additional reading instruction, particularly in subjects like earth science, where students face similar comprehension hurdles.

Language emerges as a significant barrier to science education, as noted by Cummins (1984), Wellington, and Osborne (2001), and Rutherford (1993). Ajeyalemi and Busari (1986) emphasized the role of language difficulty and confusion between home and instructional languages in hindering students' achievement in science. Reading serves various purposes in the lives of diverse groups of literate individuals. It is fundamental for acquiring knowledge across different subjects in educational settings. Regardless of the context, proficient reading enhances individuals' capacity to function effectively (Perekeme, 2012).

Ziriki (2009) defines readability as the ease with which a text can be read, largely influenced by the writing style, and it indicates the level of reading difficulty in relation to the target audience. The readability level significantly influences students' understanding of a subject (Frank, 2006) and has been associated with poor academic performance in secondary schools, often attributed to inadequate facilities, teaching methods, and student motivation (Duyilemi, 2004). However, the impact of textbook readability on student performance has received limited attention.

Addressing the question of what factors contribute to the readability of a book for specific readers is crucial, given the correlation between comprehension of scientific materials, such as biology, and text readability (Fatoba, 2014).

Tobrise (2005) highlights the significance of reading science textbooks in academic science endeavors. Educators and parents must take into account how much learning is supported by biology textbooks.

Various factors, including text characteristics such as print quality, subject familiarity, sentence structure, vocabulary, and illustrations, as well as reader factors such as language proficiency, background knowledge, reading purpose, interest, and metacognition, influence comprehension during reading. Students may struggle with texts containing unfamiliar concepts or complex sentence structures, leading to a slow reading pace and limited comprehension.

Textbooks play a vital role in the teaching-learning process, offering enduring knowledge and portability, making them accessible even in resource-constrained environments (Afolabi, 2009). The differential academic performance of students in Nigeria remains a significant concern for educators, government, and parents due to its implications for national development (Adebule, 2004).

Writing plays a vital role in promoting reasoning, communication, and conceptual connections; however, there has been little examination of the texts used in science education (Morgan, 1998). Pugalee (2001) highlights the need for research addressing the integration of writing into biology curricula. Ogundeke (2003) advocates for research on the readability of biology textbooks and its impact on student performance in secondary schools.

In conclusion, the readability and comprehension levels of biology textbooks in Kwara's Senior Secondary Schools demand attention. Addressing these issues is crucial for enhancing students' understanding and performance in the subject.

Materials and Methods

The study utilized a mixed-methods approach to analyze the readability and comprehension levels of biology textbooks commonly used in senior secondary schools in Kwara State, Nigeria. The analysis involved the use of three textbooks and the participation of 252 senior secondary school students from 10 schools in the region. While this study provided valuable insights into the readability and comprehension levels of biology textbooks used in Kwara State, the relatively small sample size, limited to 10 schools and 252 students, may restrict the generalizability of the findings. Future studies should consider including a larger and more diverse sample of schools and students across different regions to enhance the applicability of the results to a broader population.

Sample and Participants

The participants consisted of 252 senior secondary school students selected using stratified sampling techniques. Among these, 84 students were from Senior Secondary 1 (S.S. 1), 84 students from Senior Secondary 2 (S.S. 2), and 84 students from Senior Secondary 3 (S.S. 3). The students were drawn from a total of 10 senior secondary schools in Kwara State.

The textbooks selected for this study were Modern Biology for Senior Secondary Schools by S. T. Ramalingam, College Biology for Senior Secondary Schools by Ido-Umeh, Essential Biology for Senior Secondary Schools by M. C. Michael, and Comprehensive Biology for Senior Secondary Schools by A. W. Muse. All these textbooks are recommended by the Kwara State Ministry of Education and Human Capital Development, ensuring their alignment with the educational standards and curriculum. Including these specific textbooks enables a more targeted analysis of the content and teaching approaches, while also facilitating comparisons with other textbooks in future studies.

Instruments and Procedures:

Two instruments were employed to collect data: the Biology Textbook Readability Test (BTRT) and a researcher-designed Cloze Test of Readability of Biology Textbooks (CTRBT).

1. The BTRT utilized an online readability calculator to analyze passages from the textbooks and provide scores based on the Flesch Reading Ease Score. This score, derived from the average sentence length and number of syllables per word, indicates the readability level of the text.
2. The CTRBT involved randomly selecting passages from the textbooks and omitting every fifth word from each sentence after the first sentence. Students were then required to provide correct answers or similar substitutes for the missing words, indicating their comprehension of the passage.

To ensure the validity of the data collected, passages were drawn from standard textbooks recommended by the Kwara State Ministry of Education and Human Capital Development. Passages were randomly selected from the beginning, middle, and end of each textbook to ensure fair representation of all sections of the text.

Overall, the study employed rigorous sampling techniques and utilized reliable instruments to assess the readability and comprehension levels of biology textbooks among senior secondary school students in Kwara State.

Table 1: *Interpretation of Flesch Reading Ease Scores*

| Flesch Reading Ease Score | Description | Reading Grade | Nigeria Equivalent |
|---------------------------|------------------|---|---------------------|
| 0 – 29 | Very difficult | Post graduate grade | Post graduate grade |
| 30 – 49 | Difficult | College grade | Undergraduate |
| 50 – 59 | Fairly difficult | 10 th – 12 th grade | S. S. 1 – S. S. 3 |
| 60 – 69 | Standard | 8 th – 9 th grade | Basic 8 – 9 |
| 70 – 79 | Fairly easy | 7 th grade | Basic 7 |
| 80 – 89 | Easy | 5 th – 6 th grade | Basic 5 – 6 |
| 90 – 100 | Very easy | 4 th – 5 th grade | Basic 4 – 5 |

Source: (Wyatt & Schmelbach, 2008)

The data collected from the Cloze test was analyzed by doubling the scores to find the percentage. The mean readability score of the students at each class level was calculated and interpreted based on guideline provided.

Table 2: *Interpretation of Cloze test scores*

| Cloze Scores | Reading Level | Description |
|---------------|---------------|---------------|
| Independent | 60 – 100 | Too easy |
| Instructional | 40 – 59 | Appropriate |
| Frustration | 0 – 39 | Too difficult |

Source: Wellington and Osborne (2001)

Data Analysis

The data collected for the research questions were analyzed descriptively using Flesch Reading Ease Scores, Cloze Test Scores, frequency counts, and percentages.

The readability levels of the biology textbooks were determined using the Flesch Reading Ease Score. These scores were interpreted according to Table 1, which provides ranges corresponding to different readability levels and grade levels. Table 3 presents the readability levels of the biology textbooks commonly used in senior secondary schools in Kwara State.

Upon analysis, it was observed that only the text meant for SSS 1 users in textbook A met the standard, scoring 64.11. However, the texts for SSS 2 and SSS 3 scored 55.08 and 59.74, respectively, indicating that they are fairly difficult for the designated users.

For textbook B, all three sections (SSS 1, SSS 2, and SSS 3) were found to be difficult for the users, with scores of 39.66, 42.34, and 48.73, respectively.

Textbook C revealed that the text for SSS 1 scored 67.03, indicating that it is at the standard reading level for the users. However, the text for SSS 2 scored 53.29, suggesting it is fairly difficult, while the SSS 3 text scored 47.19, indicating difficulty for the designated users.

Table 3: *Flesch Reading Ease Scores of Biology Textbooks*

| Book | Class | Readability scores | Grade Level | Description |
|------|----------|--------------------|-----------------------------|------------------|
| A. | S.S.S. 1 | 64.11 | 8 – 9 th grade | Standard |
| | S.S.S. 2 | 55.08 | 10 – 12 th grade | Fairly difficult |
| | S.S.S. 3 | 59.74 | 10 – 12 th grade | Fairly difficult |
| B. | S.S.S. 1 | 39.66 | College grade | Difficult |
| | S.S.S. 2 | 42.34 | College grade | Difficult |
| | S.S.S. 3 | 48.73 | College grade | Difficult |
| C. | S.S.S. 1 | 67.03 | 8 – 9 th grade | Standard |
| | S.S.S. 2 | 53.29 | 10 – 12 th grade | Fairly difficult |
| | S.S.S. 3 | 47.19 | College grade | Difficult |

Table 4 presents the reading comprehension levels of students using biology textbooks A, B, and C. For biology textbook A, among SSS 1 readers, 17% read at the independent level, 58% at the instructional level, and 25% at the frustration level. In SSS 2, only 8% read independently, 33% at the instructional level, and the majority at the frustration level. SSS 3 respondents had 17% reading with ease, 25% found it appropriate, and 58% found it difficult.

Regarding biology textbook B, among SSS 1 respondents, 17% found it easy to read, 33% appropriate, and 50% difficult. In SSS 2, 25% found it easy, 25% appropriate, and 50% difficult. None in SSS 3 found it easy, 33% appropriate, and 67% difficult.

For biology textbook C, among SSS 1 respondents, 17% found it too easy, 33% appropriate, and 50% difficult. In SSS 2, none found it easy, 38% appropriate, and 62% difficult. In SSS 3, 36% found it easy, 45% appropriate, and 19% difficult.

Overall, the analysis indicates varied levels of readability and comprehension among students using different biology textbooks.

Table 4: *Cloze Test of Readability of Biology Textbooks*

| Book | Class | Reading level | % Score | No. of students | % Students | Remark |
|------|-------|---------------|----------|-----------------|------------|---------------|
| A | SSS 1 | Independent | 60 – 100 | 2 | 17 | Too easy |
| | | Instruction | 40 – 59 | 7 | 58 | Appropriate |
| | | Frustration | 0 – 39 | 3 | 25 | Too difficult |
| | SSS 2 | Independent | 60 – 100 | 1 | 8 | Too easy |
| | | Instruction | 40 – 59 | 4 | 33 | Appropriate |
| | | Frustration | 0 – 39 | 7 | 58 | Too difficult |
| | SSS 3 | Independent | 60 – 100 | 2 | 17 | Too easy |
| | | Instruction | 40 – 59 | 3 | 25 | Appropriate |
| | | Frustration | 0 – 39 | 7 | 58 | Too difficult |
| B | SSS 1 | Independent | 60 – 100 | 2 | 17 | Too easy |
| | | Instruction | 40 – 59 | 4 | 33 | Appropriate |
| | | Frustration | 0 – 39 | 6 | 50 | Too difficult |
| | SSS 2 | Independent | 60 – 100 | 3 | 25 | Too easy |
| | | Instruction | 40 – 59 | 3 | 25 | Appropriate |
| | | Frustration | 0 – 39 | 6 | 50 | Too difficult |
| | SSS 3 | Independent | 60 – 100 | 0 | 0 | Too easy |
| | | Instruction | 40 – 59 | 4 | 33 | Appropriate |
| | | Frustration | 0 – 39 | 8 | 67 | Too difficult |
| C | SSS 1 | Independent | 60 – 100 | 2 | 17 | Too easy |

| | | | | | |
|-------|-------------|----------|---|----|---------------|
| | Instruction | 40 – 59 | 4 | 33 | Appropriate |
| | Frustration | 0 – 39 | 6 | 50 | Too difficult |
| SSS 2 | Independent | 60 – 100 | 0 | 0 | Too easy |
| | Instruction | 40 – 59 | 3 | 38 | Appropriate |
| | Frustration | 0 – 39 | 5 | 62 | Too difficult |
| SSS 3 | Independent | 60 – 100 | 4 | 36 | Too easy |
| | Instruction | 40 – 59 | 5 | 45 | Appropriate |
| | Frustration | 0 – 39 | 2 | 19 | Too difficult |

The analysis presented in Table 4 provides insight into the reading comprehension levels of students using biology textbooks A, B, and C across different senior secondary school (SSS) levels.

For biology textbook A, among SSS 1 students, 17% were able to read the textbook independently, while 58% read it at the instructional level, and 25% experienced frustration. In contrast, only 8% of SSS 2 students read at the independent level, with 33% at the instructional level and the majority facing frustration. Among SSS 3 students, 17% read the textbook with some ease, 25% found it appropriate, and 58% found it difficult to read.

Examining biology textbook B, among SSS 1 students, only 17% found the textbook easy to read, while 33% found it appropriate, and 50% found it difficult. Similarly, 25% of SSS 2 students found it easy, 25% appropriate, and 50% difficult, while none of the SSS 3 students found it easy, 33% found it appropriate, and 67% found it difficult to read.

For biology textbook C, 17% of SSS 1 students found it too easy, 33% found it appropriate, and 50% found it too difficult. Among SSS 2 students, none found it easy, 38% found it appropriate, and 62% found it difficult, while 36% of SSS 3 students found it easy, 45% appropriate, and 19% difficult to read.

Overall, the analysis reveals varying levels of readability and comprehension across different biology textbooks and SSS levels. These findings highlight the importance of considering students' comprehension abilities when designing and selecting textbooks for educational purposes.

Results

The analysis of the data regarding the readability and comprehension levels of biology textbooks used in senior secondary schools in Kwara State yielded several key findings:

1. Readability Levels: The Flesch Reading Ease Scores were utilized to determine the readability levels of the biology textbooks. It was observed that:

- Textbook A: The text intended for SSS 1 users met the standard readability level, scoring 64.11. However, texts for SSS 2 and SSS 3 were fairly difficult, scoring 55.08 and 59.74, respectively.
- Textbook B: All sections (SSS 1, SSS 2, and SSS 3) were found to be difficult for the users, with scores of 39.66, 42.34, and 48.73, respectively.
- Textbook C: The text for SSS 1 was at the standard reading level, scoring 67.03. However, the text for SSS 2 was fairly difficult, scoring 53.29, and the text for SSS 3 was difficult, scoring 47.19.

2. Reading Comprehension Levels: The comprehension levels of students using biology textbooks A, B, and C were analyzed. The findings include:

- Textbook A: Among SSS 1 students, 17% read independently, 58% at the instructional level, and 25% experienced frustration. In SSS 2, only 8% read independently, with 33% at the instructional level and the

majority facing frustration. Among SSS 3 students, 17% read with ease, 25% found it appropriate, and 58% found it difficult.

- Textbook B: Among SSS 1 students, 17% found it easy to read, 33% appropriate, and 50% difficult. In SSS 2, 25% found it easy, 25% appropriate, and 50% difficult. None of the SSS 3 students found it easy, 33% found it appropriate, and 67% found it difficult to read.

- Textbook C: Among SSS 1 students, 17% found it too easy, 33% appropriate, and 50% difficult. In SSS 2, none found it easy, 38% appropriate, and 62% difficult. In SSS 3, 36% found it easy, 45% appropriate, and 19% difficult to read.

These findings underscore the varying levels of readability and comprehension across different biology textbooks and SSS levels, emphasizing the importance of considering students' comprehension abilities in textbook selection and design.

Discussion of Results

The analysis of the readability and comprehension levels of Biology textbooks frequently utilized in upper secondary schools across Kwara, Nigeria reveals several important insights into the challenges students face in accessing and understanding these educational materials.

Firstly, the findings indicate that the readability levels of the biology textbooks vary significantly across different sections and textbooks. While some sections meet the standard readability level for their intended users, others are found to be fairly difficult or even challenging. This suggests that there is a lack of consistency in the readability of the textbooks, which may pose difficulties for students in effectively engaging with the content.

Moreover, the comprehension levels of students using these biology textbooks also vary across different sections and textbooks. The analysis shows that a significant proportion of students, particularly those in higher SSS levels, face challenges in comprehending the textbooks, with many experiencing frustration or finding the materials too difficult to read independently. This highlights the importance of considering students' comprehension abilities when designing and selecting textbooks, as materials that are too challenging may hinder students' learning progress.

The discrepancies in readability and comprehension levels across different textbooks and SSS levels underscore the need for targeted interventions to improve students' access to and understanding of educational materials. Efforts to enhance the readability of textbooks, such as simplifying language and structure, may help make the content more accessible to students with varying reading abilities. Additionally, providing supplementary support, such as guided reading exercises or comprehension strategies, can assist students in navigating challenging texts and improving their comprehension skills.

Furthermore, the findings emphasize the importance of ongoing assessment and evaluation of educational materials to ensure their suitability for diverse student populations. Regular monitoring of readability and comprehension levels can help identify areas for improvement and guide revisions to enhance the effectiveness of textbooks in supporting students' learning.

Limitations of the Study

This study is subject to certain limitations. Firstly, the relatively small sample size may limit the generalizability of the findings. Secondly, the focus on biology textbooks may not capture the broader challenges related to textbook readability and comprehension across other subjects. Additionally, the study was limited to Kwara State, and the findings may not be applicable to other regions with different educational contexts

RECOMMENDATIONS AND CONCLUSIONS

Based on the analysis and interpretation of the collected data, several conclusions and recommendations emerge. The findings reveal that not all biology textbooks used in senior secondary schools are entirely suitable for students. While two out of the three textbooks analyzed meet readability standards, none aligns with students' comprehension levels.

Therefore, it is recommended that authors of biology textbooks prioritize simplification of vocabulary during the preparation process. Reducing the complexity of words within passages can significantly enhance students' comprehension of the text. Authors should aim to use language that is accessible and understandable to the target audience, considering the cognitive abilities of senior secondary students.

Furthermore, authors should acknowledge the importance of ensuring that textbooks are easily understood by students. Hence, they should strive to employ simple words and concise sentence structures to facilitate comprehension. Texts characterized by straightforward language and shorter sentences are more likely to engage students effectively and promote learning.

In conclusion, the study underscores the necessity for biology textbook authors to prioritize readability and comprehension. By adopting strategies to simplify vocabulary and enhance text clarity, authors can contribute to the creation of educational materials that better serve the learning needs of senior secondary students in biology classrooms.

Suggestions for Future Research

1. Expand the scope of research to include textbooks from other subjects and regions. This would provide a more comprehensive understanding of readability and comprehension issues across different disciplines and educational settings in Nigeria

2. Longitudinal Study: Conduct a longitudinal study to track changes in the readability and comprehension levels of biology textbooks over time. This would provide valuable insights into trends and patterns in textbook design and effectiveness, allowing for informed decisions regarding curriculum development and instructional practices.

3. Comparative Analysis: Compare the readability and comprehension levels of biology textbooks used in Kwara State with those used in other regions or countries. By examining cross-cultural differences in textbook design and student comprehension, researchers can identify effective strategies for improving educational materials and instructional approaches.

4. Intervention Studies: Implement and evaluate interventions aimed at improving the readability and comprehension of biology textbooks. This could involve developing and testing alternative textbook formats, instructional strategies, or supplementary materials designed to enhance student understanding and engagement with the content.

Conflict of Interest

None. We, the authors, declare that we have no conflicts of interest related to the content of this manuscript. We have no financial or personal relationships that could potentially influence our objectivity in presenting the research findings. This statement is applicable to all authors listed on this submission. We have reviewed the conflict of interest policy and collectively confirm that there are no pertinent commercial or other relationships to disclose.

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