

In the Belly of Text Complexity: Unravelling the Nexus between Lexical Density and Readability

By Justine Bakuuro*

This study set out to explore the link between lexical density (LD) as a tool for determining text complexity and the general readability of texts (in this study, texts assigned to Senior High School learners in Ghana). To clearly establish this link, the levels of LD of assigned texts have to be first determined, and then, compared with their corresponding readability values. To that end, Ure's (1971) LD formula and Halliday's (1985b) LD formula have been used to determine the LD values of the sampled texts. Gunning's (1952) and Flesch's (1948) readability indices have been used to determine the readability values of same assigned texts. LD values for the sampled texts were found to be generally very high (above the widely agreed minimum of 40%); as their corresponding readability values were low. The correlation between LD and readability is therefore adequately revealed: high LD translates directly into low readability while low LD translates directly into high readability. Implicatively, low readability of texts definitely affects learner progress negatively.

Keywords: *lexical density, readability, Senior High School learners in Ghana, Ure's (1971) LD formula, Halliday's (1985) LD formula, Gunning's (1952) readability index, Flesch's (1948) readability index*

Introduction

In teaching and learning, the most important factor apart from the teacher is the textbook (Sholichatun 2011). The textbook is a written document that facilitates teaching and learning between the teacher and the student. It outlines the content that a teacher should teach his students and, needless to say, it plays very important roles in the teaching-learning process. In an English textbook, there are various sections one of which is the reading section. Sholichatun (2011) states that knowledge and information from texts is received via the reading process, and this is not in contention. This all-important language skill (reading) is as good as understanding what is read.

As Hammond et al (2016) puts it, the effective use of the skills of language is not acquired naturally but learnt, and enhanced as a set of practices in formal instructional settings. Reading without understanding is thus a fruitless exercise in the teaching-learning process. Learners at the SHS in Ghana encounter myriad of obstacles in their quest to construct meaning from texts in their English textbooks. My preliminary observations in different schools as I teach the English language attests to this fact. It appears that there is general mismatch of text and academic levels in Ghanaian Senior High School English textbooks. To exhaust this subject,

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the study is carried through this outline: introduction, problem statement, objectives, questions, theory, literature, method, data analysis, findings & discussion of findings and conclusion to the study.

Problem Statement

Over the years, there have been myriads of unfavourable reportage from the West African Examinations Council (WAEC) regarding the generally poor performance of SHS students at the West African Senior School Certificate Examinations (WASSCE). Among other factors, poor understanding of written material (i.e., questions, passages, instructions, etc.) constitute the reason for this state of affairs. One may therefore wonder whether students at the senior high school in Ghana really understand what they read from their textbooks. Not understanding what one reads is only as good as not reading at all. This implies therefore that texts assigned to various grades at the SHS in Ghana ought to meet general readability standards so as to boost academic performance by carrying along all shades of learners. A text that does not fit the readability level of a particular grade (higher or lower than the intended grade) is a disincentive to a learner's academic progress as it retards comprehension and breeds learner apathy among other disadvantages. Some learners may get frustrated along the educational ladder as a result of this and may ultimately drop out of school. To that end, this study purports to determine whether SHS texts suit their appropriate levels and how lexical density translates into readability of these texts.

Research Objectives

1. To explore the level of lexical density of texts used in Senior High School English textbooks across genres of writing in Ghana.
2. To explore the relationship between lexical density and readability in Senior High School English textbooks across genres of writing in Ghana.

Research Questions

1. What is the level of lexical density of texts used in Senior High School English Textbooks across genres of writing in Ghana?
2. What is the relationship between lexical density and readability in Senior High School English Textbooks across genres of writing in Ghana?

Theoretical Underpinning

This study is basically anchored on the readability theoretical concept, championed by Gunning and other readability scholars. As a theoretical concept,

readability states that the ease at which a text can be read and understood determines the readability of it. Gunning (1952) defines it as the “easy degree” of a text to be understood. That is, readability refers to how easily one relates with written content. Gunning (1952) is widely credited with this concept through his innovation of what he called the Gunning Fog Index (GFI). Under this concept, ‘difficult’ words are counted and added to average number of words per sentence and then multiplied by 0.4. This gives the readability degree of the text under study. This procedure is applied in the analysis of sections of the data for this study.

Literature Review

Pratiwi (2014) opines that when students are given texts which do not fit their academic or skill levels, students’ understanding of such texts are greatly hampered. Students may read a lot without understanding what is read and may not recollect most of what is read. Gunning (1952) states that when students encounter many unfamiliar vocabularies in their reading process, they do not understand the text, hence learning does not take place. Use of borrowed words, unfamiliar words, figurative language and complex expressions among others are cited by scholars as the underlying obstacles to understanding a text. In this regard, many researchers have identified lexical density (LD) as one of the leading factors in determining text difficulty or complexity. Among other scholars, Halliday (1985b), Ure (1971), Flesch (1948), Scholichatun (2011), To et al. (2013), Nesia and Ginting (2014), Eggins (2004) and Khamahani (2015) underscore this point by stating that texts that have high LD are generally more complex or difficult to study or understand than those with low LD. Lexical Density is seen as the most fundamental determining factor of text complexity owing to its generic focus on the lexicon. Lexemes are the basic building blocks of syntax and therefore any syntactic study, such as this one, that dwells heavily on explicating the function of the lexicon must be fundamental and succinct.

Lexical density simply means the number of content words in relation to the total number of words in a text. Some scholars (notably Halliday) also define LD as the total number of lexical or content words in proportion to the number of clauses in a text (Halliday 1985b). Halliday adds that a score of between 1.5 and 2.9 using this formula suggests a text as being in the spoken mode whilst those with a score of between 3.0 and 6.0 are characterized as being in the written mode and having average standard LD. Pratiwi (2014) agrees with Halliday on this definition and assertion. Ure (1971) and Eggins (2004) however agree with the first definition above: LD is total number of content/lexical words in a text in proportion to overall number of words in the text.

Content words include words from the four (4) main word classes namely nouns, adjectives, verbs and adverbs. It must be quickly added that only lexical verbs and lexical adverbs are considered as content words. Non-lexical, grammatical or functional word classes like prepositions, conjunctions, articles, non-lexical verbs/adverbs are not content words (Halliday 1985b). It is believed

that the higher the number of content words in a text the more informative the text becomes and therefore LD is a measure of how informative a text is (Sholichatun 2011). To et al (2013) observed that out of four texts used, three had high LD ratios and were found to be difficult for intermediate learners. O'Sullivan et al (2020) cite with this assertion when they say that LD is a measure of the difficulty level of a text. Because of the high load of information in texts with high LD, comprehension and recollection is compromised greatly. Content words are mostly generally new and unfamiliar to the reader and that affects understanding, and when understanding takes place too, the learner is not likely to remember all the pieces of information conveyed, especially the details, due to the fact that a lot of information has been provided. With low LD texts, the opposite is true. Analyzing LD therefore helps authors and teachers determine which text is difficult or simple to suit their varied audience. It also helps us determine how informative a piece of information is.

From the definition of the term "text", it is derived that texts are print manuscripts that are meant to be read and understood. The extent to which a text can be interpreted and understood by the reader underlies the very essence of the concept "readability". According to Turkben (2019), readability is the degree of ease by which a text can be understood. Meaning construction from a reading text is essential to learning. Similarly, Li and Zhang (2021), define readability as how easily written materials can be read and understood. Thus, the ability of the reader to relate to written content with ease is what readability is all about. O'Sullivan et al (2020) underscore the fact that the readability level of a text which is based on linguistic factors and human enchantment is not more than a support tool for a writer in adjusting the readability of a text with the ability of the readers. Lee and Lee (2020) indicate that text readability level enables educationists and authors to communicate effectively. They do this by applying the readability theory to texts to determine how easy they are to comprehend both in terms of their forms and content.

In determining the readability of a text, Gunning Fog Index (GFI) is used and widely accepted by most authors and educationists. This formular is simple in application. According to Gunning (1952), the GFI is used to determine the amount of fog, obscurity, ambiguity or complexity in writing. He argues that words that have 3 or more syllables are "hard words" and that these words should be counted and added to the average length of the sentences in the text. The result is then multiplied by 0.4.

Admittedly, there are numerous formulae in measuring readability but Gunning's formular is the most popular and widely used, arguably, due to its simplicity and ease of applicability. As indicated earlier, the main goal of the readability theory is to improve upon writing and therefore this quest by sectors of society to improve upon writing has resulted in well over a hundred different methods in determining readability. It is worthy of note that most of these formulae are based on the idea that when short sentences and short words are used in a text, that text will generally have high readability rate.

In the light of this, the study takes a close look at the extent of lexical density and readability of texts used in Ghanaian Senior High School (SHS) English

textbooks. Basically, the connect between LD and text readability at each of the three stages of learning at the Senior High School level in Ghana remains the focus of this study.

Methodology

Instruments and Instrumentation: Textalyser, Microsoft Word, Microsoft Excel and lexicool were the tools used to process the text data into numerical data. These tools were used to count words, syllables, sentences, clauses, phrases and letters. The researcher manually cross checked the analyzed text data to ensure accuracy, validity and reliability of overall results.

Ethical Considerations: The researcher took an official letter of introduction from the department which he emailed to the author of *Global Series*, asking for permission to use the book. Permission was duly granted by the author before the researcher went on to use the texts for the analysis. This study does not involve research participants and uses only secondary data for the analysis.

Trustworthiness of Data: This study is a pure textual analysis based on laid down theoretical and conceptual paradigms. Apart from possible human error in the computational analysis, which the researcher is wide alert about, the human factor in this study is totally absent. The methodological tools employed in the analysis are tried, tested and widely used in this field of study. Regarding the sampled texts which form the data of this study, the texts are drawn from a widely used English textbook series in Ghana which is recommended by the Ghana Education Service for Senior High Schools. This authenticates the data used for the analysis.

Inter-rator reliability of data was checked. It is one of the verification tools according to Creswell (2014), which is used to check validity and reliability of research findings. To that end, the researcher hired the services of two (2) research assistants from the university to assist in testing data trustworthiness. Specifically, these research assistants together with the researcher independently checked the genre classification of texts, word class classification of text vocabulary, number of syllables in words used in the texts, number of words in each text, number of ranking phrases per clause, number of ranking clauses per sentence and number of sentences per text. The research assistants also assisted in the independent verification of the textual analysis method employed for the study. Results of each of the three verifiers (2 research assistants and researcher himself) were compared and confirmed before the researcher went on to use the data. To this end, Lincoln and Guba's (1985) refined concept of trustworthiness, which introduced the criteria of credibility, transferability, dependability and confirmability to parallel the conventional quantitative assessment criteria of validity and reliability, have adequately been espoused in this study..

Data Analysis Plan: The researcher used quantitative tools to present the qualitative data. This was done to enable the researcher be able to analyze data and make sense of the corpus data. As indicated earlier, the textual analysis plan is used for this study. It is from an English textbook series called *Global Series*

(Nelson, 2016) that the texts used in this study are drawn as data. *Global Series* is an English textbook used for SHS students in Ghana. It is recommended and approved by the Ghana Education Service and has been used by many schools in Ghana for many years in the teaching of the Queen's language. The texts were retyped from the textbook series using Microsoft Word processor. The retyped texts were meticulously edited to be exactly the same as the original ones from the textbook. They were then analyzed using the four (4) LD and readability metrics.

Data Analysis

Levels of Ure and Halliday (H'day) Lexical Density (LD) Values per Genre per Level

As stated earlier, the LD values drawn from the textual analysis and their respective averages are indicated in table 1. The levels of LD using Ure and Halliday's separate formulae on each text are stated side by side in the table. This makes it easier to see their levels and be able to compare these levels as revealed in the data analysis. From the table, it is clear that the levels of Ure and Halliday LD values on the sample texts are generally very close on the average. This presupposes that the LD metrics used by the two scholars have about the same level of accuracy in their application to texts.

Table 1. *Levels of Ure and Halliday (H'day) Lexical Density (LD) Values per Genre per Level*

	Text 1		Text 2		Text 3		Text 4		Text 5		Averages	
	Ure	H'day	Ure	H'day	Ure	H'day	Ure	H'day	Ure	H'day	Ure	H'day
Narrative texts-SHS1	51	50	56	53	71	69	59	58	65	63	60	59
Narrative texts-SHS2	51	35	61	58	68	66	57	55	62	58	60	54
Narrative texts-SHS3	56	48	60	61	70	70	61	53	61	60	62	58
Descriptive texts-SHS 1	53	35	58	62	73	69	62	60	59	58	61	57
Descriptive texts-SHS 2	61	72	64	61	64	76	59	58	63	61	62	66
Descriptive texts-SHS 3	55	55	59	61	74	69	63	61	66	70	63	63
Expository texts-SHS 1	61	58	57	55	71	67	65	59	67	58	64	59
Expository texts-SHS 2	56	59	66	65	69	67	66	53	64	60	64	61
Expository texts-SHS 3	62	62	62	61	66	64	67	62	59	57	63	61

From table 1, it is abundantly clear that the texts used for this study had very high LD ratings as all the average LD values by both authorities are well above the 40% benchmark for high LD. Ure's LD average values are fairly higher than those of Halliday. Whilst Ure's LD metric recorded 60% as the lowest LD average value and 64% as the highest, Halliday recorded 54% as the lowest LD average value with 66% being the highest value. This is represented in figure 1 below.

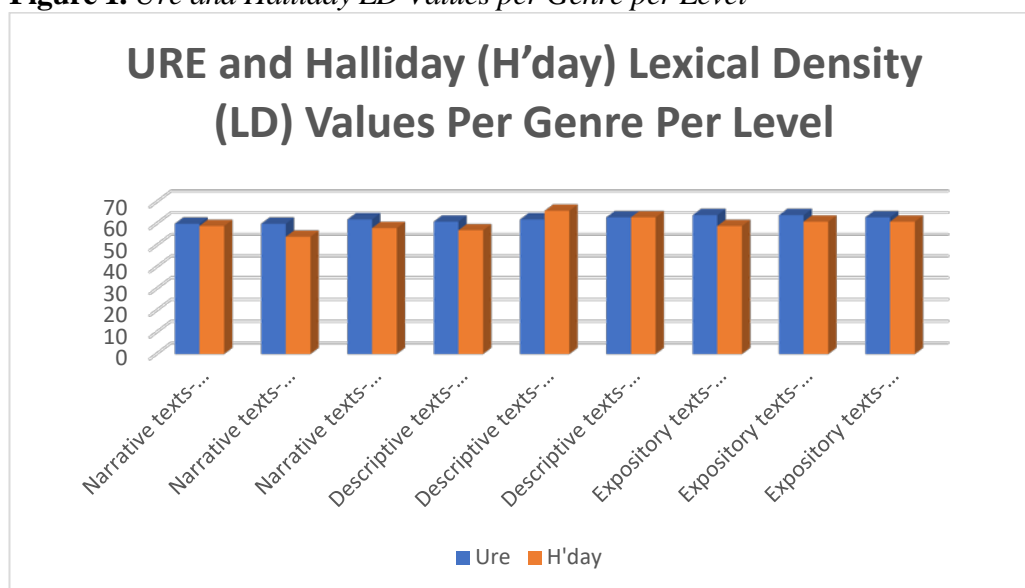
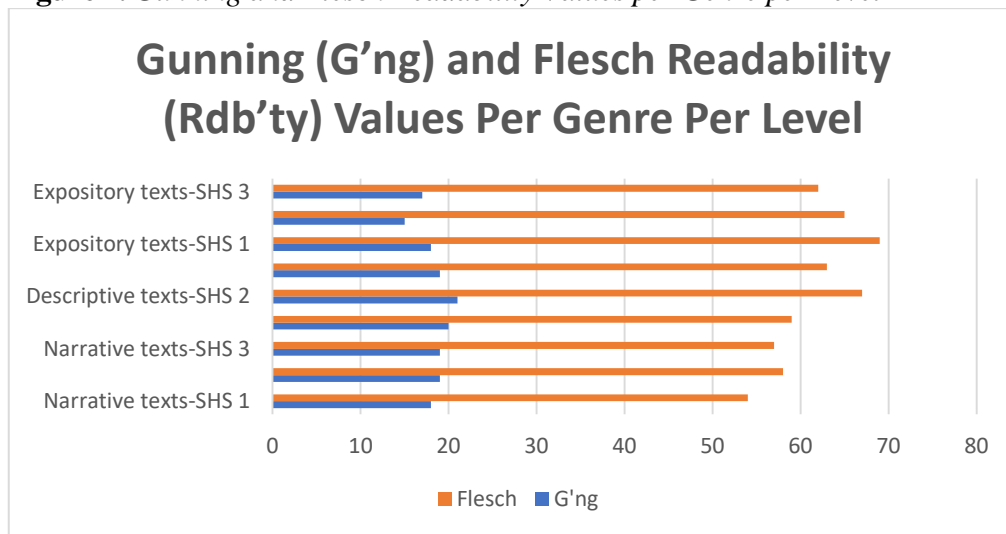
Figure 1. *Ure and Halliday LD Values per Genre per Level***Levels of Gunning (G'ng) and Flesch Readability (Rdb'ty) Values per Genre per Level**

Table 2 provides detailed statistical information on the texts used for readability analysis. The readability values arrived at using the two readability metrics by Gunning and Flesch are shown together with their respective averages for the analysis. Unlike Ure and Halliday's LD values which are generally very close on the average, Gunning and Flesch's readability values show a vast gap of difference in terms of their levels. This pre-supposes that the readability metrics used by the two scholars disagree largely in terms of accuracy in their application to same texts.

Table 2. *Levels of Gunning (G'ng) and Flesch Readability (Rdb'ty) Values per Genre per Level*

	Text 1		Text 2		Text 3		Text 4		Text 5		Averages	
	G'ng	Flesch	G'ng	Flesch	G'ng	Flesch	G'ng	Flesch	G'ng	Flesch	G'ng	Flesch
Narrative texts-SHS1	12	77	08	43	14	38	24	68	34	46	18	54
Narrative texts-SHS2	09	77	18	51	18	41	21	71	31	51	19	58
Narrative texts-SHS3	10	80	15	44	21	36	18	72	30	53	19	57
Descriptive texts-SHS 1	09	83	19	34	23	35	19	81	29	64	20	59
Descriptive texts-SHS 2	11	77	21	46	18	68	25	76	28	67	21	67
Descriptive texts-SHS 3	14	68	20	41	15	63	28	72	17	71	19	63
Expository texts-SHS 1	15	80	14	56	18	71	30	69	11	69	18	69
Expository texts-SHS 2	14	71	16	47	18	77	18	68	09	64	15	65
Expository texts-SHS 3	10	77	13	40	20	65	27	67	14	60	17	62

Figure 2. *Gunning and Flesch Readability Values per Genre per Level*



From Table 2, it is abundantly clear that the texts used for this study had relatively low readability ratings. Gunning’s readability average values are far lower than those of Halliday. Whilst Gunning’s readability metric recorded 15% as the lowest readability average value and 21% as the highest, Halliday recorded 54% as the lowest LD average value with 69% being the highest value. The generally high LD values have accordingly translated into generally low readability values. This is represented in Figure 2.

The Relationship between LD and Readability

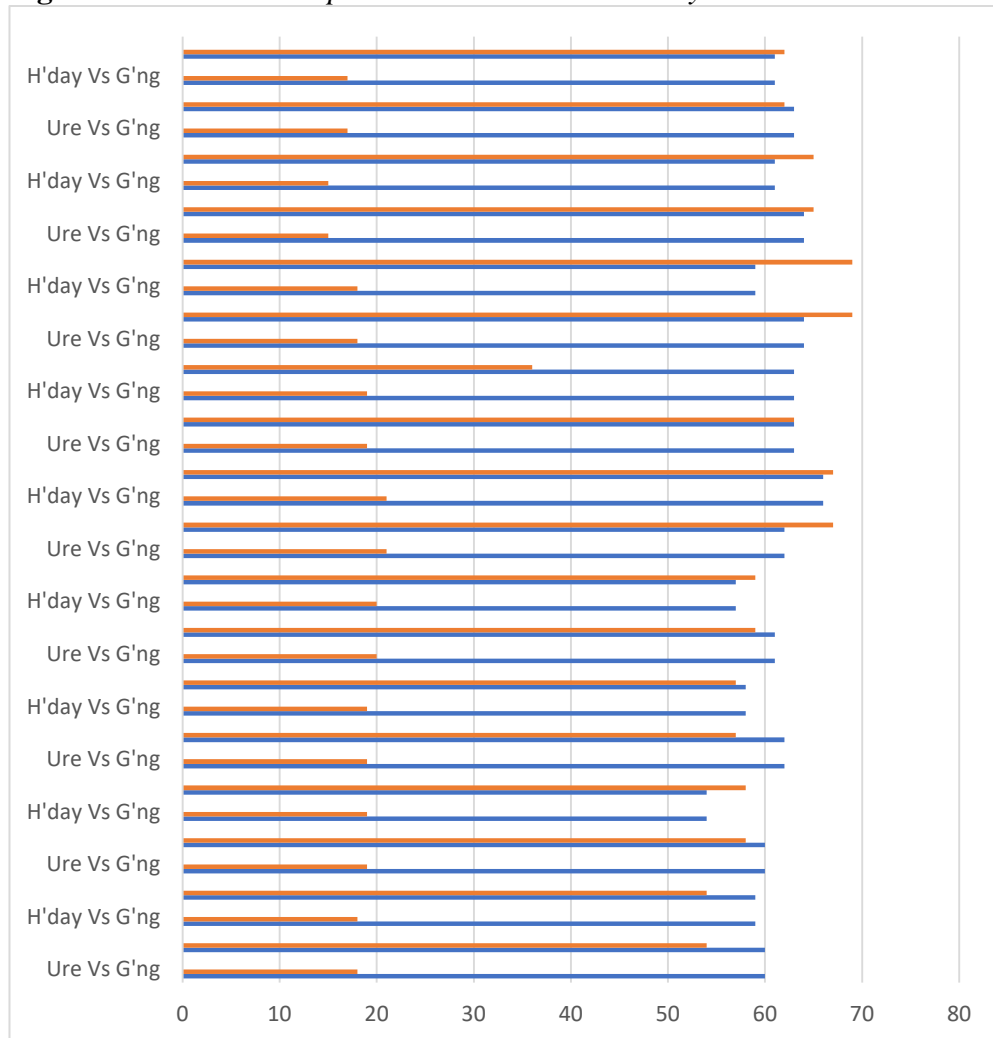
Table 3. *The Relationship between LD and Readability*

	Ure Vs G'ng	Ure Vs Flesch	H'day Vs G'ng	H'day Vs Flesch
Narrative texts-SHS1	60 18	60 54	59 18	59 54
Narrative texts-SHS2	60 19	60 58	54 19	54 58
Narrative texts-SHS3	62 19	62 57	58 19	58 57
Descriptive texts-SHS 1	61 20	61 59	57 20	57 59
Descriptive texts-SHS 2	62 21	62 67	66 21	66 67
Descriptive texts-SHS 3	63 19	63 63	63 19	63 63
Expository texts-SHS 1	64 18	64 69	59 18	59 69
Expository texts-SHS 2	64 15	64 65	61 15	61 65
Expository texts-SHS 3	63 17	63 62	61 17	61 62

Having explored the LD and readability levels of the sampled texts, we shall now look at how LD and readability relate. The focus here is basically to find out whether high LD translates directly into low readability and vice versa.

This segment of research question one seeks to map each metric onto another permutatively. The focus remains finding out the extent to which each one of the metrics relate to the other three metrics. One of the ground assumptions of this study is the fact that high LD translates directly into low readability and vice versa. This research question seeks to test the veracity of that assumption. From Table 3, it is established that Ure versus Flesch and Halliday versus Flesch permutations show the closest degree of relationships. Wherever Gunning comes into the picture, it shows a weak relationship because of the generally low readability values derived using the Gunning readability formular. This one-on-one relationship between metrics is presented graphically in Figure 3.

Figure 3. *The Relationship between LD and Readability*



Findings and Discussion of Findings

From the foregoing analysis, it is revealed that texts assigned to SHS students in the Ghanaian Education System have very high lexical density. This trend cuts across the three genres of writing under review in this study and the three academic levels implored in the study. Lead scholars on LD generally agree that an LD score of 40% and above is on the high side (Ure 1971, Halliday 1985b, Eggins 2004). As indicated earlier, high LD translates directly into low readability. This implies that texts in SHS English textbooks in Ghana are very difficult to read.

In Gyasi (2017), the results showed that a majority (63%) of the research articles used as data were graded as ‘difficult’ to read; that is, above the ‘standard’ readability level of 60 when measured on the FRE scale. This affirms the findings from research question one which reveals generally, a very high LD and by implication, readability rating of the texts used for this study.

In similar affirmation, findings in Gyasi (2013) revealed that, the textbooks used for the study were difficult to read on the average and that the Integrated Science textbook was the most difficult among all the textbooks, followed by the Physics textbook. Similarly, it was found in Owu-Ewie (2014) that most of the passages were above the age of learners and were therefore difficult for them to read and comprehend.

Findings in Nunoo et al. (2021) revealed that the selected textbooks had a problematic level of comprehension for many of their intended readership except for those who had additional resources for assistance. This directly confirms the findings from this research question which indicate that LD and readability levels are very high across genre and grades.

Data analysis under this research question further reveal that Ure’s (1971) and Halliday’s (1985b) overall LD averages across genres and academic levels are very well above the 40% mark for “high” LD rating. This affirms Fadhillah’s (2018) findings in which 15 sampled texts were found to have an overall LD average score of 50% across descriptive, narrative and recount genres. Quite similarly, this finding affirms Nesia and Ginting (2014) whose study found 4 out of a total of 8 sampled texts to have low LD levels, across genre and level. Nesia and Ginting’s (2014) findings suggest that the sampled texts for SHS students were averagely readable. This study extends the literature in Nesia and Ginting (2014) because it includes the Gunning (1952) readability index in the analysis of data.

Aulia (2019) quite corroborates the findings in Fadhillah (2018) and Nesia and Ginting (2014) as explained above. Aulia (2019) studied lexical density using Ure (1971) formular in 8 selected texts downloaded from the British Broadcasting Corporation (BBC) website as data. The texts were excerpts from the BBC Online Newspapers, sampled between April and May 2019. Applying a descriptive qualitative method of analysis, the study revealed that 5 out of the total of 8 selected texts had dominant content words compared to non-content words, making them lexically denser than the remaining 3 texts. Aulia (2019) and this study therefore corroborate significantly in terms of key findings. This study

comes with a vast extension of literature in view of Aulia (2019) as Aulia (2019) only applied Ure (1971) LD formula without comparing it with Halliday's (1985b) LD formula and without applying Gunning (1952) and Flesch (1948) readability indices.

In sharp contrast to the findings from research question one, Syarif and Putri (2018) targeted to uncover how lexical density reveals students' ability in doing academic writing. Data was taken from the introductory parts of thesis proposals written by graduate students of English. The analysis showed that there was lower lexical density (31.19%), with grammatical complexity being the underlying factor contributing to lexical density. The study revealed further that the complexities came about as a result of students still having limited knowledge about the language use in academic writing. This implied that the students' ability in academic writing was still at average level.

The findings from research question one further affirms the findings in To et al. (2013) which aimed to examine the LD and readability of four texts from English textbooks. The study revealed three of the four texts to be of high LD. Only the text for Upper-intermediate was found to have a relatively lower LD of 45.5% according to Flesch's (1948) Reading Ease Scale. Ironically however, texts 2 and 3 which had higher LD levels were found to be relatively difficult according to Flesch's (1948) Reading Ease Scale whilst text 1 was fairly easy to read with text 2 being the most challenging. It similarly affirms Ridwan and Yusuf (2016) whose study was to assess the level of LD in undergraduate thesis abstracts to determine how informative or loaded they were. From their analysis of 7 thesis abstracts, they uncovered that average LD level of the texts was 0.57 or 57% which suggested a very high LD level and 1:8 average Grammatical Intricacy (GI) ratio, indicating a high GI level also, since the ratio is high (1:8).

Sholichatun's (2011) study which used 10 texts as data, found 3 out of the number to have lower lexical densities whilst 7 had high lexical densities. This revelation by Sholichatun (2011) very much affirms the findings under research question one of this study. In further affirmation of findings under research question one, Andara and Rosyida's (2021) study reveal that all the 5 sampled texts used in the study had high LD levels with the lowest LD rating being 55% and the highest rating being 64%. In similar affirmation, Hidayatillah and Zainil (2020) researched into the readability of a course textbook on Semantics and Pragmatics as a course of study. The study concluded that the readability level of the textbook, as observed by the students, was indeed too high (73%), resulting in the difficulty in reading the text by students.

Again, the narrative genre is found to have the lowest LD across genres and levels in this study. This revelation affirms Nesia and Ginting's (2014) findings which suggest that the Expository (explanation) genre is the most difficult genre to read and understand across genre and level, whilst the Narrative genre remains the most readable. Fadhillah (2018) however finds narrative genre to be of average LD rating. This neither affirms nor contradicts the findings in this study but one may however see it as more of an affirmation of findings in this study than a contradiction in view of the fact that an average LD rating is more closely related to a low LD rating than a high LD rating. Findings in Turkben (2019) perfectly

corroborate the findings in this study as it underscores the fact that narrative texts are generally more comprehensible to High school learners.

Still on genre and readability, the expository genre generally proves to be the most difficult. Turkben (2019) underscores this fact with its findings which indicate that informing texts (a common example being Expository texts) are the most difficult texts in terms of readability. Turkben (2019) therefore affirms this finding alongside other studies (To et al. 2013, To 2018, Fadhillah 2018, Bani-Amer 2021).

Regarding readability, this study reveals a very sharp contradiction in readability levels between Gunning (1952) and Flesch (1948) with overall readability averages of 12% and 77% respectively. Whilst this contradiction only lies in the use of the two different readability formulae, the grand overall readability average of the two formulae across genre and level remains on the low side (44.5%), therefore suggesting high LD (Ure 1971). This finding is in contradiction with the findings in Turkben (2019) which found readability levels of sampled texts to be generally high (easy to read) with the narrative texts being comparatively easier to read than informing texts. The findings in this study regarding the extent of readability of assigned texts affirms the findings in Nunoo et al (2021) which uncovered that assigned textbooks for Junior High School learners in Ghana were inappropriate in terms of their readability in relation to academic levels because they had very high lexical density and readability levels. The study found the sampled texts to be "...too difficult with long sentences and multi-syllabic words...".

Similarly, Owu-Ewie's (2018) paper corroborates this piece of finding in the study as it underscores the fact that texts assigned for SHS students are "too difficult" for respective intended levels. This according to the author suggests that government and textbook authors in general ought to consider text-grade levels before assigning texts to learners. Having explored the general key findings and their relationship with literature, we shall now take the authorities and the key findings revealed by their proposed formulae one after the other.

LD analysis in this study, using Ure (1971) LD formular reveals a very high LD rating of sampled texts from English textbooks used for SHS learners within the Ghanaian educational system. This is classified as very high according to Ure's (1971) 40% benchmark for identifying "high" LD of texts. This finding contradicts the findings in Turkben (2019) which rather finds the LD-readability levels of texts selected to be comprehensible.

Lexical density analysis using Halliday's (1985b) LD formular reveals an equally high LD rating of sampled texts. Findings under research question one equally affirms To et al (2013) which aimed to examine the LD and readability of four texts from English textbooks. The study revealed three of the four texts to be of high LD. Only the text for Upper-intermediate was found to have relatively lower LD of 46% according to Flesch's (1948) Reading Ease Scale. Ironically however, texts 2 and 3 which had high LD levels were found to be relatively difficult according to Flesch's (1948) Reading Ease Scale whilst text 1 was fairly easy to read with text 2 being the most challenging. It similarly affirms Ridwan and Yusuf (2016) whose study was to assess the level of LD in undergraduate thesis abstracts to determine how informative or loaded they were. From their

analysis of 7 thesis abstracts, they uncovered that average LD level of the texts was 0.57 or 57% which means high LD level and 1:8 average GI ratio, indicating high GI level also, since the ratio is high (1:8). The current study is an extension of To et al (2013) and Ridwan and Yusuf (2016) to the extent that these two earlier studies were not interested in formular comparisons. Their focus was largely on determining lexical density and the resultant readability levels of the texts under study.

On readability, Gunning's (1952) readability analysis reveals a low readability rating of selected texts used in this study. This low readability rating translates into the generally very high LD ratings of the same texts under study. That is, a highly lexically dense text is expected to have a corresponding very low readability rating and this has been abundantly proven by this piece of finding. However, Flesch's (1948) readability analysis reveals a rather contradictory phenomenon. As stated above, a text that has high LD rating is logically expected to have a corresponding low readability index as seen in Gunning (1952) analysis using the Gunning Fog Index. However, Flesch's (1948) readability analysis reveals a very high readability rating of texts used in the study. This finding stands opposed to the findings in the readability analysis of Gunning (1952). Sholichatun (2011) very much affirms this finding as it found 7 out of 10 texts to be unreadable to the intended grade. Given the comparative focus and the in-depth exploration of readability beyond lexical density values in this study, one may conclude that this study is an extension of Sholichatun (2011) in terms of literature.

Conclusion

Given the close relationship between LD and readability as prime variables in determining text complexity, the grand LD and readability average reveals a very high LD-Readability index of texts assigned to Ghanaian SHS students from their English textbooks. Lexical density and readability values of texts in Ghanaian English textbooks are generally high across genre and academic levels. LD values are generally very high, which implies very low readability. The relationship (nexus) between LD and readability is therefore the fact that, high LD translates DIRECTLY into low readability. Implicatively, this negatively affects academic progress among SHS students in Ghana, and by extension everywhere else, as they find texts generally very difficult to read and understand.

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Appendices

The full textual analysis has a total of 90 analysed versions of the 9 separate sampled texts used in the study. The following are 4 sample analysis of the texts using the 4 metrics.

Appendix 1. Sample LD Analysis using Ure's LD formular: SHS 1 Descriptive text

KEY: Bold print = content/lexical words **Non-bold print** = grammatical/non-content words

During this **time** **Okonkwo's** fame had **grown** like a **bush** fire in the **harmattan**. He was **tall** and **huge**, and his **bushy** eyebrows and **wide** nose gave him a **very** severe look. He **breathed** heavily, and it was **said** that, **when** he **slept**, his **wives** and **children** in their out **houses** could **hear** him **breathe**. **When** he **walked**, his **heels** **hardly** touched the **ground** and he **seemed** to **walk** on **springs**, as if he was **going** to **pounce** on **somebody**. And he did **pounce** on **people** quite often. He had a **slight** stammer and **whenever** he was **angry** and could not **get** his **words** out **quickly** enough, he would **use** his **fists**.

The **last** match was between the **leaders** of the **teams**. They were **among** the **best** **wrestlers** in **all** the **nine** villages. The **crowd** **wondered** who would **throw** the other this **year**. Some **said** **Okafo** was the **better** man; others **said** he was not the **equal** of **Ikezue**.

Dusk was **already** **approaching** when their **contest** began. The **drums** went mad and the **crowds** also. They **surged** forward as the **two** young men **danced** into the **circle**. The **palm** fronds were **helpless** in **keeping** them **back**.

Ikezue held out his **right** hand. **Okafo** seized it and they **closed** in. It was a **fierce** contest. The **wrestlers** were **now** almost still in each **other's** **grip**. The **muscles** on their **thighs** and on their **backs** stood out **twitched**. It **looked** like an **equal** match.

The **two** judges were **already** **moving** forward to **separate** them when **Ikezue**, **now** desperate, went **down** quickly on **one** knee in an **attempt** to **fling** his man backward over his **head**. It was a **sad** miscalculation. **Quick** as the **lightening** of **Amadiora**, **Okafo** raised his **right** leg and **swung** it over his **rival's** **head**. The **crowd** burst into **thunderous** roar, **Okafo** was **swept** off his **feet** by his **supporters** and **carried** home **shoulder** high. **Variables:** Total content/lexical words=167 Total words=316

- Ure's (1971) LD Formula

Application:

$$LD = \frac{167}{316} \times 100 \quad LD=53\%$$

Appendix 2. Sample LD Analysis using Halliday's LD formular: SHS 1 Descriptive Text

KEY: Bold print = content/lexical words **Non-bold print** = grammatical/non-content words

//=boundaries of ranking clauses

During this time, **Okonkwo's fame** had **grown like a bush fire** in the **harmattan**//. He was **tall** and **huge**, // and his **bushy eyebrows** and **wide nose** gave him a **very severe look**//. He **breathed heavily**, //and it was **said** that, // **when he slept**, //his **wives** and **children** in their out **houses** could **hear** him **breathe**//. **When he walked**, // his **heels hardly touched the ground** //and he **seemed to walk on springs**, // as if he was **going to pounce on somebody**//. And he did **pounce on people quite often**//. He had a **slight stammer**// and **whenever** he was **angry** //and could not **get his words out quickly enough**, // he would **use his fists**//.

The **last match** was between the **leaders** of the **teams**//. They were **among** the **best wrestlers** in **all** the **nine villages**//. The **crowd wondered** //who would **throw** the other this **year**//. Some **said**// **Okafo** was the **better man**;// others **said**// he was not the **equal** of **Ikezue**//.

Dusk was **already approaching**// **when** their **contest began**//. The **drums went mad**// and the **crowds** also. // They **surged forward**// as the **two young men danced** into the **circle**//. The **palm fronds** were **helpless** in **keeping** them **back**//.

Ikezue held out his **right hand**//. **Okafo seized** it// and they **closed in**//. It was a **fierce contest**//. The **wrestlers** were **now almost still** in each **other's grip**//. The **muscles** on their **thighs** and on their **backs** **stood out twitched**//. It **looked like** an **equal match**//.

The **two judges** were **already moving forward** to **separate** them// **when Ikezue, now desperate, went down quickly** on **one knee** in an **attempt** to **fling his man backward** over his **head**//. It was a **sad miscalculation**//. **Quick** as the **lightening** of **Amadiora, Okafo raised** his **right leg**// and **swung** it over his **rival's head**//. The **crowd burst into thunderous roar**, // **Okafo** was **swept off** his **feet** by his **supporters**// and **carried home shoulder high**//.

Variables:

Total content/lexical items=162

Total Ranking Clauses=46

• Halliday's (1985b) LD Formula

$$LD = \frac{\text{Number of content/lexical items}}{\text{Number of ranking clauses}} \times (10)^*$$

Application:

$$LD = \frac{162}{46} \times 10^*$$

$$LD=35\%$$

NB:10* stands for the refractive percentile multiplier

Appendix 3. Sample Readability Analysis using Gunning's Readability Formular: SHS 1 Descriptive Text

KEY: Bold print =3+ syllable words/complex words **Non-bold print**=simple/non-complex words // =boundaries of sentences

During this time **Okonkwo's** fame had grown like a bush fire in the **harmattan**.// He was tall and huge, and his bushy **eyebrows** and wide nose gave him a very severe look.// He breathed **heavily**, and it was said that, when he slept, his wives and children in their out houses could hear him breathe.// When he walked, his heels hardly touched the ground and he seemed to walk on springs, as if he was going to pounce on **somebody**.// And he did pounce on people quite often.// He had a slight stammer and **whenever** he was angry and could not get his words out **quickly** enough, he would use his fists.//

The last match was between the leaders of the teams. //They were among the best wrestlers in all the nine villages.// The crowd wondered who would throw the other this year. // Some said **Okafo** was the better man; others said he was not the **equal** of **Ikezue**.// Dusk was **already** approaching when their contest began.// The drums went mad and the crowds also.// They surged forward as the two young men danced into the circle.// The palm fronds were helpless in keeping them back.//

Ikezue held out his right hand. **Okafo** seized it and they closed in.// It was a fierce contest.// The wrestlers were now almost still in each other's grip. //The muscles on their thighs and on their backs stood out twitched. It looked like an **equal** match.//

The two judges were **already** moving forward to **separate** them when **Ikezue**, now **desperate**, went down **quickly** on one knee in an attempt to fling his man backward over his head.// It was a sad **miscalculation**.// Quick as the lightening of **Amadiora**, **Okafo** raised his right leg and swung it over his rival's head.// The crowd burst into **thunderous** roar, **Okafo** was swept off his feet by his **supporters** and **carried** home shoulder high.//

Variables:

Total words =316;

3+ syllable words/complex words=26;

Total sentences=24

Gunning's (1952) Readability Formula (Gunning Fog Index- GFI)

$$0.4 \times \left[\left(\frac{\text{Total words}}{\text{Total sentences}} \right) + 100 \left(\frac{\text{Complex Words}}{\text{Total Words}} \right) \right]$$

NB: Complex words are words with 3 or more syllables.

Application:

$$\text{GFI} = 0.4 \times \left[\left(\frac{316}{24} \right) + 100 \left(\frac{26}{316} \right) \right]$$

GFI= 9%

Appendix 4. Sample READABILITY ANALYSIS using Flesch's Readability Formular: SHS I Descriptive Text

KEY: /= syllable boundaries // = sentence boundaries

Du/ring this time O/kon/kwo's fame had grown like a bush fire in the har/mat/tan.// He was tall and huge, and his bu/shy eye/brows and wide nose gave him a very se/vere look.// He breathed heav/i/ly, and it was said that, when he slept, his wives and chil/dren in their out hous/es could hear him breathe.// When he walked, his heels hard/ly touched the ground and he seemed to walk on springs, as if he was go/ing to pounce on some/body.// And he did pounce on peo/ple quite of/ten.// He had a slight stam/mer and when/ev/er he was an/ry and could not get his words out quick/ly e/nough, he would use his fists.//

The last match was be/tween the lead/ers of the teams. //They were a/mong the best wrest/lers in all the nine vil/lag/es.// The crowd wond/ered who would throw the oth/er this year. // Some said O/ka/fo was the bet/ter man; oth/ers said he was not the e/qual of I/ke/zue.//

Dusk was al/read/y ap/proach/ing when their con/test be/gan.// The drums went mad and the crowds al/so.// They surged for/ward as the two young men danced into the cir/cle.// The palm fronds were help/less in keep/ing them back.//

I/ke/zue held out his right hand. O/ka/fo seized it and they closed in.// It was a fierce con/test.// The wrest/lers were now al/most still in each oth/er's grip. //The mus/cles on their thighs and on their backs stood out twitched. It looked like an e/qual match.//

The two judg/es were al/read/y mov/ing for/ward to sep/a/rate them when I/ke/zue, now des/per/ate, went down quick/ly on one knee in an at/tempt to fling his man back/ward o/ver his head.// It was a sad mis/cal/cu/la/tion.// Quick as the light/ning of Ama/dio/ra, O/ka/fo raised his right leg and swung it o/ver his ri/val's head.// The crowd burst in/to thun/der/ous roar, O/ka/fo was swept off his feet by his sup/por/ters and car/ried home shoul/der high.//

Variables:

Total words =316;

Total syllables=417;

Total sentences=24;

FKGL=4.9

Flesch's (1948) Reading Ease (FRE)/Readability Formula

$FRE = 206.835 - (1.015 \times ASL) - (84.6 \times ASW)$

ASL=Average sentence length

ASW=Average number of syllables per word

FRE= 83%

