

**A CASE STUDY OF THE READABILITY OF  
TWO GRADE 4 NATURAL SCIENCES TEXTBOOKS  
CURRENTLY USED IN SOUTH AFRICAN SCHOOLS**

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## **ABSTRACT**

This thesis examines the readability of two grade 4 Natural Sciences textbooks currently used in South African schools. Being important sources of classroom input, particularly in grade 4 where learners are reading to learn, textbooks should be readable. That the Natural Sciences subject is only introduced in grade 4 makes the assessment of Natural Sciences textbooks at this level significant. The goal of this research therefore, is to assess the readability of two grade 4 Natural Sciences textbooks and their understandability by learners who speak English as an additional language.

The goal of assessing the Natural Sciences textbooks is achieved by the use of cloze and traditional comprehension tests, classic readability formulae, textual analysis and teacher interviews. Cloze and traditional comprehension tests are used to test learners' understanding of the textbooks and classic readability formulae are meant to assess the grade levels of the textbooks. The tests gauge learner understandability while readability formulae establish text readability. Textual analysis allows the assessment of text readability on the basis of more factors than those accommodated by readability formulae. The textual analysis also helps to identify the readability factors supporting or impeding readability. Teacher interviews are conducted to better understand the teachers' perceptions on the readability of the Natural Sciences textbooks.

The major findings of the study are that the two Natural Sciences textbooks used in the study are generally above the reading level of the intended readers, grade 4 learners and that the participating learners do not understand these textbooks. The challenges with the readability of the textbooks stem mainly from the vocabulary and concepts used in the textbooks which are not well explained.

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## LIST OF ACRONYMS & ABBREVIATIONS

LoLT	Language of Teaching and Learning
PIRLS	Progress in International Reading Literacy Study
CAPS	Curriculum and Assessment Policy Statement
CALP	Cognitive Academic Language Proficiency
RE	Reading Ease
ASL	Average Sentence Length
ASW	Average Number of syllables per Word
PHW	Percentage of Hard Words
FKRS	Flesch-Kincaid Readability Score
ARI	Automated Readability Index
GL	Grade Level
L1	First Language
L2	Second Language
BICS	Basic Interpersonal Communication Skills
ESL	English as a Second Language
EFL	English as a Foreign Language
NCS	National Curriculum Statement
ANA	Annual National Assessment
EFAL	English as a first additional language
SGBs	School Governing Boardies
OBE	Outcome Based Education
LSMs	Learning Support Materials
US	United States

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 INTRODUCTION**

This research assesses the readability of textbooks. It focuses on two selected grade 4 Natural Sciences textbooks used in South African primary schools. It is important to know whether these textbooks are at the right level for learners. Research has shown that the use of high quality textbooks can make a significant contribution to supporting learners in their learning process, as well as supporting teachers in their teaching and their professional development (Taylor, 2008; Singer & Tuomi, 2003), hence the need to assess the readability of the selected textbooks.

In this chapter I discuss the reason why I chose the readability of science textbooks as the research topic for my half-thesis. I also highlight the importance of textbooks in the learning and teaching process and then discuss the context of the study. Lastly, a brief outline of the thesis is provided.

#### **1.2 IMPORTANCE OF TEXTBOOKS**

Mikki (2000) observes that good quality textbooks are of prime importance in all schools as they are used as the basic teaching and learning resource. They are central to the process of reading. Learners extract meaning from them. However, the advent of Outcomes Based Education (OBE) discouraged teachers in South Africa from relying on textbooks as a source of learning input and encouraged them to develop their own learning and teaching support material (LSMs) (Department of Education, 2001). Such advice had its basis in the assumption that efficient teachers are designers of their own LSMs and do not necessarily need textbooks to successfully bring about learning. However, the need to develop teachers who are independent of the textbooks is challenged by Taylor as cited by Swanepoel (2010, p.56) who sees the exclusion of textbooks in the teaching and learning process as “nothing short of educational suicide on a national scale.” He also sees such negative attitudes towards textbooks as “one of the most damaging aspects of post-apartheid education” (p.59). What is needed, in his view, are appropriate textbooks which can mediate the learning of important content.

According to the former minister of Education, Kader Asmal (2002), learners work with textbooks for most of their time in the classroom and do their homework using textbooks as well. Teachers also rely on textbooks when they plan their teaching methods and lesson content (Henson, 2004; Issitt, 2004). Mohammad and Kumari (2007) note that textbooks are the main source of knowledge in many subjects.

In science teaching, where, as Lee and Spratley (2010) point out, complex classification systems, taxonomies and graphics are used extensively to represent conceptual relationships, textbooks have an important role to play. A teacher cannot be expected to represent all these on charts or on the chalkboard. Westbury, (cited in Oakes and Saunders, 2004, p. 1), also suggests that “The textbook is, in fact, the heart of the school and without the ubiquitous text there would be no schools, at least as we know them.”

Having highlighted the importance of textbooks, there is need to emphasize that textbooks have to be readable if ever they are to serve their purpose, for, as Allington (2002) notes, the value of textbooks is tied to the learners’ understanding of such textbooks. Readability of textbooks then becomes a major issue. Overly complicated textbooks lead to frustration which may then extend to books and knowledge in general (Graves & Graves, 2003). Taylor (2008) noted that this is in most cases the situation with science textbooks. According to Hsu and Yang (2007), most learners do not enjoy learning science because science textbooks are perceived to be difficult to understand. On the other hand, textbooks which are too easy rob learners of active processing, which negatively affects learning (Boscolo and Mason, 2003). Only comprehensible texts make learning enjoyable. Teachers, therefore, have to be careful to choose textbooks that are accessible to their learners but which at the same time also extend their learners’ learning. This study, therefore, pays special attention to the readability of grade 4 Natural Sciences textbooks currently used in South Africa. Knowledge of the characteristics of good quality textbooks is the key to being able to assess their readability and I now consider these characteristics.

### **1.3 CHARACTERISTICS OF GOOD TEXTBOOKS**

Mikki (2000) identifies several characteristics that contribute to a good textbook. A good textbook is well structured to allow learners to follow and make sense of the content. It should also have graphics to aid understanding by giving a pictorial representation of ideas,

which facilitate the remembrance of information. In the textbook there should be references to other related sources. A good textbook also includes exercises, which learners can use to test their skills. Learners do not like ‘bulky textbooks’ (p. 21) and so a good textbook should be long enough to cover and clarify the important concepts but not too long to intimidate the learners. Textbooks should also promote critical thinking. A textbook should have controversies and open-ended questions to foster thinking. Interesting textbooks encourage learners to read them. They become interesting because they are comprehensible to learners. Textbooks that are beyond learners' level are not interesting. These aspects are not exhaustive but merely illustrate how each characteristic of the textbook impacts on its reading by the learner. A fuller discussion of the characteristics used to assess the readability of the grade 4 Natural Sciences textbooks is made in the chapter containing the literature review on page 9.

#### **1.4 CONTEXT OF THE STUDY**

South Africa, where my study is situated, is a multilingual country with eleven official languages, of which English is the main language of power and access (Probyn, 2005). Before 1996, English and Afrikaans were used as the medium of instruction in all schools from Standard 3 (grade 5) onwards. Now, schools decide on their own which of the eleven official languages to use as their language of learning and teaching (LoLT) (Department of Education, 1997). However, every learner has to learn at least two official languages as subjects, one of which is used as the medium of instruction (Department of Basic Education, 2011). Teachers and learners are encouraged to continue using the learners’ home language as they learn the additional language. In other words, home languages may be used as LoLT just for the early years, but the home language continues to be taught as a subject. In most urban areas, schools have chosen English as LoLT, starting from grade 4, while in others they even start using English as LoLT in grade 1 (Vinjevold, 1999). This could be because English is perceived as a prestigious language and a language of power.

The first large scale national evaluations in 2001 across all nine provinces revealed grade 3 learners attaining a national average of 38% in reading and writing in their home languages (Department of Education, 2003). The Progress in International Reading Literacy Study (PIRLS) 2006 results indicated that South African grade 4 and 5 learners who were tested in literacy were found to be the least competent out of the forty participating countries (Mullis, Martin, Kennedy, & Foy, 2007), with 78% of the grade 5 learners not achieving the lowest

reading benchmarks (Van Staden & Howie, 2008, as cited in Pretorius & Currin, 2009, p. 67).

Confirming these low literacy figures, the Department of Education (2008) blames these in part on a lack of support for literacy in the home, identifying parental and caregivers' high rates of illiteracy and economic factors, in particular poverty, as a cause of the poor performance of learners. Poverty in the home is associated with the lack of books in many children's homes which ultimately reduces children's exposure to written texts and the development of their emergent literacy. Many South African children also have little exposure to English. Even in the schools that many South African children attend there are likely to be few reading materials. Pretorius and Machet (2004) note that less than seven percent of South African schools have functioning libraries and there may not be any community libraries (Hart, as cited in Wettmark, 2002, p. 6).

There are about 20 000 primary schools in South Africa and most of them are rural and township schools serving poor black learners (Department of Basic Education, 2011). These schools are poorly resourced and often poorly managed, classes are large and many teachers poorly qualified (Taylor, Muller and Vinjevold, 2003). In some schools only the teacher has a copy of the textbook while the learners do not. In such circumstances, reading is limited and literacy development is thus impeded.

In the Foundation Phase, Pretorius and Currin (2009) observed that in the teaching of reading much emphasis is put on decoding skills but that this is done in a superficial, decontextualised way. Learners have very little access to storybooks or readers and consequently not much reading is done in the classroom. According to Pretorius and Mampuru (2007) decoding is emphasized and not reading comprehension. Teachers may confuse decoding ability for text understanding. When children move on to the Intermediate Phase where they are supposed to read to learn it becomes an even greater challenge. Reading in both their home language and in the additional language is challenging for learners. Grade 4 is a critical stage in South Africa as learners experience two significant transitions. The first transition for the majority of South African learners is from using their home language, isiXhosa, in the case of Grahamstown where my study is situated, to using English as the LoLT (Department of Basic Education Curriculum and Assessment Policy Statement

(CAPS)) (2011). Second is the shift from the Foundation Phase, where learners are learning to read, to the Intermediate Phase where they are expected to read to learn and get access to information from texts (National Reading Strategy, 2008). In both transitions, the role of the textbook as a mediating tool is important, hence my decision to focus on the readability of textbooks written for grade 4 learners.

The transition from using home language to using English as LoLT has brought special challenges to grade 4 learners in poorly resourced schools. According to Probyn, (2005), the oral language use in the classroom is primarily in the children's home language while English is the language for reading and writing. In such a situation it is not easy for learners to gain proficiency in English and acquire Cognitive Academic Language Proficiency (CALP), which is the ability to understand and express, in both oral and written modes, concepts and ideas that are relevant to success in school and which is also necessary for reading in a second language and providing written responses to tests (Cummins, 1982; 2008). Most learners possess only Basic Interpersonal Communication Skill (BICS), which is conversational fluency in a language.

Cummins's distinction between CALP and BICS is important (Cummins, 2000). CALP is essential for students to succeed in school, and learners need time and support to become proficient in academic areas (Cummins, 2000). Learners who have not developed this CALP, according to Cummins, are at a disadvantage in learning science or other academic subjects (Cummins, 2000). Grade 4 learners who have limited oral proficiency in English and are required to read and learn content area material including science textbooks, have great challenges. This is because, according to Macdonald (1990), in the year when their language of learning changes abruptly from an African language to English, the children's listening, speaking, reading and writing skills are still poorly developed in both their mother tongue and in English (p. 4).

This context provides the background to my investigation into the readability of the grade 4 Natural Sciences textbooks. I have chosen grade 4 textbooks as this grade marks an important transition.

In this chapter I have introduced my research focus and briefly explained the context. Chapter 2 will focus on the review of literature relevant to my study. In chapter 3 the research design is described and justified. Data are presented and analysed in chapters 4 and 5, and chapter 6 concludes the research and gives recommendations on the basis of the study's findings.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

The aim of this chapter is to provide an overview of the literature related to the readability of textbooks, which is the focus of this study. I examine the relationship between the concepts 'readability' and 'understandability' and consider their differences. In addition, I examine what makes texts readable, something teachers have to consider when choosing textbooks for their learners.

The history of readability measures is also briefly discussed. Some of the readability formulae developed as objective methods for measuring the readability of texts are examined, although, as will be discussed, these are not without their limitations.

Since readability goes hand in hand with understandability, there is also an overview of the cloze procedure as a measure of learners' understanding of texts.

#### **2.2 THE CONCEPT OF READABILITY**

From the diverse definitions of readability from different authors, I have identified Dale and Chall's (1949) definition of readability as the most comprehensive. They define readability as:

The sum total (including all the interactions) of all those elements within a given piece of printed material that affect the success a group of readers have with it. The success is the extent to which they understand it, read it at an optimal speed, and find it interesting (p. 148).

Dale and Chall's definition identifies indicators of readability of texts as their potential to be understood, to be read at a desirable and normal reading speed, as well as to arouse the interest of the readers. The purpose of a text is to communicate meaning to its readers which they should understand. If readers fail to understand it, it means the text's purpose has been defeated. Only that which readers can comprehend can potentially interest them. It is important that when readers read a text, they are able to do so at an optimal speed. If a text is too difficult, they are forced to read it slowly thereby making greater demands on their memory (Abadzi, 2008), which may compromise their understanding. Very difficult texts



adversely affect comprehension and lead to frustration, which is likely to affect negatively the mood and mental readiness of the reader.

Readability recognizes the importance of matching the reader and the text well so that reading becomes enjoyable, and there is enough new information and vocabulary to prevent boredom (Graves & Graves, 2003). In the classroom context, where a text is not perfectly matched to a reader's level, it is then the teacher's task to scaffold it. Scaffolding is when teachers (or other learners) support learners to enable them to do what they cannot yet do unsupported (Gibbons, 2002). The teacher makes the text interesting and accessible by connecting reading with prior knowledge, pre-reading, discussing the text, giving illustrations, examples and where necessary, simplifying the language of the text.

### **2.2.1 Readability and Understandability**

Although they are not equivalent, the terms 'readability' and 'understandability' are often used interchangeably. The two are closely related but do not mean the same thing (Shelby, 1992). Readability looks at text difficulty without regard to a particular reader (it is text-centered), whereas understandability is concerned with the interaction between the text and the reader (Jones, 1997). My study intends first, to examine the readability of grade 4 Natural Sciences textbooks in the absence of their readers and second, to examine their understandability (whether the readers are getting meaning from the text contained in these books). Understandability relates more closely to reader comprehension than readability. I will assess the textbooks' understandability through administering cloze and traditional comprehension tests to the learners. Readability of the texts will be measured quantitatively by means of readability formulae. Content analysis, which is meant to assess text readability, and cloze testing for text understandability will both yield qualitative and quantitative results.

Another difference that is worth noting is that text readability is fixed. It is not affected by time, circumstances or other factors. This is because readability is a measure of a text which itself is a fixed entity with words and sentence patterns which do not change. On the other hand, understandability is fluid and relative because it differs from one reader to another. Understandability is more personal than readability and readability is a component of understandability. However, it does not mean that when a text is readable, it is always understandable. One may be able to read a text and fail to understand it. It is, however, not

possible for one to understand a text without being able to read it (Gough, 1996). Readability is affected by a number of factors, to which I now turn.

### **2.3 FACTORS AFFECTING READABILITY OF TEXTS**

Graves and Graves (2003) identify ten factors that affect the readability of texts. These are vocabulary; sentence structure; text length; elaboration; coherence and unity; text structure; familiarity of content and background knowledge required; audience appropriateness; quality and verve of writing; and interestingness. These variables affect text readability in different ways. Although Graves and Graves identify all these as factors affecting the readability of texts, I find that the first six impact on text readability as their focus is on the text itself, while the other four, impact on understandability as the concern is with the reader in relation to the text.

Research has shown that if a text contains a lot of difficult words, it becomes difficult to read (Fang, 2006). Several attributes of words can make them easy or difficult. Some of these attributes are the word's length, its meaning, the frequency of its use, its spelling and pronunciation. Of these different attributes, readability formulae consider word length as a measure of word difficulty. Word length itself has two units of measurement: syllables and letters. The number of syllables in a word has been used especially in readability formulae to determine word length rather than the number of letters making up the word. Word difficulty is determined by the number of syllables, and the longer the word the more difficult it is considered to be.

Although for readability formulae it is the length of words which determine a word's difficulty, one needs to recognize the important role word familiarity plays in making a word easy or difficult for a learner. A text should contain many familiar words and a few unfamiliar ones, which the learners will then be challenged to learn. A symbiotic relationship exists between comprehension and vocabulary knowledge. Effective readers are generally those who have a wide range of vocabulary (Waring & Nation, 2004). Where the reader does not possess much vocabulary, it means they encounter a lot of unfamiliar words and this negatively affects their comprehension of texts. A reader's vocabulary should, therefore, be broadened.

It is not only word difficulty which is used to determine text readability, but also sentence length. Sentence length for readability formulae is measured by the number of words in a sentence. Long and complex sentences may contribute to making texts difficult to read. In most cases shorter sentences are easier to understand and remember, but short choppy sentences are not always the best. Graves and Graves (2003) note that short sentences are only readable if they are not choppy and if they cohere. Some sentences are longer because of the inclusion of examples and illustrations to enhance comprehensibility. A balance between short, long and medium sentences would produce a readable text. Long sentences make more demands on the reader's memory and they usually embody complex structures of coordination and subordination which detract from readability. It is, however, important to note that the length and complexity of sentences varies according to the grade level of those who read them.

Texts which are elaborated are easier to understand (Graves & Graves, 2003). A text is elaborate if it has been properly explained. This gives the sentence meaning and the text becomes easier to understand. Elaboration aims to clarify and explain implicit information. Words are often added through repetition or examples to increase comprehension in different ways. A text should also have coherence. The topics, subtopics and paragraphs should link well with each other to make the text meaningful. Too many topics in one passage make the text lose its meaning and it will not be easy for the reader to remember what they have read. In relation to text structure, many readers may find narrative texts easier to read than expository ones, which generally tend to be more challenging (Ali & Ismail, 2005). The expository and non-fiction style is basically the "textbook style" of writing which explains concepts while the "narrative style" is the story style of writing which describes something that has happened. What makes the narrative style easier to read is the exposure learners have had to this kind of style from their early years of childhood. The material in the text follows a chronological order and whatever unfamiliar words the text may contain, the text always provides clues to meanings. On the other hand, expository texts normally follow patterns that are more challenging and more demanding in terms of topic, vocabulary and other aspects which present several hurdles to the reader. This means they have some complexities such as the use of technical or specialized words, use of difficult to pronounce words and unfamiliar use of familiar terms (Fogelberg, Skalinder, Satz, Hiller & Bernstein, 2008).

In terms of factors involving the interaction between reader and text, a text is more comprehensible if much of the material is familiar to the reader. Having existing or prior knowledge of what is in the text makes the text easily accessible. The reader is able to build the field (Derewianka, 1996) with the knowledge that they already have and this supports their comprehension. Lehr and Osborn (2005) observe that readers activate their network of existing knowledge, or schema, when they encounter topics or words in a text that relate in some way to that network (p. 8). Familiar material or prior knowledge is, therefore, very important in comprehension of texts. There is, however, need for some unfamiliar material so as to allow the reader to learn something new. Familiarity of a subject is, however, subjective because what may be familiar to one reader may be unfamiliar to the other.

The material should also be appropriate to the readers' needs and interests, as well as interesting (Graves, Juel & Graves, 2001). The interestingness factor is also subjective because what interests people differ: what interests one person may be boring to another person reading the same book. Some of these factors have been used in text readability studies whose history is the subject of the next section.

## **2.4 THE HISTORY OF READABILITY MEASURES**

An understanding of the history of readability measures helps one appreciate why the readability formulae currently in use focus primarily on some variables to the exclusion of others. Readability is understood differently by the designers of the different readability formulae. DuBay (2004) explores the understanding of readability in the United States (US) in terms of three types of study: The Adult Literacy Studies, the Classic Readability Studies and the New Readability Studies. The Adult Literacy Studies' focus was to grade students' reading skills using standardized reading tests; the Classic Readability Studies focused on developing practical methods to match reading materials with the abilities of students and could be used by teachers and librarians; and the New Readability Studies sought to get a clearer understanding of readability formulae, how they could be improved and what they tell us about reading and writing (p. 10).

Sherman's work falls within the classical readability studies; in the 1880s he began to teach literature from a historical and statistical point of view. As time went by in his teaching career, he discovered that sentences were shortening over time. In his book (1893), *Analytics*

*of Literature, A Manual for the Objective Study of English Prose and Poetry*, he showed how sentence-length averages shortened over time, from Pre-Elizabethan time when sentence-length was about 50 words to his time when sentences were about 23 words long. From this he concluded that the shorter and the more concrete the sentences, the easier to read and less abstract they also become (DuBay, 2004). Sherman (1893) also realized that writers tend to be consistent in their average sentence-lengths. This would help make text samples reliable to use in predicting readability of a text rather than using the whole text. Sherman also emphasized the importance of analyzing a text in relation to the reader (p. 312). A text had to meet the expectations of the person who was reading it.

According to Ulusoy (2006), readability studies started in the 1920s for two reasons. First, some students starting secondary school needed books at the right level since their background in reading was not strong (Chall, as cited in Ulusoy, 2006, p. 323), a factor equally applicable to the present study. Second, researchers and teachers were then using Thorndike's Teacher's Word Book: a book that provided teachers with an objective means for measuring the difficulty of words and texts. In the preface to the third book, Thorndike (1944) wrote that the list contained therein "tells anyone who wishes to know whether to use a word in writing, speaking, or teaching, how common the word is in English standard reading matter" (p. x). According to Thorndike, the most frequently occurring words should be reinforced by instruction so that they become a "permanent part of students' stock of word knowledge" (p. xi). This book laid the foundation for almost all the research on readability that would follow (Ulusoy, 2006).

Classic Readability Studies also brought with them classic readability formulae. An interesting study was conducted by Gray and Leary (1935) published as "What makes a book readable?" which determined text readability under four broad headings namely: content, style, format, and features of organization. This differed from other readability measures which focused on only two measures (word difficulty and sentence length). Gray and Leary found that content was the most important element, followed by style, format and then features of organization. They also claimed that measuring a text's difficulty using many aspects or variables was more accurate but more complicated than using only a few variables as in readability formulae. That perhaps explains why most readability formulae use only two variables - word difficulty and sentence length - to assess text readability. Research

eventually established that the two variables commonly used, a semantic (meaning) measure such as difficulty of vocabulary and a syntactic (sentence structure) measure such as average sentence length, are the best predictors of textual difficulty (DuBay, 2004, p. 19). This was the birth of readability formulae such as Flesch Reading Ease, Dale-Chall formula, Gunning's Fog-Index and Fry Readability formula.

## **2.5 READABILITY FORMULAE**

Readability formulae are mathematical formulae designed to predict the grade level a reader should have in order to read and understand a particular text. They focus primarily on two variables: word difficulty and sentence length. Bringing in all the variables discussed earlier on would confound the calculations and complicate the formulae. With regard to word difficulty they consider the number of syllables in a word; with regard to sentence length they consider the number of words in a sentence. The assumption is that short words and short sentences make a text easier to read and to understand (DuBay, 2004). Tann (1991) observes another variable some readability formulae also consider which is "... the proportion of substantive "concept" words to function words ... in each sentence" (p. 116). The more concept words are present, the less the readability of the text. Examples of concept words may include *mixture*, *precipitation*, *galaxy* and *earth's crust*. This largely applies to content area texts like Science and Mathematics containing a lot of concept words. Most of these concept words are not easy to read (Wellington & Osborne 2001). The number of multiple syllable words, and average sentence length, however, remain the variables which are given greatest consideration in determining text readability.

According to DuBay (2004), over 200 readability formulae have been created. Now there is an online Text Readability Consensus Calculator which uses seven popular readability formulae to calculate the average grade level, reading age, and text difficulty of samples of given texts (readability formulas, n.d). The computer does the calculations of the number of syllables, words and sentences in the sample. Computing a readability index is quite straightforward and simple. The text of the input file is read, accumulating the necessary counts. The formulae used by the Text Readability Consensus Calculator are the Flesch Reading Ease, the Gunning Fog, Flesch-Kincaid Grade Level, the Smog Index, the Coleman-Liau Index, the Automated Readability Index and the Linsear Write formulae. My study uses this Text Readability Consensus Calculator to examine the readability of the grade 4 Natural

Sciences textbooks currently used in South Africa. These grade levels refer to American schools where children are using English as their home language. Even under the best conditions, children will not read as well in their additional language (Asher, 1982). I will briefly discuss some of these readability formulae which are relevant to my study.

### **2.5.1 The Flesch Reading Ease**

This was named after Rudolph Flesch, the creator of the formulae. It was designed especially to predict the readability of school texts written in English, using two features: word and sentence length. It takes into account the average number of syllables per word (Farr, Jenkins & Paterson, 1951), the average number of words per sentence and the average sentence length. The formula is:

$$RE = 206.835 - (1.015 \times ASW)$$

Where: RE means Reading Ease

ASL means Average sentence length

ASW means Average number of syllables per word.

The answer one gets ranges from 0 to 100. Where the RE is high, this means the text is readable and where the RE is low, the text is difficult (Flesch, 1948). The following is the key to determining the relative ease of a text using the formula:

- from 90% to 100%, the text is very easy to read and is understandable by any literate person
- from 80% to 89%, the text is easy
- from 70% to 79%, the text is fairly easy
- from 60% to 69%, the text is a standard text understandable by 8<sup>th</sup> and 9<sup>th</sup> graders
- from 50% to 59%, the text is fairly difficult,
- from 30% to 49%, the text is difficult, and
- from 0% to 29% the text is very challenging and confusing, may be understood by college graduates (p. 229).

The formula is quite easy to use, hence its popularity. This formula, along with the others that follow the same procedure, has, however, been criticized for looking at only two variables yet there are many other aspects that affect the readability of texts.

### **2.5.2 The Gunning Fog Index**

This readability formula was developed in 1952 and named after its creator, Gunning. It measures the readability of English written material. Like the Flesch Reading Ease formula, it

considers the two aspects of sentence length and word difficulty. The formula implies that short sentences written in plain English are more readable than long sentences written in complicated language (DuBay, 2004). Gunning defined hard words as words with more than two syllables. The mathematical formula is:

$$\text{Grade level} = 0.4 (\text{ASL} + \text{PHW})$$

Where ASL = Average sentence length (i.e. number of words divided by number of sentences)

PHW = Percentage of hard words.

A benchmark that was used was as follows: A fog (from Gunning Fog) score of 5 is readable, 10 is hard, 15 is difficult, and 20 is very difficult. This formula has, however, been criticized for failing to consider that not all multi-syllabic words are difficult. There are some words that are short but difficult because they are not commonly used. Such short unfamiliar words may therefore, make sentences difficult to read, diminishing the strength of this assumption of the Gunning Fog formula.

### **2.5.3 The Flesch-Kincaid Grade Level**

The Flesch-Kincaid Grade Level (formerly the Flesch Reading Ease formula, simplified and converted to grade level) was designed by Peter Kincaid in America to assess comprehension difficulty when reading a passage of contemporary academic English. Like the Flesch Reading Ease, it also uses the measures of word and sentence length (DuBay, 2006). The formula is:

$$\text{FKRS} = (0.39 \times \text{ASL}) + (11.8 \times \text{ASW}) - 15.59$$

Where FKRS is Flesch-Kincaid Readability Score

ASL is average sentence length in words or average number of words in sentence (number of words divided by the number of sentences)

ASW is average number of syllables per word (the number of syllables divided by the number of words).

The result will be a number that equates to a grade level. For example, a 7.5 is a seventh grade reading level result, 8.0 is an eighth grade reading level result.

### **2.5.4 The Smog Index**

The SMOG Index formula, like the Fog Index, concentrates on the number of hard words in a text. Hard words are ones longer than 2 syllables (3 or more syllables long). The formula



entails counting the words of three or more syllables in three-sentence samples, calculating the square root of the answer (rounded off to the nearest perfect square), and adding the constant 3 (McLaughlin, 1969).

McLaughlin invented this readability formulae and his intention was to correct the error with the formulae that preceded his. His belief was that word length and sentence length should be multiplied rather than added (DuBay, 2004, p. 46). He counted the number of words with more than two syllables in 30 sentences and came up with the following formula:

$$\text{Smog grading} = 3 + \text{square root of polysyllable count}$$

He used the McCall-Crabb's passages (passages used to teach and test comprehension and develop higher level thinking skills) with his formula and obtained a 100% correct score criterion.

### **2.5.5 The Coleman-Liau Index**

This formula, designed by Coleman and Liau, relies on characters instead of syllables per word and sentence length (Coleman & Liau, 1975). The formula is:

$$\text{Coleman-Liau Index} = (0,0588L - 0,2965S - 15,8)$$

Where L is the average number of letters per 100 words and S is average number of sentences per 100 words.

This formula will output a grade. For example, 11, 6 means the text measured is appropriate for a grade 11-12 high school learner. Although it is said to be inaccurate, its use in conjunction with other formulae will help to strengthen the weakness (McCallum & Peterson, 1982).

### **2.5.6 The Automated Readability Index (ARI)**

This formula aims at gauging the readability of a text. Like the other formulae it produces an approximate representation of the US grade level needed to understand a text. The formula is:

$$GL = 0,50 (\text{words per sentence}) + 4,71 (\text{letters per word}) - 21,43$$

GL means grade level.

Characters or words used in this formula are faster to calculate because the number of characters is more readily and accurately counted by the computer programs than syllables.

Reading level 1 corresponds to ages 6 to 8; grade level 8 corresponds to 14 year olds in the US where the formula was designed. The ARI was successfully validated on technical materials in both manual and computer modes (DuBay, 2004).

### **2.5.7 The Linsear Write**

The Linsear Write is a formula that was created to help calculate the readability of the US Air Force technical manuals and reading matrices for English texts. It calculates grade level of a text sample based on sentence length and number of words with three or more syllables (McCallum & Peterson, 1982). The formula is:

$(\text{Easy words} + (\text{Hard Words} \times 3) / \text{Sentences}$

Where Hard Words have 3 or more syllables

Easy Words have 1 or 2 syllables

If answer is greater than 20 then divide by 2

If answer is less or equal to 20 subtract 2 then divide by 2. That is your answer. If the answer is 10, the text is for a 10<sup>th</sup> grader, if it is 6 the text is meant for a 6<sup>th</sup> grader.

As noted, these seven readability formulae are included in the Free Text Readability Consensus Calculator that I use in my study to assess the readability of two grade 4 Natural Sciences textbooks.

Although readability formulae provide an independent and objective assessment of the readability of a text, and have been shown to have predictive validity (Mikki, 2000) in that the results of such tests have been found to correlate with other readability measures (Chall & Conard, 1991), they have a number of limitations. These are discussed in the next section.

## **2.6 THE EFFICACY OF READABILITY FORMULAE**

It would be naive to assume readability formulae are without limitations. Readability formulae provide a mechanical, objective, but limited way of predicting text readability in the absence of readers (Flesch, 1974). The results one gets after using the formulae are not very nuanced. Most of these formulae were created and used in the US to predict the readability of native-language texts but they are now being used in many places to assess the readability of texts intended for learners of English as a second language (ESL) (Oakland & Lane, 2004). Readability formulae are criticized for failing to show us what really makes a text difficult to read. After measuring a text's difficulty using the formulae, the text has been found to be difficult, but one would not necessarily know what makes the text difficult.

Mikki (2000) notes that the characteristics of sentence length and the word length upon which most of the popular readability formulae are based are not the only aspects impacting on text

readability. Quantitative textbook analysis is untenable if it leaves some important text characteristics, such as context, prior knowledge, coherence of text and many others unconsidered (p. 123).

Although the readability formulae have these limitations, they have been used extensively to determine the grade level of reading material, including graded reading schemes. In a trial run of readability formulae that I carried out using a PIRLS text for 2006 designed for grade 4 readers, I found that the Consensus Readability Calculator accurately measured the text as appropriate for grade 4 readers. The use of the PIRLS text was motivated by both a desire to put the readability calculator to the test, as well as by my curiosity to see the extent to which a text administered to so many learners at the grade 4 level was indeed suitable for them. The readability calculator proved to have validity in that all seven readability formulae used agreed almost exactly on the text being a fourth grade one. The limitations of readability formulae only point to the need to use them in conjunction with other methods of text readability assessment rather than in isolation. In spite of their limitations, readability formulae measure something important and are quite useful as will become apparent in Chapter 3. With this in mind, I have used the readability formulae judiciously in conjunction with a more qualitative analysis of the readability of text using criteria developed from the research literature (Mikki, 2000; Graves & Graves, 2003). In the following section I discuss the use of cloze tests, which I have also used to measure the readability of texts against learner performance.

## **2.7 CLOZE TEST PROCEDURE**

The cloze procedure was developed by Taylor in 1953 as a reading test for native speakers of English. It was subsequently investigated for its appropriateness as a measure of readability of L1 and L2 materials. According to Ahluwalia (1992), in the 1960s studies focused on cloze tests as a measurement of reading comprehension in L1 and L2, but during the 1970s these tests began to be used as a measurement of overall L2 proficiency.

Marionette & Homan (2001) define cloze procedure as “a technique used to determine the readability of written material, an individual's reading level on specific material, an individual's vocabulary level in a specific subject or topic area, and an estimate of individual's general comprehension level” (p. 137).

A cloze procedure assesses the difficulty of a text, not in terms of word difficulty or sentence length like readability formulae, but in terms of a reader's understanding and response to the structure of the language of a text (Rye, as cited in Guangling Lu, 2006, p. 18). If the learners tested get 60% or more correct answers on average, it is assumed that the text is comprehensible and readable to the users. The greater the number of accurate word replacements learners make, the greater the text's readability. A cloze test, therefore, essentially measures readability on an individual basis. Taking it beyond the individual, one could then say that if, in a class of say 40 learners 10 scored above 60%, the text could be deemed readable for 25% of that group of learners. Cloze tests cannot, however, be used to measure knowledge gain. The isolation of passages from their context for the purpose of testing could also contribute to the difficulty of the passage.

There are at least five main types of cloze tests available to language teachers: The fixed-rate deletion, the selective deletion (also known as the rational cloze), the multiple-choice cloze, the cloze elide and the C-test. The table below shows the different types of cloze tests.

**Table 1: Different types of cloze tests**

fixed-rate deletion	Every nth word is deleted after the first or second sentence.
selective deletion (also known as the rational cloze)	Tester chooses items to delete from the text.
multiple-choice test	Answers are provided and learners must choose the correct answer.
cloze elide	The deleted words are replaced with different words that do not fit within the text. The learner is tasked with both the identification of incorrect words and their replacement with the correct words.
C-test	Deleting only part of every second word in a text.

In fixed-rate deletion, every nth word is deleted after the first or second sentence. When testing learners with low level language proficiency every eleventh or fifteenth word may be deleted, making the passage easier to understand.

Selective deletion consists of deleting items or words the tester chooses to delete from the passage (Bachman, 1982). The selective deletion test is mostly used to measure the grammatical and vocabulary knowledge of learners. Selecting words to delete is likely, I believe, to add to the difficulty of the text if careful criteria are not applied. Maybe the words

chosen to be deleted might be the easier words to understand and once they are deleted the text becomes difficult.

In the multiple-choice cloze test, answers are provided and learners must choose the correct answer. In the cloze elide test, the deleted words are replaced with different words that do not fit within the text. Learners are tasked with both the identification of incorrect words and their replacement with the correct words (Hadley & Naaykens, 1997). In the C-test, part of every second word is deleted and learners are supposed to complete the words. It would be much more difficult to score well on this than the fixed rate deletion test because half of the words in this passage will be partly deleted (McNamara, 2000).

An investigation of the selective deletion cloze test as a measure of grammar-based proficiency in second language learning was carried out by Hadley and Naaykens (1997) on university students whose proficiency in English was limited. The findings of this research seemed to suggest that selective deletion cloze could be used in place of or alongside grammar-based language tests (p. 5). According to Bachman (1992), deletion cloze tests are more effective and reliable than those other tests set by teachers, which are not well planned. They are also easy to set and less time-consuming in terms of marking and writing yet they help the teacher to determine the level of difficulty of the text for a particular group of learners.

In a cross-comparison form of evaluation, Brown (1998) investigated the validity of the readability formulae for second language learners using 12<sup>th</sup>-word cloze procedures. 50 passages were selected randomly from English adult reading books used by a group of Japanese students learning English as a foreign language (EFL). Brown compared the mean cloze scores he got with scores predicted by six readability formulae, which included the Flesch and Flesch-Kincaid. By so doing, he was checking for some sort of correlation between the readability formulae scoring and the cloze procedure scoring. He concluded that “first language readability indices are not very highly related to the EFL difficulty” (p. 7). He then created a new readability formula where he chose variables that were more highly predictive of difficulty for second language readers. Brown's EFL readability index consists of a small subset of variables that include number of syllables per sentence, the frequency of the cloze items in the text as a whole, and the percentage of function words (Crossley,

Greenfield & MacNamara, 2008, p. 479). The formula worked better and accounted for more variance in the second language learners' score than did the traditional formulae. So when cloze tests are used together with readability formulae, they can give a valid measure of text difficulty especially for L2 readers.

Bormuth (1962) developed a cloze and multiple choice test over some nine passages where the passages were written differently in terms of subject matter and level of difficulty. Both sets of tests were tested on grade 4, 5 and 6 learners. The tests “produced significant and roughly proportionate effects on the cloze readability and multiple-choice scores” (p. 5). Passage difficulties determined by using cloze tests corresponded closely to the passage difficulty obtained using other measures. Cloze tests when properly used result in reasonably accurate measurements of the comprehension difficulty of texts. The cloze test procedure gives more reasonably accurate results and more information than readability formulae because these tests estimate how well each learner functions when they interact with the text (Ulusoy, 2006). Best results are, however, obtained when both methods are used on the same text. Cloze tests are particularly useful when assessing the readability of texts for learners reading in their L2. I will now look at readability in ESL.

## **2.8 READABILITY FORMULAE AND ESL TEXTS**

Hamsik, as cited in Ulusoy (2006, p. 325) conducted a study to investigate if four widely used readability formulae measured reading difficulty for immigrant students who had come from the Middle East and South America who were learning ESL in the United States. They had not become fully proficient in English. The formulae Hamsik used were the Flesch formula, the Dale-Chall formula, the Fry graph and the Lorge formula. According to Greenfield (2004), Hamsik administered cloze tests on 18 academic passages to the 40 students and found significant correlations of .775 to .819 between the rank orders of difficulty of the passages as indicated by the cloze scores and as predicted by each of the four readability measures (p. 9). Greenfield (2004) concludes that the results of Hamsik’s study was evidence that these four readability formulae can be used to measure the readability of ESL texts and can help in selecting material which is at the level of learners. ESL teachers use English readability formulae to match texts to their students' reading levels. Miyazaki, as quoted in Greenfield (2004, p. 10-11) found that readability formulae predicted the readability of ESL texts just as it did with those intended for L1 speakers of English. He used

the Flesch Reading Ease and Flesch-Kincaid formulae along with the Coleman-Liau, New Dale-Chall, and Bormuth formulae. Miyazaki carried out his study with 200 EFL Japanese students from an arts college in Japan. He used randomized testing procedures based on Bormuth (1971). Correlations between observed EFL mean cloze scores and scores predicted by the formulae were .691 for the New Dale-Chall formula, .765 for Coleman-Liau, .845 for Flesch Reading Ease, .847 for Flesch-Kincaid, and .861 for Bormuth. Such findings from these studies support the conclusion that despite their perceived limitations, classic readability formulae are valid for both first and second or foreign language readers of English texts. Greenfield (1999) and Brown (1998) developed ESL readability formulae for determining the readability levels of texts for ESL learners and these formulae agreed, in terms of high correlations between students' reading levels and the texts, with classic readability formulae. This, therefore, supports Miyazaki's finding that classic formulae are useful and valid for determining readability of ESL texts.

## **2.9 READING LEVELS OF TEXTS**

Three levels of readability of texts in relation to the readers have been identified. These are the independent level, instructional level, and frustration level.

A text is said to be at the independent level if a reader can read and understand it on his or her own. For such a text, there should be 98-100% word recognition in the text (Waring & Nation, 2004). A reader should be able to read the text fluently without much hesitation as to compromise the flow of reading. When reading aloud, the reading should not have any omissions, additions, repetitions, false starts, fillers and any such things which are permissible in speech, and should be characterized by correct pronunciation. In other words it has been suggested that no more than 1 in 20 words (5%) should be difficult for the reader (Armbruster, Lehr & Osborn, 2003).

A text at the instructional level is accessible to learners with the teacher's help. Here at least 90% of words should be known (Armbruster, Lehr & Osborn, 2003). Burns, Roe and Ross (1998) maintain that the reader should register at least 75% comprehension of a text. Anything below this figure reflects readers reading at frustration level. It has been suggested that no more than approximately 1 in 10 words should be difficult (Armbruster et al 2003). For beginners (grades 1 and 2) such material should allow them 85%+ word recognition and

for grade 3 and above learners there should be 95%+ word recognition. Frustration level is reached when more than 90% of the words (more than 1 in 10) in a text are difficult (Armbruster et al, 2003). Reading material at this level should be avoided because it is likely to demotivate learners. Ideally, textbooks should be set at the instructional level because they are meant to be mediated by the teachers to the learners.

## **2.10 READING CHALLENGES OF SCIENCE TEXTS FOR LEARNERS LEARNING IN ESL IN SOUTH AFRICA**

The concept of CALP developed by Cummins is concerned with the literate skills in the first and second language. According to Cummins (2000), CALP is that language proficiency one should have if one has to read textbooks, to speak fluently, write and answer questions correctly in a language. CALP also enables learners to learn about things which are abstract and unfamiliar to them.

Cummins (2000) goes further to say that learners who have not yet developed their CALP could be at a disadvantage in learning science or other content area subjects because their academic language has not yet developed. They are not able to read fluently and write in English. What they have is BICS, which enables them just to communicate in their native language and talk about informal, concrete things. Learning science in English is problematic for ESL learners because they first have to learn English and then learn those technical, non-technical, long and unfamiliar words of science. It really gives them a hard time to cope with this. This is the case with the majority of South African learners, especially those in primary schools in townships and in rural areas. In the Foundation Phase they learn in their native languages. When they get to grade 4, however, English becomes the LoLT. They start using English to communicate in the classroom, to learn from what they are reading and at the same time are introduced to science, a difficult, abstract subject. What they only have is BICS and their CALP has not yet developed. According to Cummins (2000), it takes five to seven years for CALP. As mentioned earlier, CALP is needed if learners are to read textbooks, write and answer questions. Most South African grade 4 learners struggle to learn science because they lack this academic language proficiency which takes time to develop.

Macdonald (1990) was one of the first South African researchers who studied the problems faced in black primary schools and discovered that the problems faced by learners were two-



fold. One of the problems she discovered was poorly developed English in Standard 3 (grade 5), and it was very difficult for learners to learn content subjects like science, geography and mathematics in English (Macdonald, as cited in Langhan, 1993, p. 2). The second problem she discovered was that learners' failure to perform well in the content subjects was partly because the textbooks they were using were not accessible to them. They were written in English which was not very familiar to them. Macdonald and Van Rooyen's (1985-1990) Transvaal and Bophuthatswana research provided evidence that learners' competence in English by the end of Standard 2 (grade 4) did not prepare them adequately to cope with the transition to using English as a LoLT in Standard 3 (Langhan, 1993). A gap was thus created which it was not easy for learners to fill. According to Macdonald, as cited in Langhan (1993, p. 3) on top of their poor English language proficiency, the textbooks they were expected to use were difficult for them. The texts were too long, the language used in them difficult and they were also badly written. This posed a significant problem for the teachers as well as the learners.

Mankomo (1990) noted that some textbooks are not properly written and the process of prescription of textbooks is not valid. Her study revealed that the first textbooks that learners encountered in English had a very large number of words which learners did not know (p. 24). This means that the texts were not at the level of learners. Reading such books leads to frustration, which may contribute to reasons why some learners do not enjoy reading or drop out of school.

The problem of transition to English as a language of learning and teaching is a great one. It is made worse by teachers who have not been trained to teach the subjects they for which they are responsible. Metcalfe (2008) identifies teacher quality as the “most significant factor affecting learner performance” (p. 10), and also observes that in South Africa some teachers' conceptual knowledge is low and they do not know the content of the subjects they teach very well. They therefore make errors in teaching the content and concepts in the textbooks. The same teachers do not expect much from their learners who will as a result of this perform poorly. The teaching often consists of rote learning of material which the teachers summarize from the textbooks. As a result we cannot expect learners to learn much from this because they do not understand what they are memorizing. Memorizing is not learning. When it comes to testing, learners cannot answer the questions because they do not know what the

questions require them to do. In a context such as this the quality and accessibility of textbooks to both learners and teachers is very important.

Langhan (1993) researched the textbook as a source of difficulty in the teaching and learning of Geography through the medium of English in Standard 3 (grade 5) in black primary schools. Langhan's focus was to determine the readability of geography textbooks and the extent of their influence on the teaching and learning process in primary schools (p. 2). This research provided evidence that to a great extent textbooks present difficulty in learning and teaching content subjects like Geography because the textbooks are not meaningful to learners.

Subjects such as science and mathematics present a particular challenge for textbook writers. The language of science and mathematics is different from the language that learners use socially at home and with their peers, and in other subject areas at school. It is necessarily abstract and decontextualized. It requires CALP, which is the basis for a learner's ability to cope with the academic demands placed upon them in various subjects (Cummins, 2000). Textbook writers have to find ways of making the text as accessible as possible. It is the teacher's duty, on the other hand, to negotiate the meaning (Swain, 2000) and scaffold learning so that learners are enabled to do things with the teacher's support. The teacher being the mediator should then help simplify the texts by using familiar vocabulary, simple sentence structures and repetition and rephrasing, active and passive sentences. Repetition affords learners a second chance to process the same structure instead of it being presented too quickly with a rephrased version that may be equally challenging as the original utterance (Gibbons, 2000). Teachers must be able to understand the textbooks in order to mediate them.

## **2.11 READABILITY OF EXPOSITORY TEXTS**

Expository or informational texts are "factual representations of documented knowledge. Their purpose is to instill information and inquiry in the reader" (Hancock, 2004, p. 166). Unlike narrative texts, which describe events (usually fictional), expository texts explain concepts. What makes the narrative style easier to understand is the exposure most learners have to it from their childhood, whereas with expository texts most children encounter them at school and read them with the teacher's assistance. The exposure learners have to narrative texts may be in oral form from stories told to them by their parents, guardians or

grandparents. The language used in expository texts is in most cases complex unlike in narrative texts which are easier. The main purpose of expository text is to inform or describe. The most common expository text structures include description, enumerative or listing, sequence, comparison and contrast, cause and effect and problem and solution (Kelley & Clausen-Grace, 2010). Comprehension is usually challenging when reading a subject area textbook with subject specific language. Fang (2006) observes that there are several hurdles but I will consider four which, in my view, cause the most problems in reading. These are complex vocabulary; inaccessible graphics unsupported by text; conceptual density and unfamiliar content.

### **2.11.1 Vocabulary**

According to Parkinson (2000), most expository texts use much unfamiliar vocabulary. To add to that, familiar words are given new meanings. Examples include *riverbank*, *topsoil*, *folded mountains* and others. This is because as Zwiers (2004) notes, “we cannot invent a new word for every idea or concept so we combine the ones we have and assign them abstract meanings” (p. 149). Learning new meanings for familiar words is a learning task that affects content area reading. Science also uses some technical or specialized words which are not easy to understand. The words are specific to the subjects. Students who do not learn content subjects in their first language face the problem of understanding both the scientific terminology (technical terms) and regular explanation of the knowledge itself (Ali & Ismail, 2006). In science there are technical words such as *photosynthesis*, *organism*, *metamorphic*, *adaptability*, *carbohydrates*, and many others, even in grade 4. This density of technical words is likely to make the texts difficult to read and understand and most learners do not enjoy reading them. Such learners then end up memorizing concepts and terms at the expense of comprehension of the text (Songer & Linn, 1991). Learners have to master the language so they can get the meanings of these new concepts. The Annual National Assessments (ANA) results for grade 3 English as a first additional language (EFAL) reveal that ESL learners face greater problems because they do not have basic reading skills and strategies and therefore may not have either BICS or CALP in English (Department of Basic Education, 2011). English language learners typically acquire conversational language used in everyday activities before they develop more complex, conceptual language proficiency. As explained earlier, CALP is the language proficiency associated with schooling, and the abstract language abilities required for academic work. It is more complex, conceptual, linguistic

ability that includes analysis, synthesis and evaluation (Baker, 2006). It involves complex vocabulary as well as instruction words and more formal language styles and structures. Therefore, lack of academic language proficiency results in failure to read and understand science texts.

### **2.11.2 Graphics**

Expository texts use graphics in the form of graphs, tables, diagrams, maps and charts to help in the understanding of the text by elaborating or expanding of the concepts. To learn science effectively, students must understand different representations of scientific concepts and processes, be able to translate them into one another, as well as understand their coordinated use in representing scientific knowledge (Bedward, Weibe, Madden, Minogue & Carter, 2009). Graphics therefore assist the reader in organizing and interpreting the text or provide additional information not stated directly in the text (Norman, 2010). Graphics provide scaffolds for lower ability and learning disabled readers, allowing them to better access the content, and thus improving their comprehension (p. 5).

On the other hand, if the graphics are not supported by the accompanying text, they may become confusing and fail to serve their purpose and instead hinder learners from understanding the text (Aldrich & Sheppard, 2000). Learners should have graphic literacy if the graphics are to make meaning to them. They have to be able to read maps, graphs, pictures and diagrams. Textbooks at the grade 4 level should not only be making use of graphics, they should be facilitating the development of learners' graphic literacy.

### **2.11.3 Conceptual density**

Concept load or conceptual density is the proportion of different ideas in relation to the text's length (Vacca & Vacca, 2005). According to Reehm and Long (1996), in expository texts, many concepts may be covered one after another in a short passage. This is what is called concept overload. Too many concepts are packed into a small amount of text. Expository texts normally present information quickly and briefly. Detailed processes are minimized, and an objective, abstract view of information is presented as fact (Bernstein, as cited in Bryce, 2011, p. 480). This may be done in an attempt to finish the syllabus topics which themselves have several concepts to be developed. The textbook author(s) may have to choose between developing concepts fully and ending up with a voluminous text or making a

superficial examination of the concepts, resulting in a more concise text that does not threaten the learners. It is usually not possible to reduce the number of concepts because of the curriculum requirements.

#### **2.11.4 Nature of subject matter or content**

Vygotsky (1986) argued that scientific concept development starts with a verbal explanation that later is connected to the child's experiences. He notes that the initial verbal definition serves as the crucial moment in the development of scientific concepts (p. 193). Barton, Heidema and Jordan (2002) posit that where concepts dealt with are beyond what learners have exposure to on a daily basis, learners would have no prior knowledge or experience to fall back on. They may not have heard of these concepts before. So what they may do is just to imagine what the texts are saying or visualize the abstract concepts. Concepts like *planets*, *ozone layer* and *revolution* in science and geography are quite abstract and not easy to visualize. Learners may not have prior knowledge of these concepts and it is not easy for them to comprehend what the text intends to communicate. Vacca and Vacca (1999) suggest that what is necessary for them to do is to make use of the prior knowledge they already have to build new knowledge. The more knowledge and skills that students bring to a text, the better they will learn from and remember what they read (Barton & Heidema, 2002). Activating students' prior knowledge prepares them to make logical connections, draw conclusions, and assimilate new ideas (Barton, Heidema & Jordan, 2002, p. 24). They read, view, research, take notes and discuss thereby gaining new knowledge.

### **2.12 SCIENCE TEXTBOOKS AND THEIR CHALLENGES**

Ali and Ismail (2006) point out that most students do not find the learning of science an easy task. These difficulties arise not only from the use of symbols to represent concepts, but also the language that must be mastered, in particular the technical and non-technical vocabulary (p. 80). This problem is more pronounced especially to those learning science in English as a second language. Because they are not proficient in English, they find the language difficult for them, especially the technical and non-technical vocabulary. Language becomes a problem because the scientific terms are unique in nature and learners are unlikely to encounter them in English as a LoLT or elsewhere.

Science textbooks use a lot of graphics, which are a powerful tool to aid comprehension. There is, however, need for learners to be able to interpret them or else they become a hindrance to readability. According to Hancock (2004), some concepts the graphics are meant to elaborate are so complicated that the graphics end up being complicated themselves and fail to serve their purpose. In this case the readability of the text is lowered.

Graves and Graves (2003) argue that many science texts may lack coherent text organization and a reader-friendly style that promote reading with understanding. Some texts may not have subheadings which correspond to the information given in the text and some do not have the sub headings at all. Such texts are difficult to read.

### **2.12.1 Strategies to deal with the challenges of reading science texts in the primary grades**

Bryce (2011) gives a report of 4 primary school teachers in America whose aim was meeting the reading challenges of scientific texts in primary grades. The teachers employed some strategies to address the problems. For the problem of texts being dense with difficult technical words and abstract concepts, one teacher focused on increasing reading comprehension. She helped the learners use their background knowledge and apply reading strategies such as doing pre-reading, re-reading and using clues given in the context.

To deal with the challenge of dense presentation of concepts, learners were asked to discuss what the author intended to convey. The text was read aloud and summarized and learners had the opportunity to say what they knew and what they were learning by listening to the text being read aloud (Bryce, 2011, p. 477).

Another possible problem with science text is the superficial treatment of topics. Information may be presented briefly and quickly resulting learners being left without understanding. For this problem, the teacher went beyond what the text provided. She used videos and the internet to elaborate what the text had failed to make comprehensible. She also went on to discuss and read about the topic with the learners.

Science language is also perceived as boring because it is factual and straightforward (Sewall, as cited in Bryce, 2011, p. 479). Dramatization of what learners were reading was a solution to this problem. To address the problem of lack of organization and structural style, the teacher brought the learners' attention to the organization and style of writing that was used in

the text before reading the text. The teacher also set a reading purpose and talked about the background knowledge that learners had on the subject. This helped in accessing the information in the text. Discussing with learners the knowledge they already have is an effective way of teaching. It makes texts easier to read.

All the four teachers discussed above used different approaches to supplement the textbook. Discussions were vital in the lessons and reading aloud helped learners to understand. Technology as well is of great importance these days and that is what young learners enjoy most.

## **2.13 CONCLUSION**

The literature reviewed showed that there are many challenges faced by learners as they read their science textbooks. The review of the literature has also demonstrated that the readability of textbooks can be investigated using qualitative and qualitative measures.

In the study of expository texts, much attention has been focused on the challenges faced by learners as they learn science in both first and second languages. The challenges include:

- the vocabulary or scientific language which includes technical words, familiar words being used in an unfamiliar way and words which are difficult to pronounce
- the use of graphics in the form of charts, graphs, diagrams, maps, tables etc
- conceptual density
- the nature of the subject matter or content

As expository texts pose these challenges, it is imperative that textbooks be well designed with plenty of appropriate scaffolding for their readers. The fact that expository texts constitute the larger part of the curriculum represents an additional challenge. The preceding discussion highlights the necessity to examine more carefully the match of prescribed textbooks to the intended readers and curriculum, and this is what has motivated my desire to investigate the readability of grade 4 science textbooks. The methodology chapter which follows next is devoted to a description of how that investigation was undertaken.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **3.1 INTRODUCTION**

In this chapter I describe the research process undertaken in this study. I explain the research methods that I used and discuss the reasons for choosing these methods. I also discuss my data gathering and analysis process as well as the ethical questions I considered. I conclude the chapter with an overview of some validity issues associated with this piece of research.

#### **3.2 RESEARCH ORIENTATION**

This case study uses a mixed methods approach incorporating elements from both the qualitative and quantitative methodologies. Plano Clarke and Creswell (2008) observe that mixed methods is the use of two different methods in order to confirm, cross-validate, or corroborate findings within a single study. A mixed method approach can provide a fuller, or more complete, explanation of the phenomenon being studied than either method can, by providing more than one perspective on a phenomenon (Denscombe, 2007, p. 119). Mixing both quantitative and qualitative methods allows for triangulation which enhances the study's validity. I used quantitative methods related to cloze tests and readability formulae, relying on their strengths of both objectivity and consistency. Interviews conducted with the teachers and qualitative evaluation of the textbooks provided a qualitative dimension to the study.

The approach that I used in this case study was largely interpretive in nature. Cohen, Manion and Morrison (2000) describe interpretive research as one that seeks to understand a phenomenon: in my case the readability of selected grade 4 Natural Sciences textbooks and how learners experience them.

#### **3.3 RESEARCH METHOD**

The present study employs the case study method. Denscombe (2007) defines case study as a method that systematically investigates in depth an instance of a particular phenomenon in order to generate knowledge. The 'instance' that is investigated is called the case. In this study, the case is two grade 4 Natural Sciences textbooks. Isolating a case for study is meant to allow for a more intense examination of the case than would be the case if a broader investigation were carried out. The case study method enabled me to go for depth rather than breadth by analysing the textbooks using a variety of different data-gathering techniques, both qualitative and quantitative. Because it can accommodate both qualitative and



quantitative techniques, a case study approach also allowed me to be flexible in my choices about data collection methods and the analysis of my data.

In order to triangulate my findings I used readability formulae; techniques for assessing learner comprehension including cloze procedure, and what I refer to as a traditional comprehension test (consisting of open-ended, multiple-choice and fill-in questions); analysis of text content, and teacher interviews. Triangulation is the use of multiple sources of evidence related to the same phenomenon usually leading to thick description of the phenomenon from multiple perspectives (Denzin & Lincoln, 2005). The strength of one source or method offsets the weakness of the other (Plano Clarke & Creswell, 2008, p. 109).

### **3.4 RESEARCH SITES AND PARTICIPANTS**

The case study necessitated a purposive and careful selection of the research sites and participants which would provide the data for the case under examination. Although the case under examination was Natural Sciences textbooks, I selected the schools first, for reasons which will become clear later on. Since I wanted to go for depth rather than breadth, I selected only two schools. For both schools, I wanted a school which had predominantly isiXhosa speaking learners who are taught English as a first additional language so that I could investigate the extent to which the Natural Sciences textbooks, written in English, were accessible to grade 4 second language users of English. Ease of access to the schools was also a consideration seeing that I was a full-time student doing a half thesis. This necessitated confining my study to Grahamstown schools where I lived and studied. I therefore, used convenience sampling which, according to Plano Clarke and Creswell (2008), involves including in the samples respondents who are easily accessible and willing to participate. I chose to work with the grade 4 Natural Sciences teachers from the selected schools because they were willing to participate. Using these criteria I selected School A and School B, two primary schools situated in Grahamstown. School B is a school which caters for grades one to nine. School A has grades one to seven. Both schools are township schools; the home language of the majority of learners and teachers in School A is isiXhosa, while the majority of School B learners are isiXhosa speakers but some of the teachers do not speak isiXhosa as their home language. The learners learn English as an additional language. Both grade 4 classes in these schools, their teachers and learners, automatically became the samples for the

study. All the grade 4 learners from both schools participated. Forty eight learners participated, 13 from School A and 35 from School B.

Selection of the two textbooks was purposeful in that I selected the Natural Sciences textbooks currently used in these grade 4 classes in the schools selected. I selected the two textbooks used more frequently than others in the two classes since the teachers used a number of textbooks in the subject area. The textbooks were:

Thurlow, J., & Strydom, H. (2009). *Spot On Natural Sciences Learners, Book. Grade 4*. Gauteng: Heinemann.

Govender, M., & Subramani, T. (2004). *Learning Natural Sciences can be fun. Learners' Book Grade 4*. Pretoria: Nasou via Africa.

### **3.5 RESEARCH INSTRUMENTS**

As noted, I used cloze tests, a traditional comprehension test, readability formulae, textual analysis and teacher interviews to gather my data. I tested learners using cloze tests to assess their understanding of the Natural Sciences textbooks they used. I arranged for the teacher to administer the test in my presence. I did this so that learners would feel comfortable and confident in answering the questions with their teacher in charge in their everyday setting. This also gave me the opportunity to observe the learners' reactions and take field notes while they wrote the tests. The traditional comprehension test was also meant to assess the extent to which the learners comprehended the textbooks in question.

I also interviewed both Natural Sciences teachers to find out their views regarding the readability of the textbooks under consideration. I used readability formulae to predict the readability of the textbooks and determine the grade levels for which the textbooks are suitable. I also employed textual analysis of a more qualitative nature by looking out for the presence and nature of some factors that impact on readability in the texts.

### **3.6 DATA COLLECTION PROCEDURES**

In collecting data for the study, I first paid visits to the two schools to familiarise myself with the teachers and learners with whom I was going to work. The aim was to make them feel at ease with the procedures I was going to follow in this research process and also to get them used to my presence so as to be able to behave normally during the actual data gathering

period. During these initial visits I found out about the textbooks they were using and I had a short informal interview with the teachers where I asked about the textbooks, how they chose them, the reason why they chose those textbooks and whether they felt the books were adequate. I was introduced to the learners so that they also knew my reason for visiting and what I was going to do with them.

### 3.6.1 THE CLOZE TESTS

I used cloze procedure to answer the research question: Do participating grade 4 learners understand their Natural Sciences textbooks? Cloze procedure coincides with the human mind's tendency to complete any sequences or patterns which have gaps (Ruddell, 2005). The cloze procedure has multiple purposes which include determining the readability of written material, an individual's reading level on specific material, an individual's vocabulary level in a specific subject or topic area, an individual's language skills, and an estimate of an individual's general comprehension level. (Mariotti & Homan, 2001, p. 137). I constituted the cloze passages from passages within the selected textbooks. I selected one passage from *Spot On Natural Sciences Learners' Book Grade 4* (Book 1) and one passage from *Learning Natural Sciences Can Be Fun Learners' Book Grade 4* (Book 2), the textbooks that the two schools were using. The cloze test from Book 1 was test 1 and the one from Book 2 was test 2. Both textbooks have four sections as indicated in table 2 below.

**Table 2: Sections covered in different terms of the school year.**

Term	Section
Term 1	Life and Living
Term 2	Matter and Material
Term 3	Energy and Change
Term 4	Planets and Beyond

Selection of passages was purposive. The passages that I chose were representative of the two sections covered in terms one and two. Copies of the selected passages are included in Appendices B and D. Because I went into the schools to do my research in the first half of the year, I tested learners on the sections they had done in first and second terms. The assumption was that textbooks should get progressively more challenging in their content and its presentation as learners also get more proficient with both the language and the concepts

in the learning area. It, therefore, was only fair to test learners who were at the early stages within the grade on content which was correspondingly at the early stages in the textbooks. I gave the first test at the end of May to learners from both schools, the second and third tests in June when the learners were coming to the end of the second term of their school year. School A learners wrote the third test early in August because they did not get the chance to write it in June.

Initially, I intended to use selective deletion, omitting words whose replacement I believed relied on some conceptual knowledge of text, but I then realised that selective deletion was probably more suitable for learners who are proficient users of English. The learners I was dealing with in my study were learning and speaking English as an additional language. Purposefully selecting the words to delete would make the passage more difficult for them, as well as introduce some risk of researcher bias. I therefore, decided to use fixed-rate deletion on the two passages since the third passage was reserved for the non-cloze test. The words to be deleted were predetermined and fixed by mere determination of the nth deletion. I retyped the two passages deleting every 6th word and replacing it with dashes of equal length. Copies of these cloze passages are in Appendices A and C. Following Ekwall and Shanker's (1985) observation that the standard length of cloze passages is normally 250 words, the passages I selected were 250 words in length. A text of 250 words makes 40-item cloze tests possible with an every sixth word deletion technique. The first test had 40 item deletions and the second one had 37 item deletions. The variation was a result of the need to leave the first sentence intact so as to provide context for the passage. The sentences which remained intact were not of the same length.

Since the cloze tests learners had to complete were presented out of context save for the first sentence left intact, I felt a need to provide more context considering the proficiency level of the L2 participating learners. In addition to the cloze passages the learners had to complete, I made copies of the whole passage from which a cloze passage was extracted together with its accompanying graphics. I then deleted the same words that were deleted in the cloze test passages. That context was meant to aid learners, most of whom did not have textbooks of their own, in the completion of the cloze tests. Learners would first read these copies before completing the deleted words on cloze tests. In terms of marking, I accepted as correct, any

words used that were either synonymous, or lexically and grammatically correct. Because I was testing comprehension, spelling mistakes were ignored.

In the event that the fixed-rate deletions may have made the demands of the cloze tests higher by omitting those words learners were most ignorant about, both the provision of additional context and acceptance of appropriate but not the exact deleted items compensated for the difficulty. The 6<sup>th</sup> deletion to me produced deletions which were neither too spaced nor too close which would either have made the tests harder or easier respectively.

According to Vacca and Vacca (2005) the greater the number of correct word replacements learners make, the greater the text's actual readability. I used the following benchmark criterion for scoring which has also been used by Rankin and Culhane (1969).

**Table 3: Benchmark criteria for cloze test scoring**

<b>Score range</b>	<b>Reading level</b>	<b>Meaning</b>
61% +	Independent reading level	Learner can read and understand text on his/her own
41-60%	Instructional reading level	Learner can read and understand text with the aid of teacher mediation
Below 40%	Frustration level	Text is too difficult for the learner even with teacher mediation and should not be used

I administered the two cloze tests to 47 learners, 13 learners from School A and 34 from School B (one School B learner was absent). Learners wrote the tests on two consecutive days. At School A the teacher gave instructions to learners on how to go about the procedure, first in isiXhosa, the learners' first language, and then in English. In School B, the teacher gave instructions in English only. I sat at the back of the classroom observing what was happening and writing field notes in my journal. My field notes served as a supplement to the data from the cloze tests, and as an aid in triangulating my data. Data from cloze tests, field notes, textual analysis, interviews and readability formulae gave my findings validity. The notes were about the reaction of learners to the passages they were reading, whether or not they appeared to be writing confidently without frustration.

### 3.6.2 TRADITIONAL COMPREHENSION TEST

In addition to the cloze tests, I designed a traditional comprehension test (test 3) comprising multiple choice, open-ended, and ‘filling-in’ comprehension questions. I decided to give the learners the traditional comprehension test because they had performed badly in the cloze tests, possibly because they were not used to them. Use of common but diverse question formats would potentially ease the test. Bontis, Hardie & Serenko (2009) view such diversity of question formats as effective predictors of learners’ overall comprehension. I took the comprehension passage from *Spot On Natural Sciences Learners’ Book*. My reason for choosing two passages from *Spot On Natural Sciences Learners’ Book* (the cloze and traditional comprehension) was because it was the book that the learners had used the most and the textbook which was used by both teachers. The test was written by only 42 learners from both schools (7 from School A and 35 from School B) because some learners from School A were absent on the day the test was written.

### 3.6.3 READABILITY FORMULAE

I also applied readability formulae to selected texts from the grade 4 Natural Sciences textbooks to help me answer the research question: Are the selected Natural Sciences textbooks at the appropriate level for grade 4 learners? I used the Free Text Readability Consensus Calculator. This, as previously noted, uses seven well-established readability formulae to calculate the average grade level, reading age, and text difficulty of sample texts. Applying seven formulae to each sample would potentially increase the validity of my findings.

I used stratified probability sampling to select the text samples on which I applied the readability formulae. According to Denscombe (2007), stratified sample is defined as “one in which every member of the population has an equal chance of being selected in relation to their proportion within the total population” (p. 15). Random sampling would still be done but now on strata representative of the whole. The four sections of the Natural Sciences textbooks identified earlier on table 2 were the major strata from which the samples were taken. Within each section are different topics with several units. The samples that I used for cloze testing were amongst those included in the selected samples to further triangulate the data on them. I then randomly selected one unit from each topic throughout the whole text including those topics from which the cloze and traditional comprehension tests were

derived. I wrote numbers of the units in each topic, put them in a hat and picked any number randomly. This gave me sixteen samples per book. The Free Text Readability Consensus Calculator was then applied to each passage in turn. The Readability Consensus Calculator was then applied on each of the samples to come up with the grade level of each sample.

### 3.6.4 CONTENT/TEXTUAL ANALYSIS

Content (or textual) analysis is a systematic and objective method of analysing written, verbal or visual communication messages (Elo & Kyngas, 2008). It involves categorising some aspects of a text with the aim of attaining a condensed and broad description of it. The outcome of the analysis is concepts or categories describing the phenomenon. Content analysis is time-consuming, but there are a number of advantages in using content analysis as a data collecting method. These include that:

- it is relatively easy to get access to the text that one intends to study (in my case, grade 4 Natural Sciences textbooks),
- it is also easy and not expensive to build a representative sample,
- it usually produces reliable (usually quantitative) data,
- it is easy and possible to repeat or replicate the procedure for reliability (Harwood & Garry, 2003),
- it presents objective accounts of events or themes,
- it is an unobtrusive method. It studies a phenomenon as it is without altering it.

Line-by-line analysis of the texts allowed me to determine how some aspects such as vocabulary, graphics, conceptual density and the nature of subject matter or content, enhanced or hindered the readability of both textbooks. I used textual analysis to answer two of my research questions:

- To what extent are the selected grade 4 Natural Sciences textbooks readable in terms of specific criteria?
- What aspects of the textbooks support their readability? What aspects of the textbooks impede their readability?

#### 3.6.4.1 Technical vocabulary used in the texts

I did a textual analysis of the vocabulary used in the two textbooks to establish the extent to which it might potentially affect comprehension of texts. It has been suggested that the greatest vocabulary related challenge in content area texts is the use of technical terms, on

one hand, and of ordinary language used in unusual ways, on the other hand (Hermon, Hedrick & Wood, 2005). According to Hermon, Hedrick and Wood's study, technical vocabulary or scientific jargon are words connected with science and are, therefore, difficult to understand if a reader does not have knowledge of the subject.

In analysing the scientific vocabulary used in the textbooks, I first identified the technical words used in both textbooks. I then identified the frequency with which these words occur in the texts. Next, I grouped the technical words into three groups: technical words mentioned only; technical words defined only; and technical words defined, explained or exemplified. This was to determine whether efforts were made in the texts to support meaning of such terms and enhance comprehension. Finally, I totalled up the technical words and expressed this total as a ratio of the number of pages in the textbook to get a sense of the technical words' density in the textbooks.

#### **3.6.4.2 Graphics used in the text**

Graphics may either aid or hinder comprehension of texts especially content area texts. They may confuse learners if they are wrongly used, or if they demand the kind of graphic literacy the learners do not possess. I sought to determine the extent to which graphics eased or complicated the readability of the two textbooks. Many expository texts use graphics in the form of graphs, tables, diagrams, maps, photographs and charts to help in elaborating or expanding the concepts. Aldrich and Sheppard (2000) identify three major advantages of having graphics in text. First, graphics are concise; second, they are memorable; and third, they make relationships within the information readily apparent. I looked at the graphics to see whether they were captioned and labelled. Labelling and captioning of the graphic material helps the reader to understand their role and purpose in the text. I also analysed whether the graphics were supported by the text to ascertain their relevance.

#### **3.6.4.3 Presentation of concepts**

I also analysed how concepts are presented in the books and their density which is a measure of "the proportion of different ideas in relation to the text's length" (Harris & Hodges, 1995, p. 40). I identified all the concepts or scientific ideas in the texts, page by page and closely examined what was done with each of the concepts so as to make it more accessible to learners. I wanted to establish those concepts that were mentioned only, those mentioned and



defined only and those defined, explained and exemplified, which to me represented the ideal. Using this grouping, I calculated their relative percentages in relation to all of the concepts for each text. I then worked out the average number of concepts per page to find out the conceptual density. I expressed this as a ratio of concepts per page to indicate the books' conceptual load.

#### **3.6.4.4 Familiarity of subject matter in the text**

I also sought to determine the ratio of familiar content to unfamiliar content in the books. Familiarity of content would ease readability of text. Familiarity of content was determined by going back to the grade 3 Life Skills curriculum to see what should have been introduced then. I also determined familiarity of content from whether the topics dealt with things that were within the realm of learners' everyday experiences. The ideal with regard to a readable text would be to have most topics dealing with familiar content and fewer topics focusing on unfamiliar content meant to extend learners' knowledge. I considered units in topics and analysed whether their content was likely to be very familiar, partially familiar or unfamiliar to the learners. The results of these analyses helped to complement the data that I got from the readability formulae and cloze procedure.

#### **3.6.5 INTERVIEWS WITH TEACHERS**

I also interviewed the two grade 4 Natural Sciences teachers to get their views regarding the readability of the two textbooks, whether they used any other resources to supplement the textbooks, and so on. The interviews provided additional data for my research. According to Cohen, Manion and Morrison (2001), an interview serves a number of purposes which include gathering information about a person's knowledge, values, preferences and attitudes. Most of these were solicited in the interviews; I used the same semi-structured interview schedule for both interviews. The items were meant to guide the interview but there was flexibility built in to allow for any probing that may be necessitated by teacher responses. Probing is the technique used to stimulate discussion and get more information from the respondent (Gray, 2004). Where I was given an inadequate or unclear answer, I probed the teachers so they elaborated and clarified their answers. The duration of each interview was approximately 10 minutes. Responses were audio-recorded and later transcribed for analysis. Copies of the interview transcripts are in Appendices L and M.

### **3.7 VALIDITY OF THE RESEARCH**

Neuman (2000) defines validity as ‘how well an idea about reality fits with actual reality’ (p. 164). Two types of validity are identified: internal and external. Internal validity considers the extent to which research findings represent accurately the phenomenon that is being investigated (Ray, 2003) and are not the result of other causes that have not been investigated in the research. The certainty of the research results obtained is affected by the internal validity. External validity, in other words, determines whether or not we can say our research findings may apply elsewhere.

In my literature review chapter I highlighted some methods that have been used by researchers to assess the readability of different texts, both qualitatively and quantitatively. Internal validity, then, considers that the methods used describe and measure what is supposed to be measured. The methods I used have been well researched by a number of scholars and there is general agreement that these methods measure readability in a valid and reasonable way. My sampling was done carefully to try to avoid bias and misrepresentation, and I then used more than one method of assessing readability to cross-check my data in order to establish its validity and determine the accuracy of information I had obtained. In the interviews respondent triangulation was attempted, in that I asked the same broad questions for both participants.

The validity of my quantitative data analysis was assured by the use of seven readability formulae on each sample text. The fact that the computer does all the calculations means there are limited chances of inaccurate results.

In addition to the findings I got from the application of readability formulae, use of tests and textual analysis, I did a critical analysis of interview transcripts in order to get data from the teachers to add to my findings on the readability of the used textbooks. Field notes supplemented my data. Such triangulation was meant to enhance the validity of the study.

### **3.8 ETHICAL CONSIDERATIONS**

The most important thing to consider when conducting research is to inform participants on how the research will be conducted and about how they will get involved, thereby enabling them to make informed decisions about whether or not they wish to participate.

I met the grade 4 Natural Sciences teachers for both schools first to ask permission to conduct my research with their learners. I also asked whether or not the teachers would be willing to be interviewed. When I explained why I was doing this study, they indicated that they were willing to participate. I then asked for permission from the principal. In School A, the Natural Sciences teacher was the principal so already he had agreed to work with me. In the other school the principal expressed willingness for me to conduct my study. I also asked for permission from the School Governing Bodies (SGBs) at schools, promising that I would respect the anonymity of the schools, teachers and learners, and assuring them of confidentiality of the findings. Both SGBs gave me permission to go ahead with my research.

### **3.9 CONCLUSION**

As this chapter has shown, data on the readability of textbooks will be obtained by the application of readability formulae, using cloze and traditional comprehension tests and analysing texts, word by word and page by page (textual analysis), and from interviews with the grade 4 teachers who use these textbooks. In the next chapter, Chapter 4, the data obtained is analysed and the readability of the two textbooks assessed (in a quantitative manner).

## **CHAPTER 4**

### **QUANTITATIVE DATA PRESENTATION AND ANALYSIS**

#### **4.1 INTRODUCTION**

This fourth chapter of the study presents and analyses the data. Although a mixed methods research design was employed for the study, only the findings of a quantitative nature are presented and analysed in this chapter with the qualitative data discussed in the subsequent chapter. The quantitative data are presented largely in graphic and tabular form. The data presented are then analysed for emerging patterns and insights. Two Natural Sciences textbooks were evaluated for their readability. The two books from which the data were derived are:

Book 1: Thurlow, J., & Strydom, H. (2009). *Spot On Natural Sciences Learners' Book. Grade 4*. Gauteng: Heinemann.

Book 2: Govender, M., & Subramani, T. (2004). *Learning Natural Sciences can be fun. Learners' Book. Grade 4*. Pretoria: Nasou via Africa.

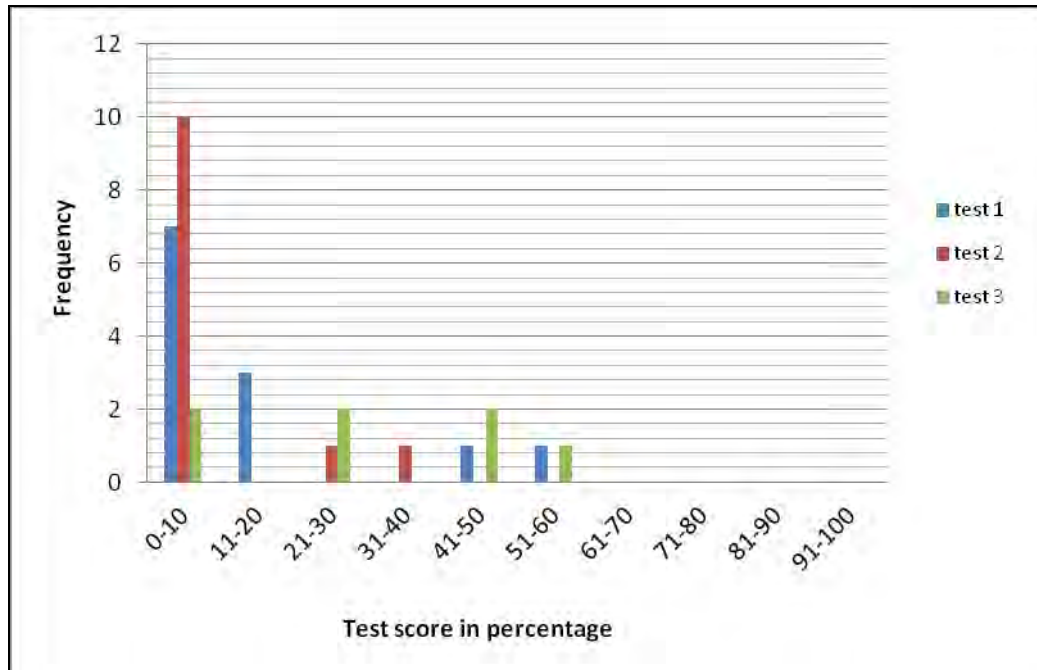
In the study, quantitative data emanated from cloze tests, a traditional comprehension test and readability formulae. The purpose of these tests was to establish how well the particular group of learners in the study understood the Natural Sciences textbooks. The first part of this chapter focuses on data that derived from the cloze tests and comprehension test that were administered to learners while the latter part deals with data gathered from the application of readability formulae to samples of the two textbooks.

#### **4.2 PRESENTATION AND DISCUSSION OF TEST DATA**

Tests 1 and 3 assess how well the learners in the study understand Book 1 and test 2 assesses how well they understand Book 2. The reason for giving two tests from Book 1 and one test from Book 2 was that Book 2 was not used as often as Book 1 by the grade 4 teachers. I therefore, chose the one which was very common to both classrooms.

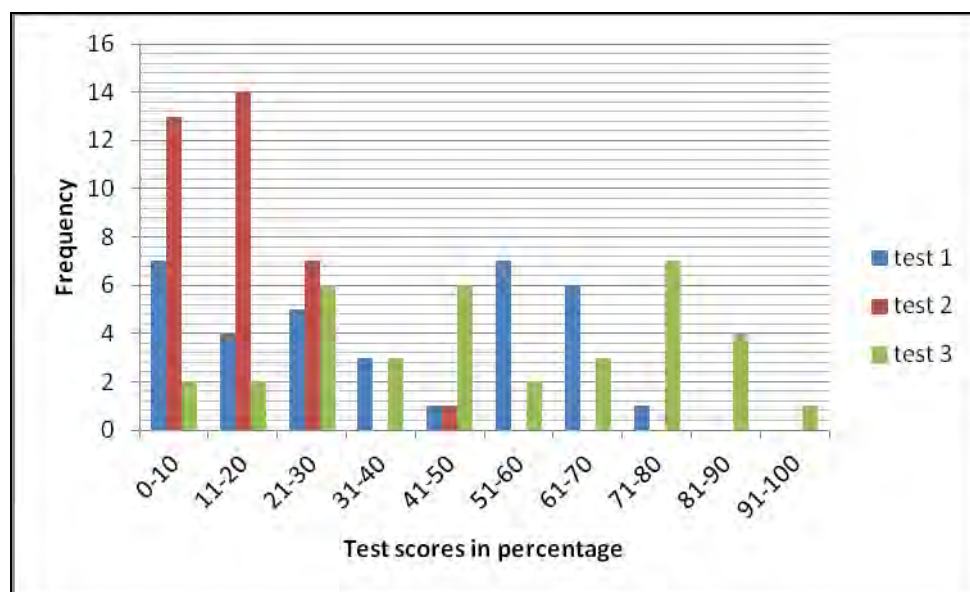
Figure 1 and Figure 2 below represent data from the tests to assess the readability of the texts for the grade 4 learners in this study. Test 3 is presented in these graphs but will be analysed later in the next chapter. Cloze tests were written by learners from School A and School B.

**Fig 1: Test scores of learners at School A for the three tests**



Learners performed poorly in all the three tests (test 1, test 2 and test 3), as is shown by the fact that the most scores for test 1 and 2 fell in the 0-10% range with the scores for the third test being consistent for the ranges 0-10, 21-30 and 41-50 but dropping in the 51-60 percentage range. The highest scores for both test 1 and 3 are in the range of 51-60%, and for test 2 are in the range 31-40%.

**Fig. 2: Test scores of School B learners for the three tests**



Test 1 scores fell in all ranges except ranges 81-90 and 91-100. The highest scores obtained in test 1 were in the range 71-80.

Most learners got scores below 61% which marks the independent reading level. However, learners performed better in test 1 than in test 2 for which scores are all concentrated within the range 0-50. Test 2 is based on Book 2 while tests 1 and 3 are based on Book 1. Book 2 was too difficult for the learners of School B.

Table 3 below is drawn from the learners' scores in the two tests. Tests 1 and 2 are cloze tests from Book 1 and Book 2 respectively. The statistical concepts of mean and standard deviation were employed in order to better understand the nature of learners' performance in the tests. This allowed for a deeper understanding of the level of difficulty of the texts. The lower the score, the higher the level of difficulty. The lowest and highest marks were also identified.

**Table 4: Learners' performance in cloze tests in the two schools**

School	Test	Book	Mean	Highest mark	Lowest mark	Range
School A n=13	1	Book 1	16	53	0	53
	2	Book 2	7	32	0	32
School B n=34	1	Book 1	37	73	0	73
	2	Book 2	14	46	0	46

Table 4 also confirms that test 2 has mean scores of 7% and 14 % for the two schools. The means for test 2 are scores which indicate that Book 2 is within the frustration reading level for both schools. However, there are differences between the schools. In terms of the range, test 1 has 53 and 73 for school A and B respectively and test 2 has 32 and 46 for school A and B respectively. This is because, in test 2, the highest scores are themselves low. The range for test 1 is larger than the range for test 2 for both School A and School B.

#### **Test 1: Book 1: School A**

In School A, 11 out of 13 learners got marks below 41%, which is a frustration reading level. Only 2 learners got 50% and 53% respectively, 53% being the highest mark. The mean is 16%. This means that 11 out of 13 learners found the text too difficult for them even with teacher mediation. The range is 53. Range is the difference between the highest and lowest values. The very high range shows a large discrepancy on the marks and it means there are learners on extremes. In this case the extreme for the weakest students is zero. According to the benchmark criterion that I used in this study, score +61% shows that the text is reasonably comprehensible for the learner who achieves this mark. In the case of school A learners, the highest mark was 53% and the others fell below 40% indicating that the text was too difficult for them. Generally, then, this book was too difficult for these learners in School A.

### **Test 1: Book 1: School B**

Learners from School B performed better than learners from school A in cloze test 1. In test 1, 7 out of 34 learners at School A got above 61%. These learners can read and understand Book 1 on their own. However, 19 learners (those who got below 40%) were reading at frustration level. The textbook was too difficult for them. The mean was 37% and the highest mark was 73%. The range was also very high because the lowest score was 0. Because both the lowest and the highest scores were so extreme, the range for this test's scores is great. It is another case where we have learners on the extreme, whose performance was poor and one whose performance was good. The text was difficult considering the benchmark criterion. A 41%-60% correct word replacement is instructional reading level and means that the text is difficult to comprehend. However, content area texts should be at instructional reading level and should be used with teacher's mediation. Only 7 learners got above 61% in this test.

### **Test 1: Book 1: School A and School B**

The text was at frustration level for most learners whose scores fell below 40%, which marks a frustration reading level. Generally, the samples from the textbook are cognitively challenging and need teacher mediation. Pinnock (2009) advises that, when texts are supported by teacher mediation, they can be slightly above the level of the reader. As discussed in Chapter 2, Armbruster, Lehr and Osborn (2001) maintain that the reader should register at least 75% comprehension of a text at the instructional reading level with teacher mediation. Below this figure, readers are said to be reading at frustration level and that is the case with most learners in the context of this research.

Although the learners in both schools have been found to be within the frustration reading level for Book 1, School B did better than School A. Some learners in School B had scores falling within both the independent and instructional reading level for Book 1. In School A, no-one scored at the independent level and only two learners scored at the instructional level. The fact that for the majority of learners, the book samples were at the frustration level supports the deduction that the textbook was too difficult for the learners and this negatively affected their comprehension. One possible reason that learners in School B did better is that they were taught exclusively in English by their teacher who was non-isiXhosa speaking; this might have developed their understanding of English whereas in School A code switching between English and isiXhosa was frequent.



### **Test 2: Book 2 School A**

Test 2, in which learners from School A got 32% as the highest mark, was based on Book 2. The mean for the test was 7%, which was lower than the mean for test 1. This low mean implies that the learners' performance in the test was poor. All the learners from School A got scores which fell under 40% indicating that the text was at frustration reading level for them. Instead of readers/learners learning from the information in that book, they are likely to be demotivated from reading.

### **Test 2: Book 2: School B**

The mean for the test 2 scores is 14% and the highest mark is 46%. A highest score of 46% means all the test candidates found the text difficult to read. A mean of 14% shows that on average learners could not read the text even with teacher mediation. The performance overall was very poor. 46% was the highest score and all the others fell below 40%. This indicates that the text was at frustration level for these learners as well as for those at School A, according to the benchmark criterion.

It is interesting to note that neither figure 1 nor figure 2 represents a normal distribution curve, which is graphically depicted as a symmetrical, bell-shaped curve with a central peak at the mean. Under normal circumstances, the majority of learners should exhibit average performance and few learners below and above average performance to indicate that the reading was within the comprehension level of the majority of the learners. In these graphs most learners are at the extreme left side of the graph where there are the lowest marks. For School A, no-one scored 60% or above in any of the tests. 10 out of 13 learners scored between 0-10% in test 2. Seven learners scored between 0-10% in test 2. No one got over 40% in test 2. This was a very poor performance and it implies that for learners in both schools the text was very difficult.

### **Test 2: Book 2: Schools A and B**

The learners had difficulty completing cloze test 2, as reflected by the scores in table 3 above. The book from which the passage was extracted had a glossary containing very few words, but the glossary was not provided in the cloze test extract. That could be one of the reasons why learners' scores fall within the frustration reading level. Although most deletions were non-technical terms (31/37), the presence of technical terms like *ecosystem*, *organism*,

*bacteria, nutrients, habitat* and *photosynthesis* in the passage could have compromised the learners' understanding of the text especially because these were not explained in the cloze passage. Words like *decomposed, organism* and *nutrients*, which were among the deleted words and also the other words listed above, are not among the list of the 3 000 most frequently used words in both spoken and written English (Bullon & Leech, 2007). This may explain why the words were unfamiliar to them.

Learners also showed that their English proficiency was limited when they failed to replace words in statements like 'a way\_\_ showing what eats what \_\_ a habitat'. The deleted words in this example were *of* and *in* which they use every day at school. A list of words that were deleted from the passage is shown in table 5.

**Table 5: List of the deleted words**

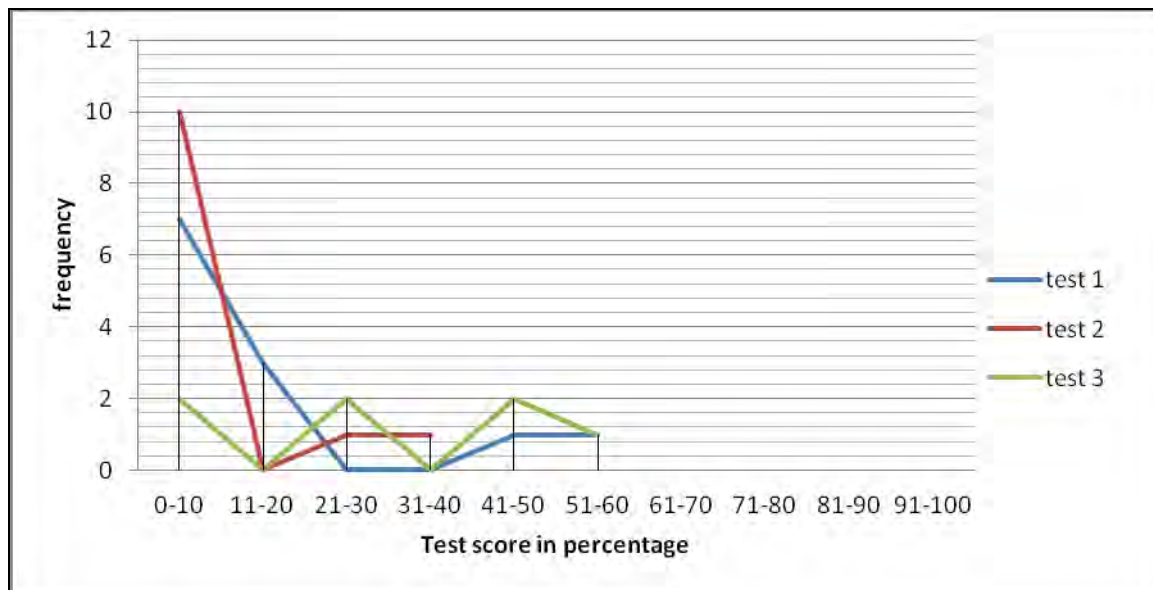
from	food	energy	then	to	then	if	decomposed	nutrients	of	
energy	food	that	is	organism	a	insects	the	this	and	can
today	kind	green	the	people	food	helps	some	animals	then	
a	are	oak	web	of	then					

Some of these words were used repeatedly in the passage. One would expect the learners to be able to fill in grammatical or function words like *is, the, to, of, a, and, are, some* which made up sixteen of the thirty-seven deletions, from their knowledge of the language. The fact that they failed to fill in these function and linking words means they do not understand the very basic building blocks of the English language.

Although the phrase 'food web' is used several times in the cloze passage and is even its title, learners failed to fill in the word 'web' after 'food.' While the textbook would possibly be readable by fourth graders who are more proficient in the English language, it was not the case with the learners in the present study.

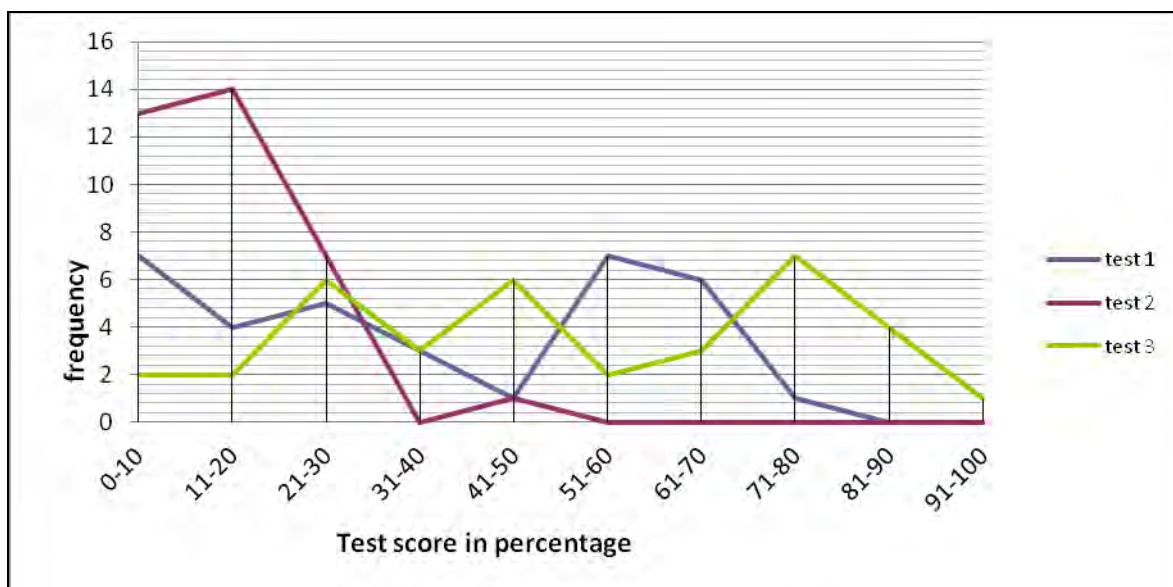
The two line graphs below show the distribution curves of the three test scores for Schools A and B, which are not normal.

**Fig. 3: Line graph to show the distribution of marks in School A**



The shapes of the curves for all the three tests do not adhere to the normal distribution curve which is bell-shaped. They are all asymmetrical. Tests 1 and 2 have their peaks at the extreme left, between the range 0-30 percent. The highest frequency is found in this lowest range. Test 3 has an irregular pattern but with consistency for the ranges 0-10, 21-30 and 41-50 but dropping in the 51-60 percentage range. What would have been expected was that the majority of learners would be having an average performance and a few learners performing below or above average, but in this case, the reverse is true.

**Fig. 4: Line graph to show the distribution of marks in School B**

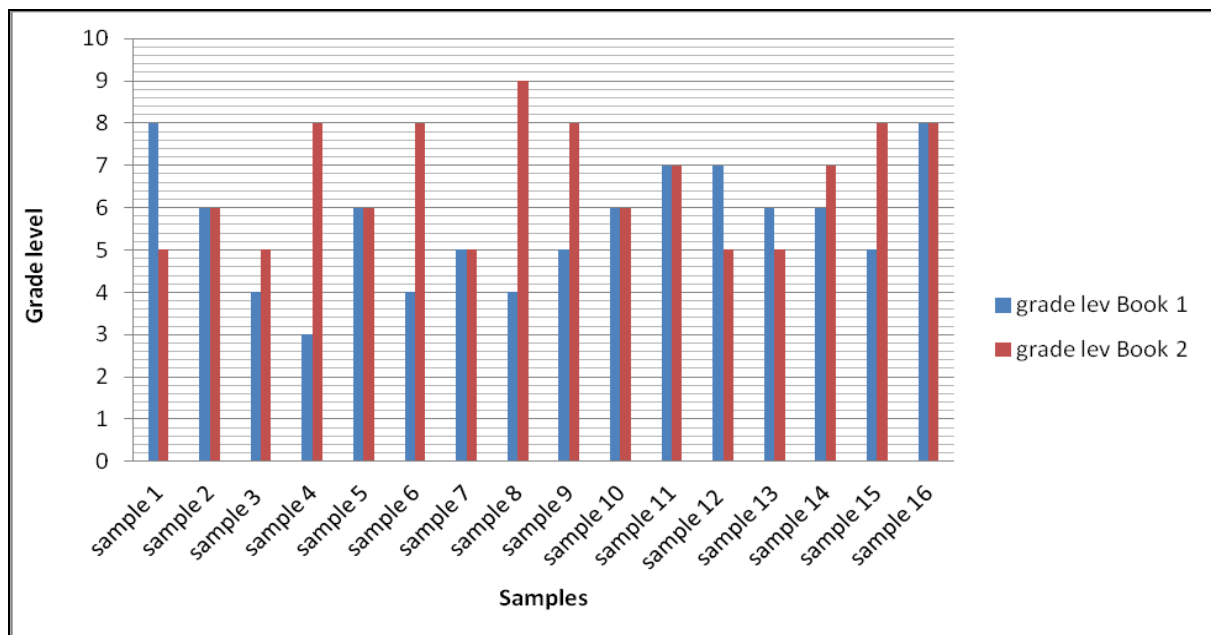


Just as in figure 3, none of the test score distributions approximates a normal distribution. It would have been ideal to have very few scores in the 0-20 and 81-100 categories, slightly more in the 21-40 and 71-80 categories and, then, the rest in the 41-70 categories, but this was not the case. Most scores were in the 0-20 category meaning that most learners were within frustration reading level. The line graph shows that test 2's curve has a peak at the 11-20 category. The majority of scores fall below 40%. All the curves have irregular patterns. Test 3 has scores within the 61%+ indicating that there were some learners who were within the independent reading level. Therefore learners performed better in test 3 than in the other two tests.

### **4.3 PRESENTATION AND DISCUSSION OF READABILITY FORMULAE DATA**

The seven quantitative readability measures discussed in chapter 3, section 3.6.3, were applied to sixteen samples from each textbook and each readability formula calculated the readability score for each sample. Finally, a consensus from all the seven measures was given. The readability consensus was based on the seven readability formulae. It gave the text sample a grade level, readability level and reader's age. The graph below summarizes the findings from assessing readability of the textbooks using the readability formulae as illustrated in Appendices N and O.

**Fig. 5: The readability grade levels of the samples from the two textbooks**



**Table 6: Comparison of the measures of central tendency between the two books**

Book	Mean	Median	Mode
Book 1	6	6	6
Book 2	7	6.5	5

The reading grade level of the textbooks can subsequently be interpreted as:

Book 1      reading level 6

Book 2      reading level 7

The means of the grade levels of the two books' samples indicate that book 2 is qualitatively more challenging than Book 1 and that neither Book 1 nor Book 2 is suitable for fourth graders.

### **Book 1 readability results**

The readability results show that the text is at grade 6 reading level. This is a reading level above the grade level for which it has been written. The Free Text Readability Consensus

Calculators give a range of grade levels from grade 3 level to grade 8 level. This indicates how cognitively challenging some of the texts are.

Book 1 does not have a text sample at grade 9 level. Two samples are at grade 8 level, two at grade 7, five at grade 6, three at grade 5, three at grade 4 and one at grade 3 level.

### **Book 2 readability results**

Book 2 has been pegged at grade 7 level. It has one sample which is below grade 4 level. Fifteen of them are above. The most difficult sample is sample 8 which is of grade 9 level. Five samples are at grade 8 level, two at grade 7 level, three at grade 6 level and five at grade 5 level. It is interesting to note that none of the sixteen samples from Book 2 is of grade 4 level. Eleven samples are pegged at grades 6 to 9 reading levels. This shows how difficult the samples are.

The readability formulae used to assess the readability of these textbooks differ in terms of variables and criterion scores used when they were developed, as a result giving different reading levels (Reddish, 2000). The authors' blurb, on the back cover of the textbook, claims that it was written for all learners and not specifically for ESL readers. If, then, it caters for all readers, it could have first language users in mind which would peg it at a level that could be difficult for the ESL readers. The readability formulae refer to L1 grade levels, but Grade 7 level is too much even for English L1 Grade 4 learners. The majority of learners in South Africa who will use this book are second language users of English.

A text which is to cater for ESL readers should be written in simple and clear language which allows them to access the text. It is, however, not the case with this textbook because the language is so complicated that it comes to grade 7 reading level on average. Cloze tests from the same textbook also gave an indication of the level of challenge it presented to grade 4 learners reading in their additional language. Such consistence in findings from different instruments speaks to the validity of the findings.

#### 4.4 CONCLUSION

**Table 7: Readability ratings for tests and readability formulae**

Text	Cloze Tests Reading Level	Readability Formulae Reading Level
Book 1	Frustration level	Grade 6 reading level
Book 2	Frustration level	Grade 7 reading level

The findings from the cloze tests and readability formulae show that both books are beyond the reading level of the grade 4 learners with Book 2 being worse than Book 1. Book 1 is better than Book 2, because Book 1 is two levels above the intended readers, while Book 2 is three levels above the intended grade 4 level, but both books are read at frustration level.

In the next chapter, Chapter 5, data presentation and analysis continues and the readability of the two textbooks is assessed in a qualitative way.

## **CHAPTER 5**

### **QUALITATIVE DATA PRESENTATION AND ANALYSIS**

#### **5.1 INTRODUCTION**

This fifth chapter of the study continues the presentation and discussion of findings, this time of a qualitative nature. In this chapter, the results of the traditional comprehension test that was administered to learners are presented and analysed. Next, textual data from the two textbooks, focusing on the technical words, graphics, content and scientific concepts used in the textbooks is also presented and discussed. Finally, the data gathered from interviews is presented and discussed. The non-cloze comprehension test, the content analysis of textual factors, and teacher interviews constituted the sources of qualitative data for the study.

#### **5.2 TRADITIONAL COMPREHENSION TEST**

Although the data for the traditional comprehension test (test 3) has been presented in quantitative form in the previous chapter, it is analysed in this section in a qualitative form.

##### **Test 3: book 1**

The traditional comprehension test (test 3) was set from Book 1. It was more realistic to assess whether the learners understood a book they had read. I decided to give the learners this test, which comprised open ended items, multiple choice and filling in comprehension questions to complement the cloze tests. I assumed that these three questioning formats in test 3 would be more familiar to the learners than the cloze tests, and their teachers confirmed this. Since the learners had performed badly in the cloze tests, I also wanted to find out how they would perform in a test type which was more familiar to them, to enable me to find out whether the textbook was really as difficult as it seemed. If students were further instructed on the way in which the item formats work, they would perform better on the test, according to Beckert, Wilkinson & Sainsbury (2003), and this served as the reason behind my use of this test.

The questions which posed a challenge to learners were questions 1 to 4 and question 7 (see Appendix E). These were open-ended questions in which possible answers were not provided. The fact that most learners failed to answer correctly in their own way shows that they might not have understood the questions and/or they could not identify the answers to



the questions although the questions were set at the literal comprehension level. Learners' English vocabulary and language proficiency was evidently limited. Looking at the question "What is a reservoir?", there was evidence from the answers that most of the learners gave that they might not have understood what the question was asking. Some of the answers given were:

1. What is a reservoir? communal areas people walk long

1. What is a reservoir?

The water moves to a building where germs ~~are~~ killed by adding chlorine to the water.

1. What is a reservoir?

A reservoir from there it is pumped to a water.

Such answers were given by many learners indicating they did not understand what the question was asking, and/or they were not able to understand the text itself, and/or they were not able to express themselves in English. They seemed just to copy some part of the text as the answer. One would have expected answers which start with 'It is a...', showing that the learners understand that it is a definition of the term which is required. The other questions to which learners demonstrated an equal lack of understanding were:

*Where is the water cleaned and purified?*

*Which two diseases do people suffer from when they drink unclean water?*

Questions 5 and 6 were multiple-choice and fill-in-the-gaps questions, respectively, each with 5 items. Because possible answers were provided and learners only had to choose the correct answer from a list, performance in these two questions was fair in School B but poorly done in School A. Question 6 was a fill-in question. It had items *a* to *e* with five answers written on top of the questions. There were five dashes to be filled in. Quite a number of learners failed to provide the correct answers. Some of them completed the blanks like this:

- a. Tank particles are filtered out of the water.
- b. Water is stored in a load high above the ground.
- c. In communal areas people walk long ago to fetch water.
- d. People can not walk when they drink dirty water.
- e. Many children in the die because of cholera and typhoid.

- a. Africa particles are filtered out of the water.
- b. Water is stored in a clean high above the ground.
- c. In communal areas people walk long Africa to fetch water.
- d. People can sweet when they drink dirty water.
- e. Many children in water die because of cholera and typhoid.

From the examples above, there is evidence that some learners either possibly could not read or did not understand the meanings of words in the passage and, as a result, they were writing any word in the gaps making the sentences nonsensical. Possibly, they did not understand the language and, as a result, failed to read the words or use them to fill in blank spaces. The majority of the learners performed poorly again. Their scores ranged from 1 to 35%. As discussed in section 2.9, Burns, Roe and Ross (1998) maintain that the reader should register at least 75% comprehension of a text; below this figure readers are said to be reading at frustration level. The answers given above are a clear indication that learners did not understand the text. This means the text would still be too difficult for them, even with the support of a teacher. What support they got from the teacher and with what effects will be discussed under teacher interviews. There was, however, a slight improvement compared to cloze test 1 from the same book. The traditional comprehension test appeared to be easier than the cloze test or possibly learners were more used to these types of questions. Although the learners performed better in this test than in the two cloze tests, it does not necessarily mean the text was readable.

Overall, the performance of learners in the traditional comprehension test showed that they were at frustration reading level. When a text is at frustration level, it means it is too difficult for learners. To answer the research question, 'Do participating grade 4 learners understand their Natural Sciences textbooks?' I would, on the basis of this test, say that they do not understand their textbook.

To gain further insight into the readability of the textbooks, textual factors are discussed next, which attempt to answer the following questions: To what extent are the selected grade 4 Natural Sciences textbooks readable in terms of these criteria? What aspects of the textbooks support their readability? What aspects of the textbooks impede their readability?

### 5.3 TEXTUAL ANALYSIS

This section presents data of the line-by-line analysis of the texts to determine how some aspects like vocabulary, graphics, conceptual density and nature of subject matter or content enhanced or hindered the accessibility of both textbooks. Although this section is largely qualitative, quantitative measures are brought in to give a clear picture of the manifestation of the textual factors in the two textbooks.

#### 5.3.1 Vocabulary (technical words)

I assessed the technical words to see if any effort has been made by the textbook writers to assist learners' comprehension of these words. As was reported in the methodology chapter, the greatest vocabulary related challenges in content area texts are their use of technical terms and their use of ordinary language in unusual ways, which may then make the text difficult to understand without knowledge of the subject.

Technical words mentioned only, technical words defined only and technical words defined, explained or exemplified were identified and Table 7 below presents this data.

**Table 8: Findings from technical words analysis**

Book	Number of technical words	Average number of technical words per page	Words mentioned only	Words defined only	Words defined, exemplified or explained
Book1(138 pages)	499	5	213 (43%)	100 (20%)	186 (37%)
Book 2 ( 92 pages)	936	7	372 (40%)	237 (25%)	327 (35%)

Table 8 shows that most of the technical words are only mentioned, without explanation or examples to make them accessible to learners. An average of 5 technical words per page is quite high considering that most passages in the textbook have between 100 and 250 words. Together with the 20 % technical words which are just defined and left at that, 63% of the technical terms are not given sufficient attention to enable the textbook users to understand the text with ease.

#### **Book 1: vocabulary (technical words) used in the textbooks**

The analysis of vocabulary shows that 43% of the technical words are only mentioned without providing explanation or examples. The ideal would be for most of the words to be in

the defined, exemplified, explained category and the least in the mentioned only. One would have expected that the technical terms that are merely made mention of are those that learners are assumed to have learnt in third grade. A look at the list of the mentioned only technical words would indicate otherwise. Considering that there is no Natural Sciences learning area in the Foundation phase and that the Life Skills curriculum in the Foundation Phase is a combination of several learning areas, maybe it cannot be assumed that learners have a working knowledge of many of the listed words when they get to grade 4. Once a learner has failed to understand the meaning of a number of words in a passage, it becomes difficult to understand what the text is about. A text becomes easier to comprehend when most words are accessible. Of course, not all words must be familiar. There should be something new in order to learn.

Technical words carry the content of content area texts. Having as high as 43% of the technical words being mentioned without explanation compromises the accessibility of a text. To make matters worse, the textbook does not have a glossary to explain the new words used in the textbook. With a lot of technical words in a text which are neither defined nor explained, comprehension of the text is likely to be minimal. Learners cannot simply come to class knowing the meanings of those words and, if they do not know the meanings, they cannot comprehend what they read. Words should be explained even if there is teacher mediation. The vocabulary played a role in lowering the reading level of the textbooks in this study. Book 1 has many technical words and not much effort has been made to enhance comprehension of the words. This leaves the textbook less readable. Below are examples of words mentioned only, words defined only and words defined, exemplified or explained:

Words mentioned only: *planet, climate, oxygen, compression, solar system, soil erosion, resources, reptile, weathering, evaporation, snow, chlorine, cholera, pollution, floods, skeleton*

Words defined only: *atmosphere, continents, universe, fossils, temperature, reservoir, zoologists, herbivores, omnivores, skeleton*

Words defined, exemplified or explained: *weather, ventilation, snow, vitamin, animal kingdom, cold-blooded, migration, proteins*

## **Book 2: Vocabulary (technical words) used in the textbooks**

Book 2 has 936 technical words and an average of 7 technical words per page. This is also quite a large number considering that most passages in the textbook are between 100 and 250 words long, including activities. There are also a lot of pictures and diagrams using up much space. Having many technical words on one page can be a disadvantage if the author has not made any effort to make the text accessible to the learner, by defining or giving examples of what the terms mean.

In this textbook, 40 % of the words are mentioned only, while 25 % of the words are defined only and 35 % are defined, exemplified or explained. Examples of words mentioned only, words defined only and words defined, exemplified or explained include:

Words mentioned only: *gravity, troposphere, stratosphere, ultraviolet, spiral galaxies, air pressure, precipitation*

Words defined only: *asteroids, tornado, water table, sewage, continents, metamorphic, chlorophyll, vaccine*

Words defined, exemplified or explained: *molecules, atoms, friction, plant dye, domesticated animals, volcanoes, evaporation*

One would wonder how ESL learners can be expected to have acquired those words in the mentioned only category. The words are not just technical, they are even difficult to pronounce or spell, let alone know. These are terms even postgraduate university students who are not in the particular science fields would not know. There are so many technical words in the textbook yet the glossary provided accounts for very few words. Some few technical words are followed immediately by bracketed words, which provide meanings for the words. This poses problems for learners when the majority of the technical words are simply mentioned, without defining or explaining them. If most of the words are new, the text becomes difficult to read and comprehend. Judging from the amount of the unclarified technical words in the textbook, the samples are cognitively challenging. There is not much done to make vocabulary meaningful and lower the reading level of the textbook especially for an ESL reader who needs clear language, which is at the right level.

Having looked at the two textbooks, both of them are difficult to read and it is justifiable to say that the textbooks are difficult in terms of vocabulary.

Concepts, like vocabulary, also need to be defined and exemplified in order to make a text accessible. The use of concepts is discussed next.

### 5.3.2 Conceptual density

According to this study, scientific concepts are scientific ideas. In my analysis, some technical words are scientific concepts while some scientific concepts fall under technical words. This means some words overlap in terms of their definition.

I identified the concepts in the texts, page by page. I then identified what was done to each of the concepts, whether they were mentioned only, defined, explained or exemplified in order to make them comprehensible. Table 9 below summarizes the findings.

**Table 9: Findings from the conceptual density analysis**

Book	Concepts	Average number of concepts per page	Concepts mentioned only	Concepts defined only	Concepts defined, explained or exemplified
Book 1	82	1	2 (2.4%)	1 (1.3%)	79 (96.3%)
Book 2	238	2	49 (20.6%)	46 (60.1%)	143 (19.3%)

#### **Book 1: Conceptual density and presentation of concepts**

Book 1 has 82 concepts. Two concepts are only mentioned, one is defined only and seventy-nine are defined, explained and exemplified. The textbook has an average of 1 concept per page. An average of 1 concept per page is reasonable. Of the concepts found in the textbook, 96.3% are accessible, because they are explained and exemplified. Only 2.4 % of the concepts are mentioned without any definitions or examples. A commendable effort has been made to assist the reader in accessing background knowledge of the concept discussed. Both the conceptual density and presentation of concepts in Book 1 eases its readability.

#### **Book 2: Conceptual density and presentation of concepts**

Book 2 has 238 concepts. Only 19.3 % of the concepts are defined, explained or exemplified. The majority (60.1 %) of the concepts are only defined without examples or explanations. Those that are only mentioned make up 20.6 %. The book has an average of 2 concepts per

page. Considering that the passages in the textbook are very short, an average of 2.3 concepts per page seems appropriate. The problem, however, is that most of these concepts are not developed. This is what happens throughout this book. Unexplained concepts lessen readability. Where over 80 % of the concepts are neither explained nor exemplified, text readability is compromised. Learners may move from one concept to the next without understanding them. Information is given quickly and briefly, which greatly lowers the readability of the textbook.

There is no conceptual overload in either book but the conceptual development is weaker in Book 2 than in Book 1. Had the concepts in Book 2 been developed, it would have raised the readability of the textbook.

### **5.3.3 Graphics**

Graphics are visual representations on some surface and examples are drawings, graphs, maps or diagrams. Diagrams and pictures were analysed to see if they were supported by the accompanying text and also if they assisted the learner to bring meaning to the text to support readability and comprehension since the readers are using an unfamiliar language. According to Smith and van Rooyen, as cited by Langan (1993), graphics/visuals have three roles:

- visuals give meaning to the reader since the readers will be using an unfamiliar language
- when visuals are used together with language, learning is reinforced and takes place at its best
- visuals attract attention and help the reader to find out more about the issue under discussion

As I analysed the data on the graphics, I considered the above functions.

#### **Book 1: Presentation of graphics in the book**

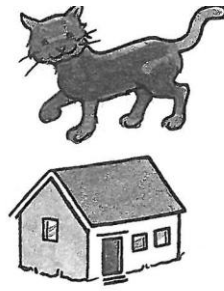
In this book, all graphics are captioned or titled. Those which needed labelling were labelled. Samples below are examples of pictures that have been captioned:

Sample 1 (p.9)



The disabled

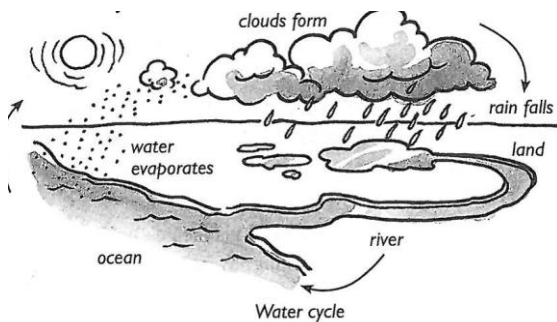
Sample 2 (p.11)



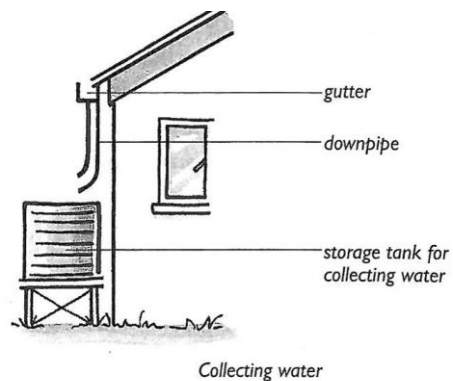
Living and non-living

The diagrams in the textbook are also labelled. Samples below show labelled diagrams. The labels in the diagrams also appear in the accompanying text. By combining visuals and text, learning is reinforced and it is optimal (Langhan, 1993).

Sample 3 (p.40)



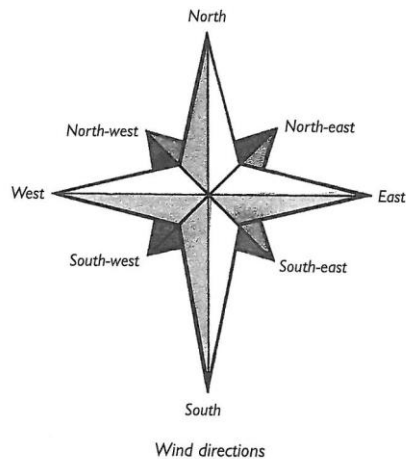
Sample 4 (p.42)



The figure below (sample 5) is labelled but the labels do not appear in the accompanying text. This is, however, the only diagram in the book with labels which are not explained in the accompanying text.



Sample 5 (p. 20)



Graphics are also supported in the preceding text. Examples of graphics supported by text are samples 6 and 7.

Sample 6 (p.32)

Builders use sandy soil when they build walls for houses. The sand is mixed with cement and water. This mixture becomes hard and keeps out the wind and rain.



Sample 7 (p. 69)

## I. The earthworm



Earthworms do not have a backbone or a hard skeleton. These animals have many different parts, called segments, that are filled with liquid. These water-filled segments give the earthworm a water (or hydro) skeleton.

In a nutshell, the graphics in Book 1 serve their purpose because of the following reasons:

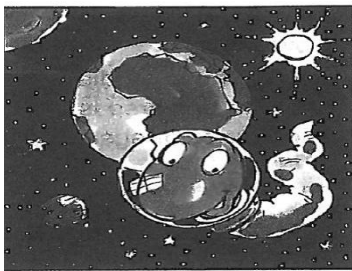
- All graphics are captioned or titled and this assists readers to right away tell what the diagram is about.
- The diagrams in the textbook are also labelled. Labelling gives meaning to the diagrams.

- Graphics are also supported in the preceding text. This supports the readability of the text as it is referred to. As the reader reads a text and then refers to the diagram, what he or she is reading makes sense.

The graphics in this textbook play an important role in raising the readability of the texts. Abstract concepts are brought to life and vocabulary is supported.

## Book 2: Presentation of graphics in the book

Sample 8 (p. 2)



Sample 9 (p.59)

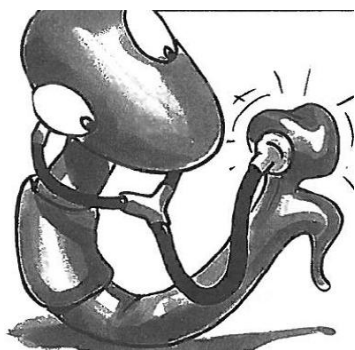


Sample 10 (p. 62)

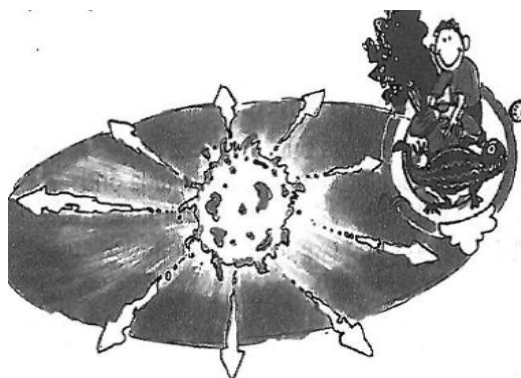


The figures above appear alongside the accompanying text in the textbook. They have no captions or titles or labels. For sample 8, the passage talks about Space and one of the drawings is a moon with a head, eyes and a long tail. Sample 9 is drawn accompanying a text which is about ‘What people need for a healthy life’ and sample 19 accompanies text on ‘Food from plants’. Although the pictures are relevant, the way they have been drawn make them fail to serve their purpose. Rather, they confuse readers. Use of humorous, cartoon-like pictures with eyes and tails where they do not belong is very common in this textbook. Similarly, a banana has been drawn with a head and a carrot with a neck tie and a tail. It is likely that a young reader may fail to tell what has been drawn especially when the diagrams are not titled and labelled. This confuses the reader and the text fails to portray things as they are in real life. For those who have never seen a moon before they will think that a moon has a tail and eyes. Therefore, such visuals fail to support a text. Rather, they hamper the readability of the passage.

Sample 11 (p. 68)



Sample 12 (p. 3)



The pictures above (samples 11 and 12) were neither referred to nor mentioned at all in the accompanying passage. The text, which is accompanied by a blood pressure machine (sphygmomanometer), talks about discoveries made and mentions the steam engine, telephone and light bulb but, next to the text, we find an instrument to measure blood pressure which is not even labelled or captioned. It is likely that if the teacher does not know the name of those instruments then readers or, in this case, learners, will not know what it is either because it has not been referred to in the text and it has not been titled. Sample 12 is a picture of the sun, a man, a plant and an animal. The accompanying text is about the sun. Nothing has been mentioned about the man, plant and animals and the reader wonders why they were included. The reader reads the diagrams in isolation from the text. The pictures hamper and lower the readability of the passage because they depict men, plants and animals that are found together with the sun, which is not correct. According to Mayer (1989), diagrams should be supported by text and they are only meaningful to the reader if they have this textual support. In this case, they are not supporting the text in any way.

Sample 13 (p.59)



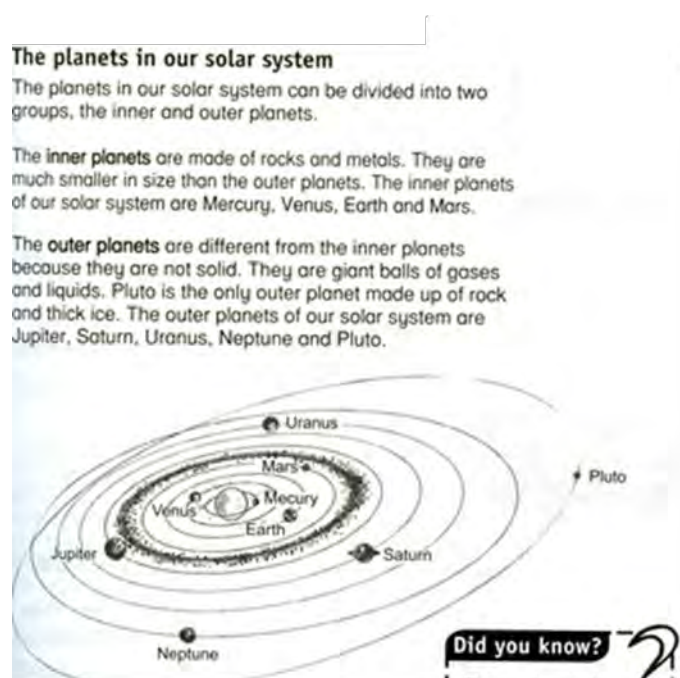
Sample 13 above is not clear at all. One cannot really say what it is, whether a human head or fish or animal. This inhibits the readability of the text. In this case, a reader would not know what benefits accrue from eating peanut butter. The diagram fails to get attention and encourage the reader to find out more information about the subject.

Sample 14 (p. 133)



The figure above (sample 14) is a picture which is not labelled and has no caption. It is left up to the reader to infer from the text that the white stuff in the tin is paint and it is the compound. The reader is left with a question of what the picture is about. The visual medium together with the language is intended to provide meaning for the reader of unfamiliar language. In this case, the visual medium has failed to do so because it is not communicating the intended meaning very clearly.

Sample 15 (p.5)



This is a diagram which is cognitively above the level of the learner. According to the worksheets being used by the Natural Sciences teachers in the Eastern Cape schools, the topic on *Planets and other bodies* is supposed to be done in the third term but in this textbook it is close to the beginning, topic 3 on page 5, which implies that the authors intended learners to learn about planets in the first or second term. Reading this topic earlier during the year would lessen the readability of the text because the topic will be too cognitively challenging for the learners.

In summary, Book 2 has the following limitations, which hinder the textbook from effectively complementing textual information and enhancing the textbook's readability:

- The graphics have no caption or title or label. The reader may fail to appreciate their purpose.
- Most graphics in Book 2 are humorous and cartoon-like pictures with eyes and tails when what they are supposed to represent in real life does not have those features. An example would be the pictures of a banana and a carrot with heads and eyes. These confuse readers because that is not what these things are in real life.
- Some of the graphics were neither referred to nor mentioned at all in the accompanying passage and the reader wonders what they are for.
- Some graphics are unclear. One would not really say what they are and so they do not assist a reader in their reading and understanding a text.
- Some graphics are cognitively above the level of the readers.

Science is a subject which uses difficult language so there have to be appropriate graphics to scaffold and mediate the texts. If the graphics are poor, then comprehension is hindered and readability lowered.

In terms of graphics, Book 1 is more readable than Book 2. Graphics in Book 1 do well in helping the learner to bring meaning to the text and help readability and comprehension whereas those in Book 2 hinder the readability of the text.

#### **5.3.4 Familiarity of content**

In analysing the familiarity of content, I looked at the content to assess whether it deals with things learners encounter or use in their daily lives or what they did in grade 3 Life Skills. I

considered the topics in the books. When reading material is familiar, it becomes easy to comprehend and read (Graves and Graves, 2003). I considered the topics in the textbooks. Assessing all the units in the topics, I categorised the content into three: very familiar, partially familiar and unfamiliar or abstract. The table below shows the findings:

**Table 10: Findings from the analysis of content in the books**

Book	Units	Very Familiar	Partially Familiar	Unfamiliar
Book 1	62	47 (75.8%)	9 (14.5%)	6 (9.7%)
Book 2	58	29 (50%)	16 (28%)	13 (22%)

### **Book 1: Familiar versus unfamiliar content**

The table shows that Book 1 has 62 units. In an analysis of the familiarity of the content of this textbook, it was found that 75.8 % of the information is very familiar, 14.5 % is partly familiar and 9.7 % is unfamiliar. This means that three-quarters of the content of the textbook deals with what learners in this context experience or see every day. Some information may be considered partly familiar, because readers are supposed to have learnt it in grade 3 Life Skills, for example, the topic on Space.

Graves and Graves (2003) state that texts with familiar content are more readable and comprehensible than those with unfamiliar content. Having so much familiar information assists in raising the readability of the textbook. When readers already have the schema or prior knowledge of what they are reading, it is easier to read and understand than read about what they do not know. As noted earlier on, Meyer (2008) notes that optimal learning occurs when learners understand most of the input (via reading or listening) while being challenged by some new material. This textbook has 9.7% new material. This is the new knowledge that readers will learn as they read their textbooks. There should not be too much new material to challenge them, because readers may be overwhelmed by it and fail to learn anything. Krashen (1985) suggests that input should be one step beyond the acquirer's current stage of competence. He represents this as  $i+1$  for input plus one. The input  $i$  is the current competence and 1 is the most immediate higher stage. So readers should have some new material in order to learn but not too much to overwhelm them. If they read only what they know, then it means no learning has taken place. The high percentage of familiar information,

therefore, has played a role in raising the readability of the textbook. The textbook is readable in terms of content familiarity.

### **Book 2: Familiar versus unfamiliar content**

Book 2 has 50 % of very familiar content, 28 % partially familiar and 22 % unfamiliar content. This means half of the content of the textbook is not very familiar. In much of what learners read, they do not have prior knowledge or a picture of what they are reading and this lowers the readability of the textbook.

An attempt at raising the readability of the textbook in terms of familiarity of content was not made in Book 2. This, therefore, makes it less readable.

Although the study was about the readability of textbooks, it was important for me to establish the views of the teachers on the readability of the texts as they were the ones who mediate between learners and the texts. Findings from teacher interviews are presented and analysed next.

## **5.4 PRESENTATION AND DISCUSSION OF INTERVIEW DATA**

To enhance the validity of my interpretations of the data presented, I conducted interviews with the two teachers to understand their own perceptions about the textbooks they used, which were also used by learners. Teacher A taught at School A and Teacher B taught at School B. This section reports and analyses the responses from the teacher interviews on issues related to the selection and readability of the textbooks they and their learners used. It also analyses the issue of learners having no textbooks of their own. Teachers' responses are reported verbatim. In response to the question about what they considered when they chose the textbooks they were using, Teacher A said that he chose textbooks whose language is accessible to learners. To the question whether or not the two textbooks were readable in the grade 4 classes, the teachers' responses were as follows:

**Teacher A:** *Yah, what I've discovered is that almost/most of them are not suitable for the kids because they don't take into consideration the level of the learners. Eh, the – how can I put it? The language that is used which is not at the level of our learners and even the terms that are in that textbook, our learners find it difficult to understand them. If you can try to*

*explain them, because it is not the language they use almost every day, so it makes it difficult for them to understand what is there. The only thing that we do, we do now with, we mix both the language of teaching and their mother tongue. That is one of the ways that assist us so that they can grasp what is in the textbooks or what they are learning.*

From this, I deduced that Teacher A felt that the textbooks they and the learners used were not at the right level for learners and learners found it difficult to read and comprehend them. It is interesting to note that the teacher said the criteria he used for choosing these textbooks was the accessibility of language to learners, but, later, he said that the textbooks did not suit the learners' reading level as the language used in the textbooks was not easy for learners to understand. This, then, forced him to use the L1 instead of using English, the LoLT. If these selected textbooks were chosen because they were considered readable, it therefore implies that the other available grade 4 Natural Sciences textbooks were more difficult than these two. They were all at frustration level. Textbooks at frustration level are not to be used by learners but are to be done away with. They discourage learners from reading.

From Teacher A's response, it is clear that the teacher could choose textbooks that suit the level of learners but his choices were, however, determined as well by the money available to buy the textbooks. Since the teacher claimed that the school did not receive enough money from the government to buy textbooks, they were forced to buy the cheapest regardless of their accessibility to the learners. It is interesting to note that these two textbooks have been considered to be better and at the learners' level although this research has shown that the textbooks are far above the learners' reading level.

On the contrary, Teacher B considers the best text as one which matches with the curriculum. This is what he says:

**Teacher B:** *I just perused the textbooks that we had in the school and saw that that one was a little bit in line with the syllabus. That is the work schedules that we have although it's not ah up to the standard I really want. And it also lacks, ah, the activities, the way that we are supposed to give learners to write.*



What mattered to him most was whether the textbooks matched the curriculum, in this case, the work schedule. Teacher B also complained that the textbooks he chose did not have good assessment activities for the learners. For him the accessibility of the language to the learners was not an issue. Since his learners were used to learning in English only during Natural Sciences lessons, without the use of L1, they got used to the language and reading in English did not cause much of a problem to some learners compared to learners in School A.

Another important issue discussed was the issue of most learners having no textbooks of their own, which was another reason for these interviews. The fact that most learners had no textbooks of their own, or they shared the textbooks, could have a negative effect on the readability of the textbooks they found to read once in a while. This is what the teachers said about it:

**Teacher A:** *Yah they are missing the interaction with the textbook because when the learner is given the textbook, he can come up with something else that was not taught in the classroom, yah and he or she can put it in his or her own perspective. Yah that's right. They are missing the interaction with the textbook really. And also, not using a textbook is discouraging them from reading and understanding because if they use a textbook, even the learner doesn't understand a word. If he or she keeps on reading, when he reaches a certain word, he will recall that part he or she didn't understand, and make sense of what might be the author's intention.*

**Teacher B:** *Yah, it's a blow to the subject because ah, the more they interact with the textbook the more they are going to learn more. So it's really a blow. They are supposed to have the textbooks at school and textbooks at home. Eh, by not having textbooks, let me first answer that one. Eh I come from \_\_\_, at times we had a situation whereby the teacher will be having a textbook. You talk about a certain picture in the textbook. It is the teacher who is seeing the, whatever the content. The learners are supposed to read and interact with whatever they are supposed to learn.*

Both teachers felt that learners were missing a lot by not having textbooks of their own. It was a big disadvantage, because they could not have time to read on their own, see the graphics that aid comprehension, see how different words are written and interpret the text

for themselves. As a follow up question, I wanted to know what the teachers did since most learners did not have textbooks.

Both teachers sometimes gave notes taken from different textbooks to make up for the absence of textbooks and difficult language in these textbooks. They gave the learners activities from these textbooks to assess whether the learners understood what the teachers were teaching. Teacher A felt that notes were very necessary because they would simplify the inaccessible language that was in the textbooks. The language, the teacher said, was difficult for the learners because it was not the one they used every day. It was new to them. So, the notes that he gave simplified the language so that learners could understand it. He would then test them to see if they understood the notes. On the other hand, although Teacher B sometimes gave notes to learners, he felt that the learners were too young to write notes. His concern as well was not about the language used in the textbooks. As a result he gave more exercises than notes. Exercises were a good way of testing to see if learners understood what they were taught.

Teachers felt that learners were lacking interaction with the textbooks. As teacher B puts it, "*it is a blow.*" Instead of a learner seeing what is in the textbook, it is the teacher who sees it because teachers are the ones with textbooks.

There were no textbooks for learners either at school or at home. The reasons were that the schools were not given enough money to buy textbooks and the parents also did not buy their children books, maybe because they could not afford it or they did not care to do so. This means there was no reading taking place in these learners' lives. Researchers now are convinced that both reading volume and oral language are the prime contributors to individual differences in children's vocabularies (Cunningham & Stanovich, 2003). The more children read, the better their cognitive skills. Krashen (1985) emphasizes that the best way to improve reading is by reading. A solution to reading problems is reading a lot, every day. The readers/learners assessed in this study did not have textbooks of their own. As evidenced by the poor performance in the tests they wrote, they have not developed their vocabulary. They failed to read and understand the texts and as a result gave meaningless answers.

Cunningham and Stanovich (2003) suggest that school principals should see to it that classrooms are full of books to read and at home learners should also be supported with print materials. This is how reading may be assured, that is, reading which then develops cognitive skills.

As we look at the readability of the two textbooks, we also have to consider the readers and their contexts. Besides the fact that the textbooks are difficult, the readers' proficiency in the language used and the availability of reading material are also important issues that have to be discussed.

As discussed in chapter 1, most grade 4 learners in South Africa face transitional challenges. The learners who participated in my study fall into this category. The first transitional challenge is that they start using English as LoLT in grade 4. It is unfortunate that they begin using English for learning yet they do not know the English language. What happens then is that teachers resort to using isiXhosa, their home language, for oral work in the classroom while English is for reading and writing (Probyn, 2005). They do this to try to scaffold the learning. They then end up using English only when writing and reading. In this case, we cannot expect learners to be able to read, worse still reading science which is more challenging. They have not developed the CALP which is necessary for reading in a second language. Basically, they cannot read English fluently, if ever they are able to read it.

The second challenge is moving from learning to read to reading to learn. It is assumed that, by grade 4, learners are supposed to be able to read and as they read, they learn from that reading. Unfortunately, with the learners in this context, by grade 4 level they are still learning to read. Because they possibly did not master the reading skills for the home language in the Foundation Phase, they might have no reading skills to transfer to the second language. PIRLS (2006) results indicated that South African grade 4 and 5 learners, most of whom were tested in literacy in their home language, were found to be the least competent out of the forty participating countries. Failing to read in one's own language is a good prediction of failure to read in the L2. No reading skills are likely to be transferred to the L2. Learners in this study are likely to have suffered from this predicament.

When I went to give tests to learners for School A, instructions were clearly given in isiXhosa, as usual, because the teacher said that without using their mother-tongue, the learners would not understand. He then gave the instructions again in English. After the test, when I tried to ask them in English how the test was, no one answered me because they did not understand what I was saying. As I observed them writing, the expressions on their faces as they were writing and the time they took to write the tests indicated that they were struggling to read and understand the texts. As a result, they performed poorly in the tests.

The Natural Sciences teacher at School B could not speak isiXhosa. Therefore, whenever he taught, he used English and no IsiXhosa was spoken in his lessons. This forced the learners to learn to speak English whenever they had to communicate with the teacher. Even when I asked them afterwards how the test was, they were able to answer me in English that the test was difficult. Most of these learners' performance on the tests was better than that of School A learners. This exposure to English might have assisted them as well in reading English texts. The fact that they performed better in the tests might mean that their reading was better as well.

It is, therefore, apparent that although the teachers chose to use the two textbooks, they admit that these textbooks are not the best. They had problems of accessibility of language and failure to be in line with the curriculum. The fact that the learners did not have textbooks of their own worsened the situation. They did not have interaction with the textbooks and therefore reading the textbooks became difficult.

The intention of this study is to answer the question: "How readable are the grade 4 Natural Sciences textbooks?" As discussed earlier in chapter 2, readability depends on the text, the reader and the context in which the text is read.

## **5.5 SUMMARY OF FINDINGS FROM THE THREE DATA SOURCES**

This section of the chapter brings together the main findings concerning the readability of each text from the different research instruments that were presented and analysed in this chapter. It seeks to compare the readability gradings of different instruments on the two books with a view to establishing their readability or otherwise.

**Table 11: Readability ratings from traditional comprehension test, content analysis of readability factors and teacher interviews**

Text	Content analysis of readability factors	Teacher interviews	Traditional comprehension test
Book 1	Technical words - not readable. Concepts - readable. Graphics - readable Content familiarity – readable	Difficult	Very difficult - Frustration level
Book 2	Technical words - not readable. Concepts - not readable. Graphics - not readable Content familiarity - not readable	Difficult	

### Overall ratings

Although performance in the traditional comprehension test which comprised multiple choice, filling in blanks and open ended questions was better than that of the cloze tests, it showed that Book 1 was very difficult.

However, textual analysis of readability factors seems to point to Book 1 being the more readable of the two. This is because, of the four factors which were considered for the textual analysis, only the technical words compromised the textbook's readability. Most technical words in this textbook were not explained, exemplified or defined and this made the textbook less readable. However, the concepts used in the textbook were developed. The graphics used served their purpose of providing visual clues about the text and often clarified or synthesized ideas more effectively than the text alone could. The content in the book was familiar to readers. It is interesting to note that vocabulary, which is also considered as a factor in readability formulae, was deemed a constraining factor to readability. This would mean the textual analysis findings do not necessarily contradict readability formulae findings but complement them. Although the three factors of readability, that is, concepts, graphics and content have been used positively in the texts, use of undefined and only mentioned technical words has helped to lower the readability of Book 1.

Book 2 has also been found to be at frustration level, just like Book 1. Considering the means of the learner's results, they performed quite badly, an indication that they did not understand their textbook. In terms of textual analysis, all four aspects, that is, technical words, concepts, graphics and content familiarity establish that the textbook is not readable. Technical words

are neither explained, defined nor exemplified. The same applies to the concepts used in this book. The graphics do not aid comprehension of the accompanying text and most of the content in the book is unfamiliar to the readers. All these factors contribute to the textbook being less readable.

Teachers interviewed claimed that the textbook was difficult. They based their views not from research but from their experience of using the books with their learners. Overall, the findings from the teacher interviews and content analysis have established Book 2 to be difficult and less readable.

## **5.6 CONCLUSION**

In conclusion, the analysis of the findings done in this chapter on the two textbooks examined show that both textbooks are above the readers' levels and learners do not understand their textbooks. The traditional comprehension test revealed that participating learners did not understand their Natural Sciences textbooks as scores were low and cases of misunderstanding the demands of the questions were rife. Textual analysis showed that much of the lack of text readability was because of the vocabulary used, which was not explained. Other factors that might have compromised the readability of the textbooks included degree and amount of exposure to the textbooks and transitional challenges that the readers faced. Overall, the different instruments yielded data which supports the conclusion that neither of the textbooks is readable for fourth grade learners in general and for the fourth graders in the present study. The next chapter, Chapter 6, concludes the study and offers recommendations to different stakeholders.

## CHAPTER 6

### CONCLUSION

The main focus of this thesis has been to assess the readability of two grade 4 Natural Sciences textbooks currently used in South African schools. The purpose has been to find out whether the selected grade 4 textbooks are at an appropriate level for children learning in their additional language in grade 4 and if the learners in the study understood their textbooks.

#### 6.1 FINDINGS

The findings from the cloze tests and the traditional comprehension test indicated that an overwhelming majority of learners did not understand their textbooks. In completing the cloze passages most learners failed to replace the blanks with the actual original word or its synonym or any other which made sense. According to the cloze test benchmark used in this study, the textbook reading of the majority of learners was evidently at frustration level, with the majority of learners getting marks below 40%. The way the majority of the learners answered the open-ended questions in the traditional comprehension test suggested that they did not understand what the questions required them to do, let alone understand the text. Their performance suggests that these learners have attained neither the BICS for general communication nor the CALP which is required in order to learn all subjects in their additional language, English. The fact that they have been learning in their L1 in the Foundation Phase and are suddenly introduced to English as LoLT in grade 4 might have overwhelmed them.

Although the readability formulae used in the study have not been calibrated for South African circumstances, they indicated that the selected grade 4 Natural Sciences textbooks were far above the level of learners, both L1 and L2 speakers of English. This then explains, in part, why the learners did not understand these textbooks. *Spot On. Grade 4 Learners' book* (Book 1) was on average found to be at reading grade 6 level considering the sixteen passages from the text on which the formulae were applied. The book *Learning Natural Sciences can be Fun. Learners' Book Grade 4* (Book 2) was on average at reading grade 7 level for the sixteen passages. Although both textbooks were written for grade 4 learners, they were both above the grade 4 reading level. There were also considerable differences in

the readability levels of different sections within a single book, which suggests that learners may sometimes encounter differences in the readability of texts in a given textbook. This suggests that textbooks are not uniform and that publishers might not have done any screening process for the readability of their textbooks.

The findings from the textual analysis of the textbooks were that the textbooks contained many technical words and concepts which were not defined, explained or exemplified. Such words are an inevitable and integral part of learning about science, so it is not surprising that they are there. The problem was that so many were not scaffolded. Most of these words were only mentioned without much done to bring them within learners' comprehension.

The graphics in Book 1 were, however, well-used to serve their purpose of assisting readers to comprehend the text. The graphics were captioned and labelled for readers to know what they were about. The graphics were also supported by the accompanying text. On the other hand, the graphics in Book 2 were neither captioned nor labelled. Some of the diagrams appeared in the book yet no text accompanied them. They appear to have possibly been included to serve a decorative purpose in the book. Some graphics were designed in humorous, cartoon-like ways to the extent that they misrepresented the reality of the objects they portrayed. An example would be a banana with a head, eyes and hands. Other graphics were unclear which could have left readers without a clue of what they represented. An example of this is a picture of something I could not identify since I could not tell whether it was a fruit or a human head eating peanut butter. As a result, in terms of graphics, the book was not readable.

Although Book 1's graphics supported comprehension of the textbook and the concepts were well developed, the large number of technical words which were mentioned only compromised the accessibility of the book by the learners. As noted earlier (Section 4.3) optimal learning occurs when learners understand most of the input (via reading or listening) while being challenged by some new material. Too much unfamiliar content makes a text inaccessible. Most of Book 1's content was familiar to learners in South Africa because it is what they meet and experience every day in their lives. So in terms of familiarity of content the textbook is readable. That learners still had challenges with reading this text with familiar



content, shows that familiarity of content is only one out of several factors which determine the readability of a textbook. Book 2 on the other hand was replete with unfamiliar content like *atoms*, *compounds* and *glass making*. This made the textbook inaccessible.

Considering these significant aspects of text that affect readability, Book 1 was evidently more readable than Book 2. Even in the tests written by learners, those from Book 1 were performed better than the one from Book 2. Book 1 had a mean of 16%, mode of 0% and highest mark of 53% for School A, compared to Book 2 which had a mean of 7%, mode of 0% and highest mark which was 32%. For School B, Book 1, the mean was 37%, mode was 58% and the highest mark was 73%. Book 2's mean was 14%, mode was 16% and the highest mark was 46%. The textual analysis therefore, possibly explains why Book 1 was better understood than Book 2 although both textbooks are beyond the level of the intended readers.

In this study it was clear that the participating teachers felt that the textbooks were beyond the grade 4 level. This corroborates findings from the readability formulae measures as well as the more qualitative analyses. These teachers worked on a daily basis with both the textbooks and the learners.

## **6.2 RECOMMENDATIONS**

Having found that the assessed textbooks were not at the reading level of the intended learners, I proffer several recommendations directed to specific stakeholders. My main foci for recommendations are on authors, publishers, teachers and Department of Education officials and other stakeholders.

### **6.2.1 Authors**

Authors of Natural Sciences textbooks should strive to ensure a match between the textbooks and the reading level of their target readers whenever they write textbooks. This can be achieved initially through testing samples or portions of their proposed texts using the different assessment measures some of which have been applied in this study. The use of quantitative readability formulae to assess the grade levels of textbooks could be of much help. At a later stage there is need for extensive piloting of textbooks and subsequent modifications where needed before they are deemed ready for the market. The DBE needs to

allow sufficient time for this when it calls for submissions from publishers. As they gain more experience writers could write to formulae. Textbooks should be challenging but they should not frustrate readers.

The research identified and explored a number of aspects and relationships to the readability of science texts. Authors should also put consider those aspects that affect the readability of texts, making them enhance comprehension rather than hinder it. These aspects include technical words, scientific concepts, graphics and the nature of content. Once these are used well in a way that enhances understanding, learners can obtain maximum learning.

The use of glossaries is also recommended so that learners have somewhere from where they can learn new words. It might be a good idea to have bilingual or multilingual glossaries. Bilingual ones would be useful, especially if they were downloadable from the publisher's website. Teachers could then download the ones appropriate for their students. Authors could also write meanings of new words in brackets, after the new words so that readers may readily get the meanings as they read the texts.

Textbook authors should be well-versed in the subjects for which they write and knowledgeable about the context of use. For instance, one who chooses to write a grade 4 Natural Sciences textbook should have taught grade 4 Natural Sciences for years and should know what learners struggle with and what is easy for them. Such a person knows how to write a text that is accessible to the learners.

### **6.2.2 Publishers**

In a similar vein, publishers should play a regulating role where they ensure that only the textbooks meeting the readability levels of their intended target audience get published.

### **6.2.3 Teachers**

Seeing that the teachers who mediate the textbook information to the learners are important stakeholders, I suggest that all teachers be trained to evaluate the suitability and readability of textbooks as part of their teacher education or in-servicing. Because there are many textbooks on the market competing for attention, teachers should therefore, be able to use sound criteria to evaluate textbooks and choose the ones appropriate and accessible to their ESL learners. A good selection process is essential to ensuring that teachers use the best textbooks available.

Where teachers see that the textbooks are beyond their learners' levels, they need to devise strategies for mediating the content and adapting some of the material and even having the knowledge to dispense with those parts of the texts that will only serve to frustrate the learners.

#### **6.2.4 Department of Education officials and other stakeholders**

It is also recommended that the government and other stakeholders provide textbooks to every individual learner. Exposure to reading material is important. Exposure compels learners to read the books and the more reading they engage in the better they improve their proficiency in reading and knowledge of the concepts. As my study has shown, many learners in rural and township schools have no textbooks of their own and this implies that not much reading of Natural Sciences is done either at school or at home. In such a case, it may be unfair to expect these learners to be able to read and understand when they do not have books to read. As noted in Chapter 2 the only way to be able to read is to read a lot. It is therefore, important that young learners be provided with textbooks and other reading material so that they can develop a culture of reading which is missing in most South African schools.

### **6.3 LIMITATIONS AND CHALLENGES OF THE STUDY**

This study was limited, firstly, by the number of textbooks that were examined. Only two Natural Sciences textbooks were examined from amongst the many recommended textbooks for grade 4. This was because of the scope of a half-thesis, and the limited time within which to complete the research; it would have been difficult to broaden the scope without compromising the depth of analysis in the time available. In future it will be very important for other researchers to look at the other grade 4 Natural Sciences textbooks and examine whether they are at the appropriate level for learners, most especially learners learning through their additional language.

Secondly, learners did not have textbooks of their own. Textbooks were used by teachers and not by learners although the goal was to deal with the readability of textbooks used in the two schools. So the learners were tested on extracts from textbooks which they had not had enough exposure to. Other related research in future may be done, testing learners who have had exposure to their textbooks to see if the results will differ.

Thirdly, two grade 4 classes and two teachers from Grahamstown schools was a small sample of the grade 4 learners and teachers in South Africa. It becomes impossible to generalise the findings to all South African grade 4 learners and teachers. Perhaps other teachers working in similar circumstances might be able to relate to these findings. The challenges the learners face as second language users of English just transitioning from learning in the medium of a home language are not unique to them only but apply to the broader population of South African learners. The study therefore, holds important insights relevant to other settings as well.

The fourth limitation was that only two cloze tests taken from work covered in terms 1 and 2 were given. They were given towards the end of term 2 of their school year. The research time frame did not allow for the researcher giving learners cloze tests from passages they were yet to do in the 3<sup>rd</sup> and 4<sup>th</sup> terms.

A further limitation in relation to the tests was that I developed the tests myself and they have not been standardized on a population. In addition to this, testing learners' comprehension of the texts did not provide an actual measure of readability of the textbooks but the poor literacy level of the learners. Although it was the intention of the research to establish whether this specific group of learners understood their textbook, it may have weakened the methodological triangulation using different techniques to establish readability.

Another limitation was that the principals organised my meeting with the SGBs where only verbal consent was granted. Although both the principal and SGB members felt there was no need for written consent, it could potentially be problematic if something went wrong in my interactions with the learners.

The challenges I encountered included absenteeism which resulted in only half of the learners writing test 3 in School A. That was a major problem especially at the end of the term when learners had finished writing their end of term tests. This also made it impossible to carry out a similar test on Book 2

#### **6.4 CONCLUSION**

The data presented in this research points to some implications and recommendations. The findings suggest that the learners in this study did not understand their Natural Sciences textbooks because the books are beyond the reading grade level of the learners. Textbook writers need to be more sensitive to the needs of their intended readers. Teachers also need to be equipped with the necessary skills to evaluate textbooks so that they can make appropriate selections from the range of textbooks available. Learners need to have their own individual copies of textbooks so that they get increased exposure to reading material both at school and at home.



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## APPENDICES

### APPENDIX A

#### GRADE 4 CLOZE TEST 1

Fill in the missing words.

#### **They breathe air**

Trees are alive because they breathe air. Trees are big plants that (1) \_\_\_\_\_ air and water to grow (2) \_\_\_\_\_ make food. A tree cannot (3) \_\_\_\_\_ from one place to another (4) \_\_\_\_\_, but as it grows its (5) \_\_\_\_\_ move upwards. Most trees are (6) \_\_\_\_\_. You can climb into a (7) \_\_\_\_\_ and watch people from above. (8) \_\_\_\_\_ can sit in its shade (9) \_\_\_\_\_ rest. Trees are good for (10) \_\_\_\_\_ because they make oxygen. We (11) \_\_\_\_\_ eat the fruit of fruit (12) \_\_\_\_\_. The wood can be used (13) \_\_\_\_\_ make furniture, or to make (14) \_\_\_\_\_ fire to keep warm.

Plants (15) \_\_\_\_\_ alive because they breathe air. (16) \_\_\_\_\_ use air, water and sunlight (17) \_\_\_\_\_ make food. Plants grow and (18) \_\_\_\_\_ off oxygen. Plants are held (19) \_\_\_\_\_ by roots in the soil (20) \_\_\_\_\_ move downwards in search of (21) \_\_\_\_\_. Some plants are useful and (22) \_\_\_\_\_ not useful at all. We (23) \_\_\_\_\_ some plants as food.

Can (24) \_\_\_\_\_ think of examples? Some grasses (25) \_\_\_\_\_ used as thatch to make (26) \_\_\_\_\_ for houses. Most animals eat (27) \_\_\_\_\_ of use them as shelter.

(28) \_\_\_\_\_ are alive because they breathe (29) \_\_\_\_\_ and drink water. Without air (30) \_\_\_\_\_ water animals will die. Animals (31) \_\_\_\_\_ all move around. Some animals (32) \_\_\_\_\_ really fast, some animals can (33) \_\_\_\_\_ and some swim in water. (34) \_\_\_\_\_ are useful to us because (35) \_\_\_\_\_ use some of them as (36) \_\_\_\_\_. We keep animals as pets, (37) \_\_\_\_\_ we use animals to do (38) \_\_\_\_\_ for us.

#### **Rocks, wood and metal**

Rocks are not (39) \_\_\_\_\_ because they do not breathe (40) \_\_\_\_\_.



## APPENDIX B

### CLOZE PASSAGE 1

## 2. They breathe air

Trees are alive because they breathe air. Trees are big plants that use air and water to grow and make food. A tree cannot move from one place to another, but as it grows its trunk moves upwards. Most trees are green. You can climb into a tree and watch people from above. A person can sit in its shade on a hot day. Trees are good for people because they make oxygen. We eat the fruit of some trees. The wood can be used to make furniture, or to make a fire to keep warm.



Tree

Plants are alive because they breathe air. They use air, water and sunlight to make food. Plants grow and give off oxygen. Plants are held in the soil by roots that move downwards in search of water.

Some plants are useful and some are not useful at all. We use some plants as food. Can you think of examples? Some grasses are used as thatch to make roofs for houses. Most animals eat grass or use them as shelter.

Animals are alive because they breathe air and drink water. Without air and water animals will die. Animals can all move around. Some animals are really fast, some animals can fly, and some swim in water. Some animals are useful to us because we use some of them as food. We keep animals as pets, and we use animals to do work for us.



Cows

### Activity 2.1 Trees, plants and animals

Answer the question in your workbook.

What do trees, plants and animals have in common?

22: Constructing science knowledge: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

## APPENDIX C

### GRADE 4 CLOZE TEST 2

Fill in the missing words.

#### FOOD CHAINS

##### Food webs

In an ecosystem, energy is constantly passed from organism to organism. This simply means that certain groups of organisms in an ecosystem depend on other organisms for their energy (food). For example, plants absorb energy (1) \_\_\_\_\_ the sun, and this energy (2) \_\_\_\_\_ passed on from the plants (3) \_\_\_\_\_ insect that eat plants, and (4) \_\_\_\_\_ to birds that eat insects. (5) \_\_\_\_\_ one of these birds dies, (6) \_\_\_\_\_ bacteria in the soil causes (7) \_\_\_\_\_ bird to decompose (rot). The (8) \_\_\_\_\_ body of the bird gives (9) \_\_\_\_\_ to the soil in which (10) \_\_\_\_\_ gives these nutrients to plants.

(11) \_\_\_\_\_ food web is a way (12) \_\_\_\_\_ showing what eats what in (13) \_\_\_\_\_ habitat, and therefore where the (14) \_\_\_\_\_ goes. In other words a (15) \_\_\_\_\_ web shows the flow of (16) \_\_\_\_\_ from plant to animal and (17) \_\_\_\_\_ from animal to animal. There (18) \_\_\_\_\_ a number of food chains (19) \_\_\_\_\_ depend on each other for (20) \_\_\_\_\_ and survival in a food (21) \_\_\_\_\_. A tree such as an (22) \_\_\_\_\_ can form the basis of (23) \_\_\_\_\_ food web. Many of the (24) \_\_\_\_\_ in the food web will be (25) \_\_\_\_\_. You can find out about (26) \_\_\_\_\_ by making a beater tray (27) \_\_\_\_\_ seeing how many insects you (28) \_\_\_\_\_ find.

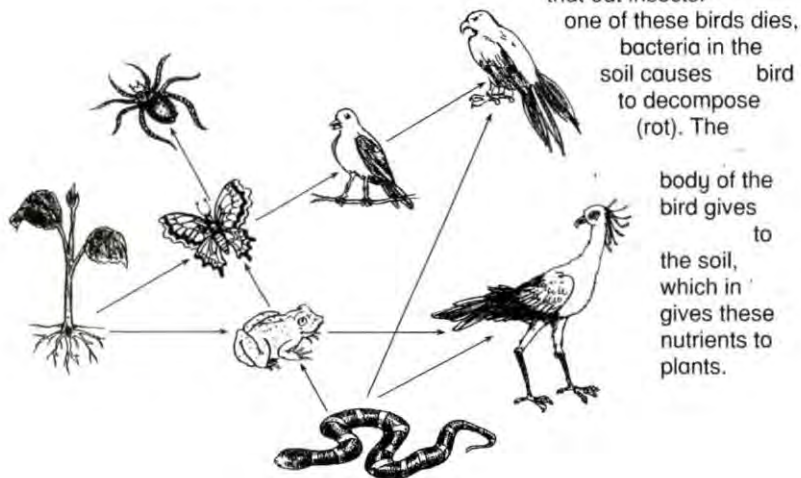
##### Food chains

What do you eat (29) \_\_\_\_\_? All living things need some (30) \_\_\_\_\_ of food to stay alive. (31) \_\_\_\_\_ plants make their own food, (32) \_\_\_\_\_ the process called photosynthesis, but (33) \_\_\_\_\_ and animals need to eat (34) \_\_\_\_\_. Food gives you energy and (35) \_\_\_\_\_ you grow and stay healthy. (36) \_\_\_\_\_ animals eat plants and some (37) \_\_\_\_\_ eat other animals.

## Topic 2: Food chains

### Food webs

In an ecosystem, energy is constantly passed from organism to organism. This simply means that certain groups of organisms in an ecosystem depend on other organisms for their energy (food). For example, plants absorb energy from the sun, and this energy is passed on from the plants to insects that eat plants, and to birds that eat insects.



Example of a food web.

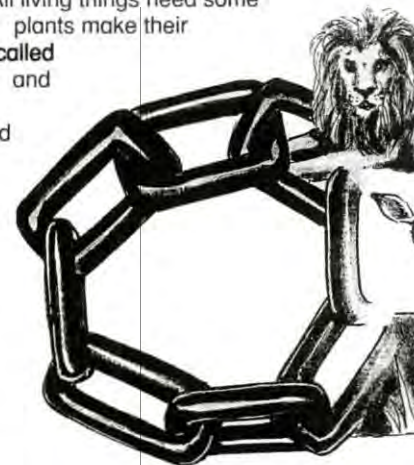
A food web is a way of showing what eats what in a habitat, and therefore where the energy goes. In other words, a food web shows the flow of energy from plant to animal and from animal to animal. There are a number of **food chains** that depend on each other for energy and survival in a food web.

A tree such as an oak can form the basis of a food web. Many of the organisms in the web will be insects. You can find out about them by making a beater tray and seeing how many insects you can find.

### Food chains

What did you eat? All living things need some of food to stay alive. Plants make their own food, the process called **photosynthesis**, but animals need to eat. Food gives you energy and you grow and stay healthy.

Animals eat plants and some eat other animals. Animals and plants depend on each other for food. They form food chains based on the food they eat.



## APPENDIX E

### TRADITIONAL COMPREHENSION TEST

Read the passage and then answer the questions.

Water is kept in a storage dam called a reservoir. From there it is pumped to a water treatment plant where the water is cleaned and purified. Solid particles are removed, and smaller particles are filtered out of water.

The water moves to a building where germs are killed by adding chlorine to the water. Water can now be stored closer to town, so it is pumped to a storage tower. This is usually a tank that is high above the ground. Clean water can now be pumped for you to use at home and at school.

In some parts of South Africa, not all people can get clean water easily. They have to walk a long way to fill buckets and drums at communal taps. The South African government is providing more communities with clean water through special projects. More people can now have clean water.

If you drink dirty water, you might get illness like cholera and typhoid. They can make you very ill, and people can even die when tiny germs in the water make them sick. You get an upset stomach when you drink water that is dirty. Many children in Africa die because of these illnesses.

1. What is a reservoir?

2. Where is the water cleaned and purified?

3. What two things do people use to fetch water?

4. Which two diseases do people suffer from when they drink unclean water?

5. Choose the correct answer and write it on the line.

a. Solid particles are \_\_\_\_\_.

A purified      B removed      C filtered      D treated

b. Not all people can get clean water easily in \_\_\_\_\_ parts of South Africa.

A a few      B most      C some      D many

c. Germs make people \_\_\_\_\_.

A healthy      B dirty      C sick      D clean

d. When you drink dirty water your \_\_\_\_\_ becomes upset.

A hand      B head      C stomach      D legs

e. Purified means \_\_\_\_\_.

A made clean      B made sweet      C filtered      D stored

6. Complete the following sentences by filling the gaps with the words provided.

tank    die    Africa    smaller    distances

- a. \_\_\_\_\_ particles are filtered out of the water.
- b. Water is stored in a \_\_\_\_\_ high above the ground.
- c. In communal areas people walk long \_\_\_\_\_ to fetch water.
- d. People can \_\_\_\_\_ when they drink dirty water.
- e. Many children in \_\_\_\_\_ die because of cholera and typhoid.

7. Have you ever drunk dirty water? What happened?

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## APPENDIX F

### MARKS FOR SCHOOL A LEARNERS: TESTS 1, 2 AND 3

	Test 1	%	Test 2	%	Test 3	%
Out of	40	100	37	100	17	100
	21	53	2	5	10	59
	20	50	1	3	5	29
	15	38	0	0	7	41
	0	0	0	0	1	6
	5	13	0	0	4	24
	4	10	0	0	1	6
	2	5	0	0	7	41
	0	0	0	0		
	3	8	12	32		
	0	0	2	5		
	3	8	1	3		
	6	15	6	16		
	5	13	10	27		
Mean		16		7		29
Mode		0		0		41
maximum		53		32		59
Min		0		0		6

## APPENDIX G

### MARKS FOR SCHOOL B LEARNERS: TESTS 1, 2 AND 3

	Test 1	%	Test 2	%	Test 2	%
Out of	40		37		17	
	27	68	2	5	10	59
	28	70	5	14	14	82
	6	15	7	19	6	35
	8	20	4	11	11	65
	23	56	4	11	5	29
	21	53	1	3	13	76
	14	35	6	16	5	29
	20	50	11	30	1	6
	4	10	11	30	11	65
	23	56	6	16	14	82
	22	55	6	16	8	47
	22	22	3	2	3	18
	8	20	11	30	4	24
	29	73	17	46	8	47
	26	65	2	5	2	12
	25	63	1	3	15	88
	26	65	7	19	12	71
	6	15	0	0	4	24
	11	28	11	30	13	76
	1	3	0	0	12	71
	12	30	4	11	8	47
	10	25	3	8	16	94
	23	56	6	16	8	47
	3	8	11	30	6	35
	22	55	6	16	12	71
	0	0	5	14	7	41
	16	40	2	5	6	35
	9	23	7	19	12	71
	1	3	5	14	4	24
	2	5	9	24	0	0
	10	25	0	0	15	88
	25	63	1	3	7	41
	13	33	4	11	4	24
	1	3	8	22	13	76
			1	3	9	53
mean		37		14		50
mode		58		16		47
maximum		73		46		94
minimum		0		0		0

**APPENDIX H**  
**LETTER TO THE TEACHER**



**RHODES UNIVERSITY**  
*Grahamstown 6140 South Africa*

**EDUCATION DEPARTMENT**

Tel.: (046) 603 8383/4 Fax: (046) 622 8028 e-mail: P. Ngalo@ru.ac.za

30 April 2012

Mr \_\_\_\_\_  
\_\_\_\_\_ - School

P. O.Box \_\_\_\_\_  
GRAHAMSTOWN  
6140

Dear Sir

Re: YOUR AGREEMENT TO ALLOW ME INTO YOUR CLASSROOM

Thank you very much, for agreeing so readily to have me in your classroom, and for your willingness to thereby contribute to my Master of Education (ELT) half-thesis research. I'm most grateful to you.

I attach herewith a copy of the letter which I have given to your Principal in this regard.

If there is anything which you are unhappy or uncertain about regarding the way I am going about the research, please do tell me, and we can work around it. Please know also that if at any stage you wish to withdraw from the project that is entirely your prerogative.

My sincere regards

Sibanda Lucy



**APPENDIX I**  
**LETTER TO SGB CHAIRPERSON**



RHODES UNIVERSITY  
*Grahamstown 6140 South Africa*  
EDUCATION DEPARTMENT

Tel.: (046) 603 8383/4 Fax: (046) 622 8028 e-mail: P. Ngalo@ru.ac.za

30 April 2012

The Chairperson  
School Governing Board  
\_\_\_\_\_ School

P.O Box \_\_\_\_\_  
GRAHAMSTOWN  
6140

Dear Sir/Madam

**Re:SEEKING PERMISSION TO CONDUCT RESEARCH AT YOUR SCHOOL**

I am seeking permission to carry out a research at your school.

I am a student at Rhodes and I would like to carry out a research on the readability of grade 4 Natural Sciences textbooks currently used in South Africa. I would like to test the grade 4 learners so that I find out whether or not they understand the Natural Sciences textbooks they are using. The research in your school will form the substance for my half-thesis.

I have briefed the grade 4 teacher on the area that I am focusing on in his class and has been most welcoming to me. When it comes to writing up the half-thesis I shall, of course, preserve the anonymity of both the school and the teacher concerned through the use of pseudonyms. No learners will be identified.

I will be very grateful if you consider my request.

My sincere regards

Lucy Sibanda

**APPENDIX J**  
**LETTER TO THE PRINCIPAL**



RHODES UNIVERSITY  
*Grahamstown 6140 South Africa*  
EDUCATION DEPARTMENT

Tel: (046) 603 8383/4 Fax: (046) 622 8028 e-mail: [P.Ngalo@ru.ac.za](mailto:P.Ngalo@ru.ac.za)

30 April 2012

The Principal

\_\_\_\_\_ School

P.O.Box \_\_\_\_\_  
GRAHAMSTOWN  
6140

Dear Sir/ Madam

Re: PERMISSION TO CONDUCT RESEARCH AT YOUR SCHOOL

I am seeking for permission to conduct research at your school.

I am doing Master of Education degree in English Language Teaching with Rhodes University. My research is to examine the readability of Grade 4 Natural Sciences textbooks currently used in South African schools. In your school I would like to test Grade 4 learners with cloze test to see if they comprehend the textbook they are using. I have now paid visits to the Grade 4 Science teacher and I briefed him as to the research area that I am focussing on in his classroom and has been most welcoming to me.

When it comes to writing up the half-thesis I shall, of course, preserve the anonymity of both the school and the teacher concerned through the use of pseudonyms. No learners will be identified. If at any time the teacher wishes to withdraw from the project that's entirely his prerogative. I do, of course, fervently hope that this circumstance will not arise. Should you and/or the class teacher be interested in reading the final product of this research I'll very gladly provide a copy of my half-thesis.

It is my greatest hope that you will allow me to carry out my study in your school and I will be grateful.

Yours Faithfully

Sibanda Lucy

## **APPENDIX K**

### **INTERVIEW QUESTIONS**

1. My concern is on Grade 4 Natural Sciences textbooks. Can you tell me how the school chooses the textbooks that are currently being used and how they order and deliver them to your school?
2. When you are choosing the textbooks what do you consider?
3. Who delivers these books to the school?
4. When you chose these textbooks that you are using, what thought did you have in your mind or what sort of things did you consider?
5. How do you feel about those textbooks that you are using? Do you feel that they are good for the children?
6. I understand that most of your learners do not have textbooks of their own, what could be the reason? Is it a decision of the school?
7. What could be the reason that there are fewer textbooks than the children available?
8. Because your learners do not have textbooks of their own, how do you manage the coverage of the topics?
9. How do you feel that your learners do not have textbooks?
10. Do you have any other teaching aids that you use besides the textbook?

## APPENDIX L

### TRANSCRIPT OF INTERVIEW WITH TEACHER A

22 MAY 2012

#### TRANSCRIPTION CONVENTIONS

##### **R- Researcher**

**R:** My concern is on grade 4 Natural Sciences textbooks. Can you tell me how the school chooses the textbooks that are currently used and how they order and deliver them to your school?

**Teacher A:** (Pause)

Eh, OK can you repeat your question?

**R:** OK. Can you tell me about how the school chooses the textbooks that you are currently using?

**Teacher A:** We are getting the textbooks from the department.

**R:** (Education?)

**Teacher A:** Yah we are getting a list of the textbooks from the department or sometimes from the service providers and then the school decides to choose those that are fit to use.

**R:** So when you are choosing the textbooks what do you consider?

**Teacher A:** We consider the finance that is available.

**R:** Who delivers these books to the school?

**Teacher A:** The same service providers whom we would have chosen to deliver the textbooks to the school.

**R:** OK. When you chose these textbooks that you are using, what thought did you have in your mind or what sort of things did you consider?

**Teacher A:** *Yah.* From the textbooks that are brought by the providers, we look for the textbooks that can suit the learners, that will be at the standard, or which the learner would easily grasp what is inside and then (pauses) in everything, we see that we will be at the best interest of the learners.

**R:** And how do you feel about those textbooks that you are using? Do you feel that they are good for the children or what is your feeling?

**Teacher A:** Yah, what I've discovered is that almost/most of them are not suitable for the kids because they don't take into consideration the level of the learners. Eh, the\_\_\_ how can I

put it? The language that is used which is not at the level of our learners and even the terms that are in that textbook *anhe*, our learners find it difficult to understand them. If you can try to explain them *anhe*, because it is not the language they use almost every day, so it makes it difficult for them to understand what is there. The only thing that we do, we do now with, we mix both the language of teaching and their mother tongue. That is one of the ways that assist us so that they can grasp what is in the textbooks or what they are learning.

**R:** I understand your learners do not have textbooks, what could be the reason? Is it the decision of the school?

**Teacher A:** The problem is that maybe you've maybe got 20 learners in your class and then you get maybe 7 textbooks or maybe 6 textbooks and then it will be difficult for all the learners to have the textbooks and then we decide that ok, instead, you will use the textbook in the way that every learner can get information, not maybe giving them text book each *anhe*, getting a textbook, *anhe*, you use the textbook *anhe*, and you supplement that textbook with other resources that you can get.

**R:** What could be the reason that there are fewer textbooks than the children available?

**Teacher A:** As I've already said it to you, it's the finance that is made available for textbooks.

**R:** At the school?

**Teacher A:** Yah.

**R:** So because your learners don't have textbooks of their own, how do you manage the coverage of the topics and maybe you decide to make notes like you've said you do, how do you really choose the notes, how to write the notes?

**Teacher A:** Yah you know what we do in notes *anhe*, as I've said we are using these different sources *anhe* and then you compile the notes *anhe*, the notes that maybe at the level of the learners. So they start with these notes, and we keep giving the same tests, short tests *anhe*, to see if they have grasped the concepts which you were dealing with. So notes are the way for them.

**R:** OK. So you always write on the board?

**Teacher A:** Yes, on the board and to us it's very difficult because we don't even have a machine. If you want to photocopy a thing *anhe*, you must use your own pocket or sometimes they (learners) will bring me 50c, and 50c is only one page and maybe you've 2 pages that you need, and you say, "bring me 1 rand," *anhe* and if you keep on asking this money from them, they end up not coming to school.

**R:** OK. But how do you feel that your learners do not have textbooks? What is your feeling?

**Teacher A:** That's our problem. You know, in the past, the textbooks were, we were discouraged from using textbooks, previously. It's now that the department is taking textbooks seriously. "You must stop *anhe*, you must not use textbooks because you are not

able to use the textbooks to learners *anhe*. The learners must do this, this and this” *anhe*. Having seen that that doesn't work *anhe*, they are coming back now to the textbook. It's now that it is taken seriously that the textbook must be used by learners.

**R:** Who used to say that you should not use textbooks?

**Teacher A:** It was the department. Yah we were discouraged from using the textbooks to learners in the past.

**R:** OK. So maybe by writing on the board, what could be your children be missing, maybe by copying notes on the board?

**Teacher A:** Yah they are missing the interaction with the textbook *anhe* because when the learner is given the textbook, he can come up with something else that was not taught in the classroom *anhe*, yah and he/she can put it in his/her own perspective *anhe*. Yah that's right. They are missing the interaction with the textbook really. And also, not using a textbook is discouraging them from reading and understanding because if they use a textbook *anhe*, even the learner doesn't understand a word *anhe*. If he/she keeps on reading *anhe*, when he reaches a certain word *anhe*, he will recall that part he/she didn't understand *anhe*, and make sense of what might be the author's intention.

**R:** Thank you. Eh do you have any other teaching aids that you have beside the textbook?

**Teacher A:** Yah we've got it. The only other better way that we are using is to go out, and going to the museum and go to other educational places where the learners can add more to what they've got from the classroom.

**R:** Thank you SIR.

## APPENDIX M

### TRANSCRIPT OF INTERVIEW WITH TEACHER B

29 May 2012

#### TRANSCRIPTION CONVENTIONS

##### **R- Researcher**

**R:** Good afternoon.

**Teacher B:** Afternoon.

**R:** My concern is Natural Science textbooks. Can you tell me about how the school chooses the textbooks used at the school, about the ordering and delivering process of the textbooks?

**Teacher B:** We only ordered books last year and that was the first time I witnessed the school ordering some books. Ah, as for the contents, we were going the different samples of textbooks, that is, Natural Science. I am talking on grade 4, grade 5, grade 6 Natural Science and amongst the books that I saw, I preferred *Spot On*. That is how we chose the Spot On that we are using right now.

**R:** OK. Where did you get the books from?

**Teacher B:** Eh, the books were supplied by a certain bookshop, Maranatha, here in Grahamstown. Eh, we made our order through that bookshop then they ordered from the suppliers. I don't know exactly but that's how we got the textbooks.

**R:** OK. So how were the books brought to school?

**Teacher B:** *Ah*, when we bought them, we just communicate with the *ah*, bookshop. *Ah*, Intermediate *eh*, I don't know how.

**R:** Are they the ones who bring them to school or the school goes to collect them?

**Teacher B:** No. No they are the ones who bring them to the school. All what we do is to order and they bring them to school.

**R:** OK. So when you chose those textbooks, what thoughts did you have in your mind or what sort of things did you put into consideration when you were choosing the textbooks that you are currently using?

**Teacher B:** *Yah Au Iiih* I just perused the textbooks that we had in the school and saw that that one was a little bit in line with the syllabus. That is the work schedules that we have although it's not *ah* up to the standard I really want.

**R:** Where do you take the work schedules from?

**Teacher B:** The work schedules are supplied by the Department of Education.

**R:** OK. How do you feel about the textbooks that you are using?

**Teacher B:** Eh, it seems, according to me, the I saw the textbooks, the textbooks they are not going exactly in line with the work schedules because ah when people are writing these ah textbooks, so I think they are supposed to be referring to the content from the requirements of the Department of Education. So with the textbooks that we are using ah, can I quickly move away from grade 4. In grade 6 we've got ah, the pacesetters that are supplies, supplied by the ministry of education. Some of the topics are not there completely, like ah, this topic on planets. It's not there. I had to use the grade 4 textbooks. And it also lacks, ah, the activities, the way that we are supposed to give learners to write.

**R:** I understand your learners do not have textbooks, their personal, and their own textbooks. What could be the reason? Is it the decision of the school or otherwise?

**Teacher B:** Eh (pause), I can't safely give you the *ah*, answer but for the learners I think the parents are supposed to buy them, not the school to buy them ah, to be their personal copies. So the problem maybe lies with the parents. But we have got here and there some learners who have their own personal textbooks. Maybe I can say motivation from the parents is lacking.

**R:** OK. Eh, because some learners don't have those textbooks of their own, so how do you manage the coverage of the topics, maybe when you are giving them work, how do you manage it since they don't have the textbooks?

**Teacher B:** We are using the textbooks that we have in the school and besides, eh in 2010, we didn't have textbooks at all. As teachers we are supposed to be resourceful. You know we improvise. We use whatever we have. So their homework I will be just using the textbooks that I have. At times I photocopy. If I want, I feel that there is a graph that I want to draw on the board I just photocopy and give them.

**R:** So do you sometimes write notes on the board?

**Teacher B:** For the learners?

**R:** Yes for the learners.

**Teacher B:** Yes. I sometimes write notes, though very rarely because personally I believe eh, primary school learners they don't write notes. We sometimes don't give notes. What about them? It's even worse. So I am not of the idea of writing notes for these young children. Instead, I give exercises.

**R:** OK. Where do you get the exercises from?

**Teacher B:** I get the exercises from their textbooks but I will just create my own questions in line with whatever we are teaching.

**R:** How do you feel that your learners don't have textbooks?



**Teacher B:** Personal textbooks?

**R:** Yes.

**Teacher B:** Yah, it's a blow to the subject because ah, the more they interact with the textbook the more they are going to learn more. So it's really a blow. They are supposed to have the textbooks at school and textbooks at home.

**R:** What could learners be missing by not having these textbooks or by coping notes from the board?

**Teacher B:** Eh, by not having textbooks, let me first answer that one. Eh I come from\_\_\_\_, at times we had a situation whereby the teacher will be having a textbook. You talk about a certain picture in the textbook. It is the teacher who is seeing the, whatever the content. The learners are supposed to read and interact with whatever they are supposed to learn.

**R:** Thank you. Do you have any other teaching aids that you use besides the textbook?

**Teacher B:** Yah. I create my own teaching aids like the charts whenever I am teaching a certain topic. I make sure I have some teaching aids, the charts, the flashcards, like if I'm teaching like, ah, (pause), about the world. I can even bring the globe and stuff like that, anything related to whatever I'm teaching.

**R:** OK. Since some of your kids have got photocopies, do you have a machine?

**Teacher B:** Photocopying machine?

**R:** Yes.

**Teacher B:** Yah. We were blessed this year. We've got a photocopying machine, that is for the cluster, our own cluster, but it's here in the school and we use that one. But the ink, we talked with Rhodes University, particularly the RUMAP. They said they can assist where there are technical problems on the machine but so far there's no problem.

**R:** OK. There's no problem with the buying. You can afford to buy it?

**Teacher B:** Yah. There's no problem because eh, prior to the coming of this machine we were photocopying papers, sending learners to the library. So it was so inconveniencing. Now that we've got the machine here, *ah*, so far no problem.

**R:** OK. Thank you.

## APPENDIX N

### BOOK 1 READABILITY FORMULAE

#### Sample 1

##### Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** About Techn ...(show all text)

ology Technologists are people who use scientists' ideas to invent or make things that will make our lives easier. Technologists have good imaginations and clever ideas. Technology is about looking for new ways to make our lives better. We can all be technologists. Science and Technology Science and Technology go hand- in- hand. When scientists make a discovery, technologists can help them to build or make what they have discovered. Technologists can also use scientists' ideas to make useful things. For example, a weed may be killing all the plants in a garden. The scientists may invent a weed killer. The technologist could help the scientists by inventing a machine that sprays the weed killer on the weeds. Whenever you want to carry out an investigation or experiment it is always helpful to ask these questions. Before the experiment or investigation, What do I want to find out?

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	58.3	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>difficult</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>	9.5	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	8.2
Grade	level:	<u>Eighth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	11
Grade	level:	<u>Eleventh</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	7.8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	8.1
Grade	level:	<u>12-14</u> <u>yrs.</u> <u>old</u> <u>(Seventh</u> <u>and</u> <u>Eighth</u> <u>graders)</u>	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	6.9
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Grade level: Seventh Grade.  
[ f ] | [ a ] | [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: fairly difficult to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

### Sample 2

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** The shape of things The earth is changing all ...[\(show all text\)](#)  
the time. Mountains are made and continents move around slowly. Wind and water are carving and land into new shapes. The earth is made up of different layers of rock and metal. Some of the layers are hard, but others are so hot that the rock has melted. Continents are very big pieces of land that are slowly moving. There are seven continents. Continents are the pieces of land separated by salty water called oceans and seas. Oceans are really big. They cover as more than twice as much of the Earth as land does. There are four oceans: the Pacific, the Atlantic, the Indian and the Arctic oceans. Oceans and seas contain salty water that cannot be used for drinking. Lakes, rivers and ponds contain fresh water. It is safe for humans and animals to use water from lakes, rivers and ponds. The layer of air around the Earth is called the atmosphere. The atmosphere shields the earth from the sun's harmful rays. The atmosphere is made up mainly of gases. All living things are protected by this special layer of air. All plants are situated to the climate where they grow. If the climate is dry you will find plants growing there that are situated to dry areas. Different types of plants are found in water, and other types are found in jungles. Some plants have flowers and others do not have flowers. Humans can eat some plants, but others may be harmful to you. Some plants are useful, but some are harmful.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	80.7	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>easy</u> to <u>read</u> .
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog:</b>		6.5	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> to <u>read</u> .
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	4.7
Grade	level:	<u>Fifth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
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Grade level: Eighth grade  
[ f ] [ a ] [ r ]

**The** **SMOG** **Index:** 5.1  
Grade level: Fifth Grade  
[ f ] [ a ] [ r ]

**Automated** **Readability** **Index:** 4.7  
Grade level: 8-9 yrs. old (Fourth and Fifth graders)  
[ f ] [ a ] [ r ]

**Linsear** **Write** **Formula:** 5.2  
Grade level: Fifth Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 3

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Air in space ...(show all text)

Squeezing air

Air can be put into small spaces. At a birthday party the room is often decorated with balloons. The balloons are blown up by squeezing air into them. When air is squeezed into a small space, we compress the air. It is more difficult to squeeze liquids than gases. It is almost impossible to compress solids. Ventilation Air also fills large areas, like your classroom. Windows and doors allow fresh air to come into a building. Old used air that you breathe out can leave the room. Fresh clean air can come into the room. Letting fresh air into the room is called ventilation. So remember to open the windows each day to ventilate the classroom with clean, fresh air.

**Flesch** **Reading** **Ease** **score:** 77.1 (text scale)  
Flesch Reading Ease scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]

**Gunning** **Fog** **Fog:** 6.7 (text scale)  
Gunning Fog scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]

**Flesch-Kincaid** **Grade** **Level:** 5.1  
Grade level: Fifth Grade.  
[ f ] [ a ] [ r ]

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	5.3
Grade	level:	<u>Fifth</u>	<u>Grade</u>
[ f ]   [ a ]   [ r ]			

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	4.7
Grade level:	8-9 yrs. old (Fourth and Fifth graders)		
[ f ]   [ a ]   [ r ]			

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	5
Grade	level:	<u>Fifth</u>	<u>Grade.</u>
[ f ]   [ a ]   [ r ]			

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: fairly easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 4

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** The magic l ... ([show all text](#))

liquid Water covers about 75% (three-quarters) of the Earth. The drops that fall to the ground when it rains are also water. Water is a special liquid. It is not alive, you cannot make it, and we cannot survive without it. Your body is made up mostly of water. Plants and animals need water to live. Nothing can live without water. Water changes form as the weather changes. If it becomes very cold, liquids turn to solids. When this happens to water it is called ice. Where have you seen this happening? When water becomes very hot it evaporates. It is then called water vapour. Where have you seen this happening? Water vapour is always in the air around us.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	80.2	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>easy</u> to <u>read.</u>
[ f ]   [ a ]   [ r ]						

<b>Gunning</b>	<b>Fog:</b>	4.6	(text	scale)
Gunning	Fog	scored	your	text:
[ f ]   [ a ]   [ r ]				<u>easy</u> to <u>read.</u>

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	4.1
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Grade level: Fourth Grade.  
[ f ] [ a ] [ r ]

**The Coleman-Liau** Index: 7  
Grade level: Seventh Grade  
[ f ] [ a ] [ r ]

**The SMOG** Index: 3.5  
Grade level: Fourth Grade  
[ f ] [ a ] [ r ]

**Automated Readability** Index: 2.8  
Grade level: 8-9 yrs. old (Third and Fourth graders)  
[ f ] [ a ] [ r ]

**Linsear Write** Formula: 3.4  
Grade level: Third Grade  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 4

Reading Level: easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 5

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Staying at home and flying away Birds' nests Nes ...(show all text)

ts are the homes of birds. Birds build nests to hold their eggs, to hatch them, and to look after their babies. Birds in different places use different material to make their nests. Birds like sparrows make bowl-shaped nests out of sticks and grass. Birds like swallows weave nests out of grass. They usually weave their nests onto branches above water. Birds like swallows mix mud and grass to make their nests. Their nests are usually attached to cliffs, or found under roofs. Birds like woodpeckers use their beaks to make holes in old trees. Birds that travel Many birds travel, or migrate, when the seasons change. Migration is when birds fly to another country. Birds travel when the weather starts to get cold and it is hard to find food. They stay in the country they have flown to until it gets cold there. When it gets cold there, they fly back to the warmer country. Birds have a good sense of direction. Scientists think that they use the sun and stars to find their way.

**Flesch Reading Ease** score: 89.1 (text scale)  
Flesch Reading Ease scored your text: easy to read.

[f] | [a] | [r]

**Gunning**                      **Fog:**                      6.6                      (text                      scale)  
Gunning                      Fog                      scored                      your                      text:                      fairly                      easy                      to                      read.  
[f] | [a] | [r]

**Flesch-Kincaid**                      **Grade**                      **Level:**                      3.7  
Grade                      level:                      Fourth                      Grade.  
[f] | [a] | [r]

**The**                      **Coleman-Liau**                      **Index:**                      8  
Grade                      level:                      Eighth                      grade  
[f] | [a] | [r]

**The**                      **SMOG**                      **Index:**                      4.7  
Grade                      level:                      Fifth                      Grade  
[f] | [a] | [r]

**Automated**                      **Readability**                      **Index:**                      5.2  
Grade                      level:                      8-9                      yrs.                      old                      (Fourth                      and                      Fifth                      graders)  
[f] | [a] | [r]

**Linsear**                      **Write**                      **Formula:**                      5.4  
Grade                      level:                      Fifth                      Grade.  
[f] | [a] | [r]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 6

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** The ...(show all text)

y breathe air Trees are alive because they breathe air. Trees are big plants that use air and water to grow and make food. A tree cannot move from one place to another place but as it grows its branches moves upwards. Most trees are useful. You can climb into a tree and watch people from above. You can sit in its shade and rest. Trees are good for us because they make oxygen. We can eat the fruit of fruit trees. The wood can be used to make furniture, or to make a fire to keep warm. Plants are alive because they breathe air. Plants use air, water and sunlight to make food. Plants grow and give off oxygen. Plants are held up by roots in the soil that move downwards in search of water. Some plants are useful and

others not useful at all. We use some plants as food. Can you think of examples? Some grasses are used as thatch to make roofs for houses. Most animals eat plants or use them as shelter. Animals are alive because they breathe air and drink water. Without air and water animals will die. Animals can all move around. Some animals run really fast, some animals can fly and some swim in water. Animals are useful to us because we use some of them as food. We keep animals as pets, and we use animals to do work for us.

**Flesch Reading Ease** score: 89.9 (text scale)  
 Flesch Reading Ease scored your text: very easy to read.  
 [ f ] [ a ] [ r ]

**Gunning Fog** score: 6.5 (text scale)  
 Gunning Fog scored your text: fairly easy to read.  
 [ f ] [ a ] [ r ]

**Flesch-Kincaid Grade** Level: 3.2  
 Grade level: Third Grade.  
 [ f ] [ a ] [ r ]

**The Coleman-Liau Index**: 6  
 Grade level: Sixth Grade  
 [ f ] [ a ] [ r ]

**The SMOG Index**: 4.9  
 Grade level: Fifth Grade  
 [ f ] [ a ] [ r ]

**Automated Readability Index**: 2.6  
 Grade level: 8-9 yrs. old (Third and Fourth graders)  
 [ f ] [ a ] [ r ]

**Linsear Write Formula**: 4.6  
 Grade level: Fifth Grade.  
 [ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 4

Reading Level: very easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 7

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Use water wisely Most of the water taken from r ...(show all text)



ivers and lakes ends up in our homes. In the cities and towns of South Africa most people can have water whenever they want it by simply turning on a tap. Pipes in most homes supply baths, showers, washing machines and toilets with water. People use water to drink and to cook their food. We boil water in kettles or pots to make coffee or tea. To stay healthy we need to drink about eight glasses of clean water a day. Another big user of water is the electricity industry. A lot of is used to make electricity. At the power station water is heated to change into steam. This turns big turbines. They generate electricity. Eskom provides most of the electricity used in South Africa. At dams water runs over turbines causing them to turn and generate electricity. This is called hydro-electricity. Hydro means water. Farming also uses a lot of water. A farmer gives his animals water to drink. If the farmer grows vegetables and maize he must water the crops. When you eat some fruit, think about water that was used to water it. Water makes up nearly three-quarters of your weight. Without water you would die in a few days. All forms of life need water to live. We all need to drink clean, healthy water. If you drink polluted water you become ill and could even die. In nature water flows into rivers and lakes and on to the sea. Along the way water keeps plants and animals alive. Animals like crocodiles and fish live in water. Some plants grow in water. Water in dams is used for drinking, for fishing or to water crops on farms. Most of the things we buy in shops need water to be made. The paper of this book, and even your clothes, need water during the manufacturing process. A complicated item, such as a bicycle, is made up of hundreds of parts, all of which need water to be made.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	75.1	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly easy to read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>	6.7	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly easy to read.</u>
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	5.4
Grade	level:	<u>Fifth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	7
Grade	level:	<u>Seventh</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	5.1
Grade	level:	<u>Fifth</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	3.9
Grade	level:	8-9 yrs. old (Fourth and Fifth graders)	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	5
Grade	level:	<u>Fifth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

#### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5  
 Reading Level: fairly easy to read.  
 Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

## Sample 8

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** ...(show all text)

EROSION Sometimes heavy rains fall in sandy places. When this happens the soil is washed away. Deep holes and valleys are formed. In South Africa we call this dongas. This process of soil washing away is called erosion. When strong winds blow in sandy areas, the top layer is blown away. This is called erosion. The harder soil below cannot be used to grow crops. Soil erosion happens when good, fertile soil is removed from the top part of the earth's surface by water or wind. Overgrazing A lot of farmers keep cattle. The cattle stay in the veld around the villages where the farmers live. If there are only a few cattle, there is enough grass for all the cattle to eat. But some farmers keep too many cattle. The cattle eat all the grass. This is called overgrazing. The soil is left bare. Water and wind can remove the soil easily because there are no plants to keep the soil together. Once the soil is washed or blown away, no plants can grow there. Deep holes called dongas are formed. Overgrazing that causes erosion is bad for the land.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	84.2	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>easy</u> to <u>read</u> .
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>	5.7	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> to <u>read</u> .
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	3.9
Grade	level:	<u>Fourth</u>	<u>Grade</u> .
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	4.6
Grade	level:	<u>Fifth</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	3.8
Grade level:	8-9 yrs. old (Fourth and Fifth graders)		
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	4.3
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Grade level: Fourth Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 9

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Types of soil Sand soil ...(show all text)

It is made up of tiny bits of rock. These are called grains of sand. This type of soil is normally loose. Sandy soil does not hold a lot of water. Water runs through sandy soil quickly. Wind blows away sandy soil easily. Sandy soil becomes warm quickly on a sunny day. Clay soil It is made of very fine pieces called clay particles. Clay particles stick together easily. Clay soil holds a lot of water. Water runs through clay slowly. Clay soil does not blow away easily. Clay soil is cooler than sandy soil. Loam soil This is a mixture of sand and clay soil. Loam soil is quite loose. It holds water better than sand, but as well as clay soil. Water does not run through loam soil very quickly, but not very slowly either. Wind does not blow away loam soil easily. Water does not wash away loam soil easily.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	87.6	(text	scale)
Flesch	Reading	Ease	scored	your	text:	easy to read.
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog:</b>	5.6	(text	scale)	
Gunning	Fog	scored	your	text:	fairly easy to read.
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	3.1
Grade	level:	Third	Grade.
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	7
Grade	level:	Seventh	Grade
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	4.3
Grade	level:	Fourth	Grade
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	2.2
Grade level:	6-8 yrs. old (First and Second graders)		
[ f ]   [ a ]   [ r ]			

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	3.6
Grade level:		Fourth	Grade.
[ f ]   [ a ]   [ r ]			

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 4

Reading Level: easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 10

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Making the ...([show all text](#))

most of where they live Plants live in many different places around the world. These areas can be hot, cold, dry or wet. To help them live in the climate and soil of the area where they grow, plants have to have different parts or special adaptations. These adaptations help them to live in the area where they grow. Deserts and dams are two very different places where plants live.

Deserts: Deserts are very dry and there is not much water. Plants that live in deserts can store water in their fleshy stems. They have spikes or thorns to stop animals from taking the water that they are storing. Dams and rivers Some plants that live in water do not have roots because they do not need to be fixed to the ground. They do not need roots to dig into the ground because they live in water. Some plants have leaves that hold air to help them float.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	86.4	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>easy to read.</u>
[ f ]   [ a ]   [ r ]						

<b>Gunning</b>	<b>Fog:</b>	7.3	(text	scale)
Gunning	Fog	scored	your	text:
[ f ]   [ a ]   [ r ]				<u>fairly easy to read.</u>

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	4.8
Grade	level:	Fifth	Grade.
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	7
Grade	level:	Seventh	Grade

[ f ] | [ a ] | [ r ]

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	4.6
Grade	level:	<u>Fifth</u>	<u>Grade</u>
[ f ]   [ a ]   [ r ]			

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5.8
Grade level:	10-11 yrs. olds (Fifth and Sixth graders)		
[ f ]   [ a ]   [ r ]			

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	6.9
Grade	level:	<u>Seventh</u>	<u>Grade.</u>
[ f ]   [ a ]   [ r ]			

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 11

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** It is not always easy to spot poisonous plant. P ... ([show all text](#))

oisonous plants may have beautiful colours and attractive flowers. Sometimes you can eat one part of a plant, but another part of the same plant may be poisonous. The leaves and branches of the oleander bush are very poisonous. Using oleander wood for braai, or putting a leaf into your mouth, can damage your heart and even kill you. Apricots are fruits that we all eat all the time. The fruit is healthy, but the kernels in the seed contain cyanide. Children have died from eating too many kernels. Daffodils are pretty flowers, but their bulbs are very poisonous. Eating daffodil bulbs will cause nausea, vomiting and diarrhoea. Eating daffodil bulbs has killed people.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	69.6	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]   [ a ]   [ r ]						

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>	9.7	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]   [ a ]   [ r ]					

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	6.3
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Grade level: Sixth Grade.  
[ f ] [ a ] [ r ]

**The** **Coleman-Liau** **Index:** 10  
Grade level: Tenth Grade  
[ f ] [ a ] [ r ]

**The** **SMOG** **Index:** 7.1  
Grade level: Seventh Grade  
[ f ] [ a ] [ r ]

**Automated** **Readability** **Index:** 6.4  
Grade level: 10-11 yrs. olds (Fifth and Sixth graders)  
[ f ] [ a ] [ r ]

**Linsear** **Write** **Formula:** 6  
Grade level: Sixth Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 7

Reading Level: fairly easy to read.

Reader's Age: 11-13 yrs. old (Sixth and Seventh graders)

### Sample 12

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Water polluti ...(show all text)

on Fresh water is precious liquid in South Africa. Water pollution is a serious problem. Factory wastes, oil and household detergents are poured into the rivers. Water from these rivers is pumped into the reservoirs, and we use this water in our homes. This water has to be cleaned and made pure. Cleaning water can be very expensive as it takes time, people need to be employed and the equipment is costly. People and chemical substances are not the only causes of water pollution. Sometimes, soil at the bottom of rivers and dams comes loose and mixes with water. This is called silting. It is dangerous, because it can kill animal life in the water. The sea is also polluted. People have used the ocean as a dumping ground for chemicals and sewage. This has killed many sea plants and animals. Many sea animals, like fish and shellfish, eat the poisons and then people eat fish. This can make people ill. Sometimes a ship will spill oil accidentally. This is called oil spill. Oil spills are very dangerous to sea life. Because oil and water do not mix, the oil covers the surface of the water and stops oxygen from getting into the water. Plants and animals cannot get oxygen to breathe.

**Flesch Reading Ease** score: 71.7 (text scale)  
 Flesch Reading Ease scored your text: fairly easy to read.  
 [f] [a] [r]

**Gunning Fog** score: 8.4 (text scale)  
 Gunning Fog scored your text: fairly easy to read.  
 [f] [a] [r]

**Flesch-Kincaid Grade** level: Sixth **Level:** 5.9 Grade.  
 [f] [a] [r]

**The Coleman-Liau** Index: 9  
 Grade level: Ninth Grade  
 [f] [a] [r]

**The SMOG** Index: 6.4  
 Grade level: Sixth Grade  
 [f] [a] [r]

**Automated Readability** Index: 5.2  
 Grade level: 8-9 yrs. old (Fourth and Fifth graders)  
 [f] [a] [r]

**Linsear Write** Formula: 5.5  
 Grade level: Sixth Grade.  
 [f] [a] [r]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: fairly easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 13

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** There are lots of different animals. There are b...(show all text)

irds, spiders, people, fish, microbes and many more. Zoologists are people who study animals. They have tried to make sense of animal kingdom by grouping similar animals together.

Animals without backbones: These animals do not have backbone or spine, but they are different from one another in other ways. These are called invertebrates. Slugs and worms

have soft bodies. Spiders and insects have a hard body. This hard body is called an outside or exoskeleton. Snails have a soft body, but carry a hard shell for protection.

Animals with backbones: These animals have a backbone made up of many bones that fit into each other, called vertebrae. These animals are called vertebrates. Animals without backbones can be grouped by what they eat. Some eat only plants. They are called herbivores. Some eat only meat. They are called carnivores. Some eat both plants and meat. They are called omnivores. Animals without backbones can also be grouped by their body temperature. Some are cold-blooded. This means that their body temperature is the same as the temperature of the air or water around them. Fish, frogs and lizards are examples of cold-blooded vertebrates. Some are warm-blooded. This means that they can keep their body temperature the same, whether the air around them is hot or cold. Birds and mammals are warm-blooded vertebrates.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	70.4	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly easy to read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>		9.1	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly easy to read.</u>	
[ f ]	[ a ]	[ r ]				

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	5.7
Grade	level:	<u>Sixth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	11
Grade	level:	<u>Eleventh</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	6.6
Grade	level:	<u>Seventh</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5.9
Grade	level:	10-11 yrs. olds (Fifth and Sixth graders)	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	4.7
Grade	level:	<u>Fifth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 7

Reading Level: fairly easy to read.

Reader's Age: 11-13 yrs. old (Sixth and Seventh graders)

### Sample 14



## Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** The rat A rat is a ...[\(show all text\)](#)

furry animal. It is like a mouse, but bigger. Rats are found all over the world. They can live in many different temperatures. Rats have front teeth that look like chisels. Their teeth can gnaw or bite through paper, plastic, cardboard and wood. Squirrels, beavers and moles have the same kind of teeth. There are many different types of rats, but brown rats and black rats are the most common. Rats are pests for these reasons: -they carry germs that spread dangerous diseases -they damage or destroy crops -they kill livestock like chickens, lambs and baby pigs -they destroy property by eating houses, furniture and clothing -they cause fires by chewing electrical cords. Rats usually only live for about one year in the wild. This is because they have o many natural enemies. Enemies of the rat are dogs, cats, owls and snakes. Domestic rats live in our houses. These rats can live for three years. People try to get rid of rats by destroying their homes, setting traps, or putting down rat poison. Rat poison can be very dangerous to people too. Adults who put down rat poison need to make sure that children cannot reach it. To stop rats from coming into your home, make sure the dustbin lid is always on, and keep food in closed containers.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	80.7	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>easy to read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>		8	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly easy to read.</u>	
[ f ]	[ a ]	[ r ]				

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	5.1
Grade	level:	<u>Fifth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	5.9
Grade	level:	<u>Sixth</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5.8
Grade	level:	<u>10-11 yrs. olds (Fifth and Sixth graders)</u>	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	6.2
Grade	level:	<u>Sixth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

## Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

## Sample 15

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** A door-sized garden If you have s ...(show all text)

pace in your back garden the size of the door, you can grow your own vegetables. We can grow most vegetables in our back gardens. Vegetables that we grow ourselves are healthier than the ones we buy in shops. Growing your own vegetables is fun, and it can save a lot of money. Different vegetables grow at different times of the year. If you are going to grow your own vegetables, make sure that you plant them at the correct time of the year. Before you plant any vegetable seeds, prepare your garden. The soil should not be too sandy. You can add extra vitamins and minerals to the soil by putting compost in it. Make your own compost heap by choosing a small piece of land where you put all your fruit and vegetable waste. This includes things like leaves, grass cuttings, the skins of peeled fruit and vegetables, apple cores, etc. Tiny creatures called micro-organisms eat these fruit and vegetable wastes and help to get the vitamins and minerals back into the soil. Keep the compost heap damp, turn it over with a garden fork every few weeks, and in a few months I will have rotted into dark fine compost. By digging compost into your garden, you are always adding vitamins and minerals that will help your plants to grow. Digging and turning the soil will also help the plants to grow.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	73.1	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog:</b>	9.9	(text	scale)	
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	7.1
Grade	level:	<u>Seventh</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	7
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Grade level: Seventh Grade  
[ f ] [ a ] [ r ]

**Automated** **Readability** **Index:** 7.2  
Grade level: 11-13 yrs. old (Sixth and Seventh graders)  
[ f ] [ a ] [ r ]

**Linsear** **Write** **Formula:** 8.5  
Grade level: Ninth Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: fairly easy to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

### Sample 16

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Air is .... Temperatur ...(show all text)

e is how hot or how cold something is. The earth's surface is heated by the Sun. The Earth is surrounded by a layer of air called the atmosphere. The temperature of the air depends on the surface of the earth. If the surface is hot, the air will be warm. If the surface is cold, the air will be cool. The land heats up quickly, and the oceans slowly. Air from cold places moves to warm places. This moving air is called wind. You can feel the moving air on your face. You can see that air is moving when the branches of a tree move.

Moving air: When air moves it is called wind. Wind causes objects to move or bend. Air can move at different speeds. We use an instrument called a wind speed meter to see how fast the wind moves. The speed is measured per hour. We can guess how fast the wind is blowing by looking at what it does. On a calm day, smoke from the fire will go straight up. If the wind blows slightly, dust and paper are moved around. A strong wind can move large branches and even blow away roof tops.

**Flesch** **Reading** **Ease** **score:** 98.3 (text scale)  
Flesch Reading Ease scored your text: very easy to read.  
[ f ] [ a ] [ r ]

**Gunning** **Fog:** 4.9 (text scale)  
Gunning Fog scored your text: easy to read.  
[ f ] [ a ] [ r ]

**Flesch-Kincaid** **Grade** **Level:** 2

Grade	level:	Second	Grade.
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	5
Grade	level:	Fifth	Grade
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	3.3
Grade	level:	Third	Grade
[ f ]   [ a ]   [ r ]			

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	1.9
Grade level:	6-8 yrs. old (First and Second graders)		
[ f ]   [ a ]   [ r ]			

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	4.1
Grade	level:	Fourth	Grade.
[ f ]   [ a ]   [ r ]			

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 3

Reading Level: very easy to read.

Reader's Age: 8-9 yrs. old (Third and Fourth graders)

## APPENDIX O

### Book 2 Readability formulae

#### Sample 1

#### Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** What is a plane ...(show all text)

t? A planet is a body that orbits (goes around) a sun. There are nine known planets that orbit the sun in our solar system. These planets, together with the sun, form what is known as our solar system. The planets in our solar system can be divided into two groups, the inner and outer planets. The inner planets are made of rocks and metals. They are much smaller in size than the outer planets. The inner planets of our solar system are Mercury, Venus, Earth and Mars. The outer planets are different from the inner planets because they are not solid. They are giant balls of gases and liquids. Pluto is the only outer made up of rock and thick ice. The outer planets of our solar system are Jupiter, Saturn, Uranus, Neptune and Pluto. Earth is the only planet known to have water and oxygen. It is the only planet that supports life.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	73.7	(text	scale)
Flesch	Reading	Ease	scored	your	text:	fairly easy to read.
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>	5.7	(text	scale)
Gunning	Fog	scored	your	text:	fairly easy to read.
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	5.9
Grade	level:	Sixth	Grade.
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	7
Grade	level:	Seventh	Grade
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	4.4
Grade	level:	Fourth	Grade
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	4.4
Grade	level:	8-9 yrs. old (Fourth and Fifth graders)	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	5.4
Grade	level:	Fifth	Grade.
[ f ]	[ a ]	[ r ]	

## Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: fairly easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

## Sample 2

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** In topic 1 we learnt that air is important to all ...([show all text](#))

living things. In other words, we need air to breathe and stay alive. Why is breathing so important? The air you breathe is sucked into your lungs. In the lungs, oxygen passes from the air into your blood. The oxygen is carried in the blood all around your body. The oxygen helps you use the energy you get from food. Without oxygen, a living body cannot function (work). How does our air become polluted? Many of the things that make our lives comfortable, such as cars, air conditioning and electricity; also cause many harmful gases and chemicals to escape into the air. The burning of coal and oil produces a gas called sulphur dioxide. A car's exhaust lets out carbon monoxide after the engine burns out the air every minute of the day.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	71.9	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[f]	[a]	[r]				

<b>Gunning</b>	<b>Fog:</b>	8.7	(text	scale)	
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[f]	[a]	[r]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	6.2
Grade	level:	<u>Sixth</u>	<u>Grade.</u>
[f]	[a]	[r]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[f]	[a]	[r]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	6.4
Grade	level:	<u>Sixth</u>	<u>Grade</u>
[f]	[a]	[r]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5
Grade	level:	<u>8-9</u> <u>yrs.</u> <u>old</u> <u>(Fourth</u> <u>and</u> <u>Fifth</u> <u>graders)</u>	

[ f ] | [ a ] | [ r ]

**Linsear**

Grade

[ f ] | [ a ] | [ r ]

**Write**

level:

**Formula:**

Sixth

6.2

Grade.

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: fairly easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 3

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Food All our food co ...(show all text)

mes from plants and animals. The plants that we grow for food are called crops. The foods people eat are very different in different countries. This is because the weather and soil in different parts of the world affects the sorts of crops that people can grow and the types of animals that they can keep on farms. People's cultures and beliefs also influence the types of foods they eat. Food comes from plants. Plants have been grown as food crops for hundreds of years. Some important plant foods are grains, fruit and vegetables. Grains are also called cereals. The seeds of barley, maize, rice, oats and wheat are all cereals. Wheat is used to make bread. People have based their diets on grains for a long time. Other foods from plants are nuts, herbs and spices. Spices are used to flavour foods. Coffee, tea and cocoa are also made from plants.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	90.3	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>very</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog:</b>	<b>score:</b>	6.2	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	3.4
Grade	level:	<u>Third</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	4.4
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Grade level: Fourth Grade  
[ f ] [ a ] [ r ]

**Automated** **Readability** **Index:** 5.1  
Grade level: 8-9 yrs. old (Fourth and Fifth graders)  
[ f ] [ a ] [ r ]

**Linsear** **Write** **Formula:** 5  
Grade level: Fifth Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: very easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 4

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** The Earth's crust ...(show all text)

The Earth's crust is a tiny thin layer of rock that covers the Earth's surface. This layer of rock is broken into large and small pieces called tectonic plates. These plates are moving all the time, but very slowly. This movement causes changes to the Earth's surface or landscape. The plates that are above sea level are known as continents. The plates that form the ocean floor are called oceanic plates. The continents are large landmasses that are moving very slowly all the time. This movement is called continental drift. There are seven continents that make up most of the land's surface of the earth. Large bodies of water called oceans surround the continents. Why does the surface of the earth change continuously? There are several natural phenomena (happenings) that are responsible for altering (changing) the shape of the earth's crust (surface). These phenomena either add on to the surface or make the surface lose much of its rock layers and soil. These phenomena are volcanoes, earthquakes and erosion

**Flesch** **Reading** **Ease** **score:** 72.7 (text scale)  
Flesch Reading Ease scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]

**Gunning** **Fog** **Fog:** 10 (text scale)  
Gunning Fog scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]

**Flesch-Kincaid** **Grade** **Level:** 6.2



Grade level: Sixth Grade.  
[ f ] [ a ] [ r ]

**The Coleman-Liau** **Index:** 11  
Grade level: Eleventh Grade  
[ f ] [ a ] [ r ]

**The SMOG** **Index:** 7.4  
Grade level: Seventh Grade  
[ f ] [ a ] [ r ]

**Automated Readability** **Index:** 7.8  
Grade level: 12-14 yrs. old (Seventh and Eighth graders)  
[ f ] [ a ] [ r ]

**Linsear Write** **Formula:** 6.8  
Grade level: Seventh Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: fairly easy to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

### Sample 5

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** What is a cell? A cell is the smallest part of ...(show all text)

a living organism that is able to function on its own. There are a large number of different kinds of cells. Cells come in all sizes and shapes, and they perform different functions in a living organism. All living organisms grow because their cells are growing and dividing. Cells are very tiny, and cannot be seen with a naked eye. How do we study cells? We study cells through an instrument called a microscope. A microscope is an instrument that can magnify an object (make it bigger) to 1 000 times its normal size. Therefore, a cell which cannot be seen with the naked eye can be seen under a microscope. When we study a cell, we smear it with a special dye. The dye makes the structures of the cell clearer, so that we can study them more easily.

**Flesch Reading Ease** **score:** 76.9 (text scale)  
Flesch Reading Ease scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]

<b>Gunning</b>	<b>Fog:</b>	9.2	(text	scale)
Gunning	Fog	scored	your	text:
[f]	[a]	[r]	fairly	easy to read.

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	5.9
Grade	level:	Sixth	Grade.
[f]	[a]	[r]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	7
Grade	level:	Seventh	Grade
[f]	[a]	[r]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	6.7
Grade	level:	Seventh	Grade
[f]	[a]	[r]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5
Grade	level:	8-9 yrs. old	(Fourth and Fifth graders)
[f]	[a]	[r]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	7.1
Grade	level:	Seventh	Grade.
[f]	[a]	[r]	

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: fairly easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 6

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** FOOD ...(show all text)

CHAINS Food webs In an ecosystem, energy is constantly passed from organism to organism. This simply means that certain groups of organisms in an ecosystem depend on other organisms for their energy (food). For example, plants absorb energy from the sun, and this energy is passed on from the plants to insects that eat plants, and then to birds that eat insects. When one of these birds dies, the bacteria in the soil cause the bird to decompose (rot). The decomposed body of the bird gives nutrients to the soil which in turn gives these nutrients to plants. A food web is a way of showing what eats what in a habitat, and therefore where the energy goes. In other words a food web shows the flow of energy from plant to animal and then from animal to animal. There are a number of food chains that depend on each other for food and survival in a food web. A tree such as an oak can

form the basis of a food web. Many of the organisms in the web will be insects. You can find out about this by making a beater tray and seeing how many insects you can find.

**Flesch Reading Ease** score: 71.4 (text scale)  
 Flesch Reading Ease scored your text: fairly easy to read.  
 [f] [a] [r]

**Gunning Fog** 12.1 (text scale)  
 Gunning Fog scored your text: hard to read.  
 [f] [a] [r]

**Flesch-Kincaid Grade** Level: 7.9  
 Grade level: Eighth Grade.  
 [f] [a] [r]

**The Coleman-Liau Index** 7  
 Grade level: Seventh Grade  
 [f] [a] [r]

**The SMOG Index** 8.6  
 Grade level: Ninth Grade  
 [f] [a] [r]

**Automated Readability Index** 7.3  
 Grade level: 11-13 yrs. old (Sixth and Seventh graders)  
 [f] [a] [r]

**Linsear Write Formula** 11.4  
 Grade level: Eleventh Grade.  
 [f] [a] [r]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: fairly easy to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

## Sample 7

### Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Safety in the home ...(show all text)

It is supper time in the Naidoo household. Mom dishes rice in the rice bowls and curry in the curry bowls. There are also some salads and pickles on the table. The food smells delicious

and everyone gets busy eating. After supper, dad says, ‘Tonight we are going to learn about safety in the home. When I came in I saw lots of things lying about, which can cause very big accidents. Therefore, we are going to work as a team to make our home safe before we go to bed. I hope that from today we are going to learn to be very safe in our home. Mom and Helen will clear the kitchen. Ruben, my son, you and Ryan will make the bathroom neat, tidy and safe. Ruveshnie will pack up the toys on the stairs, and wipe up the spills on the tiles. Rajan, you, being the eldest of my children, will check and clear all three bedrooms and make them neat and safe. I will check the lounge to see if all the plugs are in the sockets and if the fire guard is in front of the fire, and to clear all the toys that are lying about. When everyone is finished, we will meet in the lounge to make a night-time checklist that we are going to use every night.

**Flesch Reading Ease** score: 85 (text scale)  
 Flesch Reading Ease scored your text: easy to read.  
 [ f ] [ a ] [ r ]

**Gunning Fog** score: 7.6 (text scale)  
 Gunning Fog scored your text: fairly easy to read.  
 [ f ] [ a ] [ r ]

**Flesch-Kincaid Grade** Level: 5.2  
 Grade level: Fifth Grade.  
 [ f ] [ a ] [ r ]

**The Coleman-Liau Index**: 5  
 Grade level: Fifth Grade  
 [ f ] [ a ] [ r ]

**The SMOG Index**: 4.8  
 Grade level: Fifth Grade  
 [ f ] [ a ] [ r ]

**Automated Readability Index**: 4.5  
 Grade level: 8-9 yrs. old (Fourth and Fifth graders)  
 [ f ] [ a ] [ r ]

**Linsear Write Formula**: 7.3  
 Grade level: Seventh Grade.  
 [ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 8

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** RECYCLING WASTE Th ...[\(show all text\)](#)

e growing demand of the ever-increasing human population for energy and material goods has led to large environmental problems. Two of these problems are solid waste (rubbish and garbage) and sewage (all the dirty water that goes down your drain, as well as the human waste that goes down your toilet). Rubbish dumps or landfills cannot decompose garbage fast enough, and untreated sewage poses a health problem. Recycling is the only solution for these two growing problems. Solid waste Recycling solid waste means less land needed for rubbish dumps. Less energy is needed to produce paper from timber, and so we save natural resources like water and timber.

Sewage: If we recycle sewage, we will minimise the pollution of our rivers and dams. This prevents the death of many water animals, plants and fish. It also helps prevent harmful diseases from spreading.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	58	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>difficult</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog:</b>	10.6	(text	scale)
Gunning	Fog	scored	your	text:
[ f ]	[ a ]	[ r ]		<u>hard</u> <u>to</u> <u>read.</u>

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	9.2
Grade	level:	<u>Ninth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	11
Grade	level:	<u>Eleventh</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	8.1
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	9.9
Grade	level:	14-15 yrs. old (Ninth to Tenth graders)	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	8.9
Grade	level:	<u>Ninth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

**Readability Consensus**

Based on 8 readability formulas, we have scored your text:

Grade Level: 9

Reading Level: fairly difficult to read.

Reader's Age: 13-15 yrs. old (Eighth and Ninth graders)

## Sample 9

### Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** What is energ ...(show all text)

y? Energy is the ability to work. Anything that does any work uses energy in some form or the other. We need energy for all our daily activities. Even cars and buses need energy to move. Energy can take many forms. In fact, there are seven known forms of energy. We will learn about only four of these forms. They are : electric energy, heat energy, potential energy and kinetic energy. Electric energy Electric energy is caused by an electric current. Electricity can come from different places. A power station supplies electricity to homes and cities. A generator supplies emergency power to hospitals, shops,etc. Batteries are used for various household appliances and dynamos are used for a bicycle's headlamps.

Heat energy: When you move very fast, heat will be produced. Potential energy Each and every object on earth has energy stored within it. Potential energy is the energy a body has as a result of its position above the ground.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	52.5	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>difficult</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]				

<b>Gunning</b>	<b>Fog:</b>	13.9	(text	scale)	
Gunning	Fog	scored	your	text:	<u>hard</u> <u>to</u> <u>read.</u>
[ f ]	[ a ]	[ r ]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	8.3
Grade	level:	<u>Eighth</u>	<u>Grade.</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	10
Grade	level:	<u>Tenth</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	9.2
Grade	level:	<u>Ninth</u>	<u>Grade</u>
[ f ]	[ a ]	[ r ]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5.7
Grade	level:	<u>10-11</u> <u>yrs.</u> <u>olds</u> <u>(Fifth</u> <u>and</u> <u>Sixth</u> <u>graders)</u>	
[ f ]	[ a ]	[ r ]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	6.2
Grade	level:	<u>Sixth</u>	<u>Grade.</u>
[ f ]   [ a ]   [ r ]			

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: fairly difficult to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

### Sample 10

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** What is melting? ...(show all text)

Before we discuss what melting is, let us first understand what molecules are, because understanding the melting process starts off with understanding what molecules are. Molecules are found in everything, be it a solid, a liquid, or a gas. In module 4 you will learn that molecules are made out of even smaller parts called atoms. But for now we will only focus on molecules. Molecules are atoms of the same and different kinds joined together. The way molecules are arranged in a substance affects its behaviour, for example, in a liquid or gas, molecules are free to move about. Now that you know what molecules are, let us get back to melting. When a solid, e.g. an ice cube, gets warm enough, the molecules start to move and get further apart. The solid turns into a liquid. This is called melting. Let us do this activity

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	70.9	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[ f ]   [ a ]   [ r ]						

<b>Gunning</b>	<b>Fog:</b>	9.3	(text	scale)
Gunning	Fog	scored	your	text:
[ f ]   [ a ]   [ r ]				<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	6
Grade	level:	<u>Sixth</u>	<u>Grade.</u>
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	<u>Eighth</u>	<u>grade</u>
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	6.9
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Grade level: Seventh Grade  
[ f ] [ a ] [ r ]

**Automated** **Readability** **Index:** 4.8  
Grade level: 8-9 yrs. old (Fourth and Fifth graders)  
[ f ] [ a ] [ r ]

**Linsear** **Write** **Formula:** 5.8  
Grade level: Sixth Grade.  
[ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 6

Reading Level: fairly easy to read.

Reader's Age: 10-11 yrs. olds (Fifth and Sixth graders)

### Sample 11

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** What are energy syst ...(show all text)

ems? Energy is the ability to work; a system is a set of things, or parts, forming a whole. Therefore, an energy system is a set of things, or parts, working together as a whole. For example, the muscles and bones in our bodies make the forces that move us. When one of your muscles works, pulls a bone. When your muscle relaxes, it stops pulling. Therefore the muscles in your legs, arms and body work in pairs. Let us take another example, of a man guiding a lorry into a parking space. The man raises his forearm; the force comes from the biceps muscle. When the biceps muscle works, it pulls on the bones and raises them. When the man lowers his forearm, the force now comes from the triceps muscle. When the triceps muscle works, it pulls the forearm bones in the opposite direction to where the biceps pulls them. Besides the energy system in your arms, energy systems are also found in our legs, in bicycles, tricycles, motor cars, lorries, trains and airplanes. Energy systems require fuel to work. In the human body they need food, but in other systems they need oil, water, petrol, diesel or grease to work.

**Flesch** **Reading** **Ease** **score:** 75 (text scale)  
Flesch Reading Ease scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]

**Gunning** **Fog:** 8.8 (text scale)  
Gunning Fog scored your text: fairly easy to read.  
[ f ] [ a ] [ r ]



<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	6.2
Grade	level:	Sixth	Grade.
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	8
Grade	level:	Eighth	grade
[ f ]   [ a ]   [ r ]			

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	6.4
Grade	level:	Sixth	Grade
[ f ]   [ a ]   [ r ]			

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	5.8
Grade level:	10-11 yrs. olds (Fifth and Sixth graders)		
[ f ]   [ a ]   [ r ]			

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	7
Grade	level:	Seventh	Grade.
[ f ]   [ a ]   [ r ]			

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 7

Reading Level: fairly easy to read.

Reader's Age: 11-13 yrs. old (Sixth and Seventh graders)

### Sample 12

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** . What is matter? Anything that takes up space ... ([show all text](#))

is called matter. Everything you see, feel and touch e.g. a ball, a broom, water, your desk etc., are made up of matter. What makes up matter? All matter is made up of very tiny particles called atoms. Atoms are building blocks of matter. Atoms are arranged differently in different types of matter, and therefore matter can be found in three basic forms, called states: solid, liquid and gas. Atoms in solids A solid is matter with a definite size and shape. The atoms in a solid are tightly packed and arranged in a regular (set) pattern, and do not move around easily.

Atoms in liquids A liquid is matter with no size or shape. The atoms in matter in a liquid state are in contact with one another, but they move around freely.

Atoms in gases :A gas is matter that does not have any fixed volume, shape or size. The atoms in a gas fill the space the gas occupies. The atoms are not joined together, and move around freely.

**Flesch Reading Ease** **score:** 79.9 (text scale)  
 Flesch Reading Ease scored your text: easy to read.  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

**Gunning Fog:** 6.7 (text scale)  
 Gunning Fog scored your text: fairly easy to read.  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

**Flesch-Kincaid Grade** **Level:** 4.6  
 Grade level: Fifth Grade.  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

**The Coleman-Liau Index:** 7  
 Grade level: Seventh Grade  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

**The SMOG Index:** 5  
 Grade level: Fifth Grade  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

**Automated Readability Index:** 3.2  
 Grade level: 8-9 yrs. old (Third and Fourth graders)  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

**Linsear Write Formula:** 4.7  
 Grade level: Fifth Grade.  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 13

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Passage 1 Sources of water and the water cycle W ...(show all text)

**Flesch Reading Ease** **score:** 71.1 (text scale)  
 Flesch Reading Ease scored your text: fairly easy to read.  
[\[f\]](#) | [\[a\]](#) | [\[r\]](#)

<b>Gunning</b>	<b>Fog:</b>	7.9	(text	scale)
Gunning	Fog	scored	your	text:
[f]	[a]	[r]	fairly	easy to read.

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	6.3
Grade	level:	Sixth	Grade.
[f]	[a]	[r]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	9
Grade	level:	Ninth	Grade
[f]	[a]	[r]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	5.8
Grade	level:	Sixth	Grade
[f]	[a]	[r]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	6.3
Grade	level:	10-11 yrs. olds	(Fifth and Sixth graders)
[f]	[a]	[r]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	5.9
Grade	level:	Sixth	Grade.
[f]	[a]	[r]	

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 5

Reading Level: fairly easy to read.

Reader's Age: 8-9 yrs. old (Fourth and Fifth graders)

### Sample 14

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** Glass Natu ...(show all text)

ral glass has been found on Earth, but the glass as we know it is man-made. Glass has some very special properties that make it very useful to us.

Properties of glass: Glass is translucent (allows light to pass through it) and has therefore become a standard feature in all buildings. Glass is very easy to clean. It can withstand heat. When hot it can be moulded (shaped), rolled and stretched. No chemical or acid can affect glass.

The history of glass: Glass was discovered as many as 77 000 years ago, when cavemen found pieces of volcanic glass and used them as tools. Four thousand years ago the first man-made glass was produced in Egypt, in the form of glass beads, ornaments and tiny bottles. The Romans were responsible for the invention of the blowing tube. This invention meant that glass could now be hollowed and shaped.

**Flesch Reading Ease** score: 78.6 (text scale)  
 Flesch Reading Ease scored your text: fairly easy to read.  
 [ f ] [ a ] [ r ]

**Gunning Fog** score: 8.9 (text scale)  
 Gunning Fog scored your text: fairly easy to read.  
 [ f ] [ a ] [ r ]

**Flesch-Kincaid Grade** Level: 5.7  
 Grade level: Sixth Grade.  
 [ f ] [ a ] [ r ]

**The Coleman-Liau Index** 8  
 Grade level: Eighth grade  
 [ f ] [ a ] [ r ]

**The SMOG Index** 6.7  
 Grade level: Seventh Grade  
 [ f ] [ a ] [ r ]

**Automated Readability Index** 6.2  
 Grade level: 10-11 yrs. olds (Fifth and Sixth graders)  
 [ f ] [ a ] [ r ]

**Linsear Write Formula** 7.1  
 Grade level: Seventh Grade.  
 [ f ] [ a ] [ r ]

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 7

Reading Level: fairly easy to read.

Reader's Age: 11-13 yrs. old (Sixth and Seventh graders)

### Sample 15

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

Your Results:

**Your text:** How coal was for ...(show all text)

med Coal was formed long before there were any people on Earth. The Earth's crust was still changing shape and its surface was covered with swamps (large pieces of land covered with water and plants). Rivers flowed into these swamps, bringing sand and silt (fine fertile soil) with them. The silt caused giant ferns and trees to grow all over the swamps, making very large forests. When the plants and trees of the forests died, they fell into the waters of the

swamps, decomposed (rotted) and changed into peat (a compressed layer of rotting material that lies on the surface of the earth). The sand and the silt that the rivers brought started covering the peat, and for thousands of years it was pressed down deeper into the earth's crust. Deep down in the crust heat and bacteria (tiny organisms) changed the peat into coal. Coal stopped forming when the earth's crust settled (stopped changing). More and more layers of rock formed on top of the coal. Sometimes coal is found near the earth's surface, but most of the time it is found hundreds of meters underground.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	81.6	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>easy to read.</u>
[f]	[a]	[r]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>		8.7	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly easy to read.</u>	
[f]	[a]	[r]				

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	6.6
Grade	level:	<u>Seventh</u>	<u>Grade.</u>
[f]	[a]	[r]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	9
Grade	level:	<u>Ninth</u>	<u>Grade</u>
[f]	[a]	[r]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	4.4
Grade	level:	<u>Fourth</u>	<u>Grade</u>
[f]	[a]	[r]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	9.5
Grade level:	<u>14-15 yrs. old</u>	<u>(Ninth to Tenth graders)</u>	
[f]	[a]	[r]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	9
Grade	level:	<u>Ninth</u>	<u>Grade.</u>
[f]	[a]	[r]	

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: easy to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

### Sample 16

Text Readability Consensus Calculator

**Purpose:** Our Text Readability Consensus Calculator uses 7 popular readability formulas to calculate the average grade level, reading age, and text difficult of your sample text.

## Your Results:

**Your text:** Changes in states ...(show all text)

of matter In Unit 1 of this module you have learnt that solids retain their shape because their atoms are packed closely together. Liquids take the shape of the container they are placed in, because its atoms are tightly packed. A gas has no size or shape because its atoms are very far apart and move around freely, allowing the gas to fill any space. How do you change states of matter? To change matter from one state to another, the arrangement and speed of the atoms must be changed. The only way to do this is to apply heat to the substance to change its state. Heat transfer The result of heat transfer is that it speeds up atoms, but it does not change the arrangement of the atoms of the substance.

<b>Flesch</b>	<b>Reading</b>	<b>Ease</b>	<b>score:</b>	74.5	(text	scale)
Flesch	Reading	Ease	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[f]	[a]	[r]				

<b>Gunning</b>	<b>Fog</b>	<b>Fog:</b>	9.5	(text	scale)
Gunning	Fog	scored	your	text:	<u>fairly</u> <u>easy</u> <u>to</u> <u>read.</u>
[f]	[a]	[r]			

<b>Flesch-Kincaid</b>	<b>Grade</b>	<b>Level:</b>	7.7
Grade	level:	<u>Eighth</u>	<u>Grade.</u>
[f]	[a]	[r]	

<b>The</b>	<b>Coleman-Liau</b>	<b>Index:</b>	7
Grade	level:	<u>Seventh</u>	<u>Grade</u>
[f]	[a]	[r]	

<b>The</b>	<b>SMOG</b>	<b>Index:</b>	5.6
Grade	level:	<u>Sixth</u>	<u>Grade</u>
[f]	[a]	[r]	

<b>Automated</b>	<b>Readability</b>	<b>Index:</b>	8.3
Grade	level:	12-14 yrs. old (Seventh and Eighth graders)	
[f]	[a]	[r]	

<b>Linsear</b>	<b>Write</b>	<b>Formula:</b>	10.6
Grade	level:	<u>Eleventh</u>	<u>Grade.</u>
[f]	[a]	[r]	

### Readability Consensus

Based on 8 readability formulas, we have scored your text:

Grade Level: 8

Reading Level: fairly easy to read.

Reader's Age: 12-14 yrs. old (Seventh and Eighth graders)

## APPENDIX P

### READABILITY FORMULAE TABLE

**Table 2: Findings from readability formulae: samples from book 1 and 2**

book 1	grade level	readability level	reader's age	book 2	grade level	readability level	reader's age
Sample 1	8	Fairly difficult to read	12-14 yrs: 7 <sup>th</sup> -8 <sup>th</sup> graders	Sample 1	5	Fairly easy to read	8-9yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders
Sample 2	6	Easy to read	10-11 yrs: 5 <sup>th</sup> & 6 <sup>th</sup> graders	Sample 2	6	Fairly easy to read	10-11 yrs: 5 <sup>th</sup> & 6 <sup>th</sup> graders
Sample 3	6	Very easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders	Sample 3	5	Fairly easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders
Sample 4	4	Very easy	8-9yrs: 3 <sup>rd</sup> & 4 <sup>th</sup> graders	Sample 4	8	Fairly easy to read	12-12 yrs: 7 <sup>th</sup> & 8 <sup>th</sup> graders
Sample 5	5	Fairly easy to read	10-11 yrs: 5 <sup>th</sup> & 6 <sup>th</sup> graders	Sample 5	6	Fairly easy to read	10-11 yrs: 5 <sup>th</sup> & 6 <sup>th</sup> graders
Sample 6	4	Easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders	Sample 6	8	Fairly easy to read	12-14 yrs: 7 <sup>th</sup> & 8 <sup>th</sup> graders
Sample 7	5	Easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders	Sample 7	5	Very easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders
Sample 8	5	Easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders	Sample 8	9	Fairly difficult	13-15 yrs: 8 <sup>th</sup> & 9 <sup>th</sup> graders
Sample 9	4	Fairly easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders	Sample 9	8	Fairly difficult	12-14 yrs: 7 <sup>th</sup> & 8 <sup>th</sup> graders
Sample 10	6	Easy to read	10-11 yrs: 5 <sup>th</sup> & 6 <sup>th</sup> graders	Sample 10	6	Fairly easy to read	10-11 yrs: 5 <sup>th</sup> & 6 <sup>th</sup> graders
Sample 11	7	Fairly easy to read	11-13 yrs: 6 <sup>th</sup> -7 <sup>th</sup> graders	Sample 11	7	Fairly easy to read	11-13 yrs: 6 <sup>th</sup> & 7 <sup>th</sup> graders
Sample	6	Fairly easy to	11-13 yrs:	Sample	5	Easy to read	8-9 yrs.:

12		read	6th-7 <sup>th</sup> graders	12			4 <sup>th</sup> & 5 <sup>th</sup> graders
Sample 13	7	Fairly easy to read	10-11 yrs: 5th-6 <sup>th</sup> graders	Sample 13	5	Easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders
Sample 14	6	Easy to read	10-11 yrs: 10th-11 <sup>th</sup> graders	Sample 14	7	Fairly easy to read	11-13 yrs: 6 <sup>th</sup> & 7 <sup>th</sup> graders
Sample 15	8	Easy to read	8-9 yrs: 4 <sup>th</sup> & 5 <sup>th</sup> graders	Sample 15	8	Easy to read	12-14 yrs: 7 <sup>th</sup> & 8 <sup>th</sup> graders
Sample 16	3	Fairly easy to read	12-14 yrs: 7th-8 <sup>th</sup> graders	Sample 16	8	Fairly easy to read	12-14 yrs: 7 <sup>th</sup> & 8 <sup>th</sup> graders