ENGLISH-MEDIUM INSTRUCTION PROGRAMME IN MALAYSIA: READABILITY OF SCIENCE TEXTBOOKS USED IN DUAL LANGUAGE PROGRAMME AT PRIMARY SCHOOLS

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Manuscript received 18 November 2023
Manuscript accepted 17 November 2024
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https://doi.org/10.33736/ils.6290.2024

ABSTRACT

The use of English as a medium of instruction in the teaching of science and mathematics in the Dual Language Programme (DLP) in Malaysia is to increase students' exposure to English in developing English proficiency to meet globalisation needs. One of the main issues in the implementation of DLP is student readiness to learn science in English. This study examines the readability of primary school science textbooks using Text Inspector to ascertain the difficulty level of the English used. One unit from Year 1 to Year 6 of science textbooks were analysed. The analysis used two features of the Text Inspector: Lexis: EVP and Scorecard. The findings indicate that the language used in science textbooks is beyond CEFR level B2, which suggests that the readability exceeds the primary students' English proficiency, hence affecting their ability to comprehend the textbooks. In addition, the findings showed that the readability of the science textbooks does not differ much from Year 1 to Year 6. The study found that the readability of the science textbooks used in primary school is inappropriate; hence, proposes policy and pedagogical implications for teachers to support students learning of science in English.

Keywords: English medium instruction; Dual Language Programme; readability; science textbooks; CEFR

Introduction

Students in non-Anglophone countries are now expected to read academic texts in English in view of the rise of English as a medium of instruction (EMI) in primary and secondary schools (Dearden, 2014). The interest in the use of EMI in Malaysian schools has continued to enable students to attain literacy in scientific English to meet the challenges of modernisation and globalisation, especially in the application of Science, Technology, Engineering and Mathematics (STEM). The teaching of science and mathematics in English was originally put in place in 2003 under the *Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris* (PPSMI) policy but was gradually phased out in 2010 in view of students' academic achievements in science, mathematics and English, and strong pressure from mother-tongue lobbyists (Ministry of Education Malaysia, 2010).

In this connection, the Ministry of Education introduced a new language policy *Memartabatkan Bahasa Malaysia Memperkukuh Bahasa Inggeris* (MBMMBI) or to uphold Bahasa Malaysia and strengthen the English Language in 2009 (Ministry of Education Malaysia, 2010). The policy supports the position of Bahasa Malaysia as the national language, and at the same time strives to improve students' English proficiency so that they can access knowledge vital to compete at national and global levels. Teaching STEM in English was also perceived as a means of providing students with more exposure to English.

The MBMMBI was extended to include the Dual Language Programme (DLP) in 2016, with English used as a medium of instruction in the teaching of science and mathematics in primary and secondary schools (Ministry of Education Malaysia, 2015a, 2015b). A review of studies showed that schools offering the DLP faced challenges to implement it, primarily because of the level of readiness of teachers to teach in English and of students to learn in English. The lack of English proficiency (Moses & Malani, 2019; Othman et al., 2020) and professional development and support structure for teachers (Ananthan & Mohd Said, 2019; Has Bullah & Md Yunus, 2019) were identified as the major contributing factors affecting teachers' readiness. The readiness of students was affected by their low proficiency in English (Masrom et al., 2021; Suliman et al., 2018), which could in turn hinder learning especially in subjects such as science and mathematics.

Science textbooks are the primary source of knowledge input in primary schools, as they are used to impart scientific knowledge to the students. Their content is intrinsically difficult to understand because of the technical terms and abstract concepts. In addition, the complex lexical content may decrease the readability of the science texts, which makes learning more challenging (Peters & Abdullah, 2017; Pun et al., 2022), especially for students with low proficiency when the lexical items are at a level beyond their proficiency.

This paper aims to examine the readability of science textbooks written in English which are used in primary schools from Years 1 to 6 to ascertain the level of readability according to the Common European Framework of Reference for Languages (CEFR) level. The authors acknowledge that the CEFR level of the lexical items is concerned with lexical suitability rather than content suitability, because the content is made more comprehensible by means of relevant visuals and pictures. Even so, it is necessary to raise awareness on the part of science teachers about the level of difficulty of the words, so they can decide which words require further explanation to improve comprehension.

This paper is organised as follows: we first discuss the policy on DLP within the context of the Malaysian education system and describe the methodology which includes a web-based tool used to measure the difficulty level of text and vocabulary, and to generate a list of words coded according to the CEFR level. The section that follows presents the findings and leads into a discussion on the need to address text complexity and readability and issues concerned with the implementation of DLP. The conclusion includes pedagogical and policy recommendations.

Dual Language Programme (DLP)

DLP which uses English as a medium of instruction in the teaching of science and mathematics in primary and secondary schools was introduced in schools in 2016 (Ministry of Education Malaysia, 2015a, 2015b). Taking into account the reasons for the reversal of the PPSMI policy, a decision was made to offer DLP as an optional programme; schools are given the choice whether or not to implement it. This delegation of authority is indeed important, given that Malaysia has a centralised education system, and initiatives tend to be one-size-fits-all (Ali & Hamid, 2018).

Unlike PPSMI, DLP is an optional programme for schools to use English-medium to teach science and mathematics. Conditions that schools must meet to offer DLP include certification by headmasters that the teachers are able to teach science and mathematics in English, adequate classrooms, written requests from parents for DLP classes for their children, school's satisfactory achievement in Bahasa Malaysia in the national exam or achieving above the standard level specified by the Ministry of Education, and at least 15 students per class. In addition, to qualify to teach in English, teachers are required to obtain at least C in English in *Sijil Pelajaran Malaysia* (SPM), Malaysian Certificate of Education, or its equivalent (Ministry of Education Malaysia, 2020). SPM is a national exam taken by all Form 5 students in Malaysia before continuing tertiary education. However, enrolment in the DLP class is based on parental choice, not on students' English proficiency (Abdul Rahim, 2015).

Although DLP is a voluntary programme, the pilot project in 2016 involved 300 primary and secondary schools (Ismail, 2012). The demand from parents for DLP has been strong. In August 2020, the then Education Minister Datuk Dr Radzi Jidin reported to Parliament that 2,291 schools were involved, including 737 primary schools and 1,554 secondary schools (Rajaendram, 2022). The Minister also reported that the demand for DLP classes exceeded the supply for the programme. In addition, Dr Nair from the Malaysian English Language Teaching Association pointed out that many schools were unable to offer DLP because the English proficiency of their science and mathematics teachers was not sufficient enough for them to teach in English (Rajaendram, 2022).

Studies on DLP reported readiness issues related to teachers' English proficiency, students' English proficiency, and code-switching during the class (Abdullah et al., 2019; Suliman et al., 2017a, 2017b). In addition, the lack of professional development and support structure for teachers (Ananthan & Mohd Said, 2019; Has Bullah & Md Yunus, 2019) were identified as the major contributing factors affecting teachers' readiness. Other EMI programmes from primary to tertiary levels also faced these critical issues and challenges (see e.g., Ali & Hamid, 2018; Pun et al., 2022; Suliman et al., 2021).

The Language of Science in the EMI Classroom

The language of science is by nature technical, consisting of concrete and abstract terms, and relating to classification, correlation, explanation, prediction, and processes (Gardner, 1974; Quilez, 2020). It is however necessary to distinguish between technical and non-technical terms. Technical terms include words such as acid, energy, and heat, while non-technical terms are usually non-specific or non-disciplinary terms such as category, elaborate, and specific, which contribute meaning to the technical terms (Gardner, 1974; Quilez, 2020). Despite these differences, technical and non-technical terms share two significant features in that they are abstract and polysemic (Quilez, 2020).

To understand science in English, students need sufficient command of the language, including both technical and non-technical terms. Their lack of proficiency in this area is the critical issue highlighted in the EMI literature (e.g., Ellili-Cherif, 2014; Neri et al., 2021; Suliman et al., 2019). Studies have reported the importance of the link between reading comprehension and science performance (Cromley et al., 2010; Imam et al., 2014; Snow, 2010). It is believed that they complement each other to improve science achievement in the classroom. Students with good reading comprehension benefit from scientific texts, as they can understand the vocabulary (both technical and non-technical) and also extract information from the written text. The language of science is considered a cognitively demanding skill, and a better understanding is needed when students read scientific texts. To improve the learning of science in class, it is important for students to understand the vocabulary and at the same develop the ability to read scientific materials independently.

Although limited in number, there have been studies which have examined the readability of science textbooks in their contexts of use (see e.g., Gyasi, 2013; Hu et al., 2021), and which have raised concerns about the difficulty of the English used in the textbooks. A number of linguistic issues relating to the teaching and learning of science in DLP, and other EMI programmes were highlighted in the literature (see e.g., An & Thomas, 2021; Astiani & Widagsa, 2021; Suliman et al., 2021).

Viewed from this perspective, the knowledge gap addressed by the present study is ascertaining the readability level of English science textbooks used in the DLP. The focus is on the readability of scientific texts in Primary Years 1 to 6 textbooks based on word level difficulty according to the CEFR, which has been used for readability analysis. The use of the CEFR in this context is appropriate because the English language education system in Malaysia is aligned to the CEFR (Ministry of Education Malaysia, 2013, 2015c) with proficiency targets set at each school level, namely, A2 at primary, B1 at secondary and B1/B2 at post-secondary school (Ministry of Education Malaysia, 2015c).

Common European Framework of Reference for Languages (CEFR)

The CEFR levels (A1 - C2) are the commonly defined levels of proficiency for foreign language learning including English. It has three subdivided levels: Basic (A1 and A2), Independent (B1 and B2), and Proficient (C1 and C2). The can-do-descriptors describe in positive terms real-world communicative activities that learners can perform and have been exploited in the development of curriculum and assessment of language proficiency courses. Table 1 shows the CEFR descriptors for overall reading comprehension, which indicate that a learner can use the language at the CEFR levels.

Table 1
Overall Reading Comprehension (Council of Europe, 2018, p. 60)

Overall Reading Comprehension	
C2	Can understand virtually all forms of the written language including abstract, structurally complex, or highly colloquial literary and non-literary writings. Can understand a wide range of long and complex texts, appreciating subtle distinctions of style and implicit as well as explicit meaning.
C1	Can understand in detail lengthy, complex texts, whether or not they relate to his/her own area of speciality, provided he/she can reread difficult sections. Can understand a wide variety of texts including literary writings, newspaper or magazine articles, and specialised academic or professional publications, provided that there are opportunities for re-reading and he/she has access to reference tools.
B2	Can read with a large degree of independence, adapting style and speed of reading to different texts and purposes, and using appropriate reference sources selectively. Has a broad active reading vocabulary, but may experience some difficulty with low-frequency idioms.
B1	Can read straightforward factual texts on subjects related to his/her field and interests with a satisfactory level of comprehension.
A2	Can understand short, simple texts on familiar matters of a concrete type which consist of high frequency everyday or job-related language. Can understand short, simple texts containing the highest frequency vocabulary, including a proportion of shared international vocabulary items.

A1	Can understand very short, simple texts a single phrase at a time, picking up familiar names, words and basic phrases and rereading as required.

The Roadmap 2015-2025 sets aspirational targets for Malaysian students to achieve by 2025 beginning with CEFR A2 as the target for primary schools (Ministry of Education Malaysia, 2015c; Mohd Don & Abdullah, 2019). This makes it possible to monitor student progress in English from primary school to university. In terms of reading comprehension, students are required to achieve a particular target of overall reading comprehension as they progress through their education level (see Table 1).

Although the target proficiency level for the end of primary schooling is CEFR A2, a preliminary study of English language used in science textbooks for DLP at primary level showed that it was CEFR B2 and higher. This indicates that the readability of science textbooks is beyond primary students' proficiency level, which is likely to affect their comprehension and their interest in science (see Pun et al., 2022; Quilez, 2020).

Studies on Readability of Science Texts

Despite the limited number of publications, the studies highlighted the concerns on the readability of science textbooks written in English in their contexts. None of the studies used the readability formulas that can generate the score in the CEFR. The readability formulas commonly used in the methodology were Flesch Kincaid Reading Ease, Flesch Kincaid Grade Level, Gunning Fog, Cloze Test Readability Index and a few others. None of the readability formulas used can generate the score in the CEFR.

Hu et al. (2021) evaluated the difficulty of English used in science and EFL textbooks used in secondary Grade/Year 1 in English-medium instruction secondary schools in Hong Kong. This study took a corpus-based approach to examine the coverage of academic and general words in the textbooks. Multiple formulas such as Automated Readability Index (ARI), Flesch Reading Ease, General Service List (GSL) and Gunning Fog were used to examine the readability levels of the textbooks. According to the analysis, science textbooks in English-medium are difficult to read and inappropriate in terms of the coverage of academic words and the readability level for EFL learners.

Gyasi (2013) investigated the readability of science textbooks at senior high school level in Ghana. The study used two aspects to understand readability: the Gunning Fog Scale and the Cloze Test Readability Index. The Gunning Fog Scale was used to analyse four science textbooks (Biology, Chemistry, Integrated Science and Physics). In addition, 300 high school students from five schools in Ghana were selected to take the cloze test to assess their reading ability. The findings indicated that only the Chemistry textbook was appropriate for senior high school students, while the Physics, Biology, and Integrated Science textbooks were very difficult for them to understand. On average, all four textbooks were quite difficult to read, and most of the students experienced frustration in reading them. In addition, the students also found it difficult to comprehend the content of the science textbooks in English.

Sibanda (2014) evaluated the readability of two Grade 4 natural science textbooks, using the Online free tool Text Readability Consensus Calculator, which included seven readability formulas (Flesch Reading Ease, Gunning Fog, Flesch Kincaid Grade Level, Smog Index, Coleman-Liau Index, Automated Readability Index, and Linsear Write). The study concluded that the readability of the two textbooks used in South African schools was not suitable for Grade 4 learners as they contained many technical words and unfamiliar concepts.

Difficulties in reading scientific text and textbooks are faced not only by school students but also by pre-university students. Ong et al. (2015) evaluated the readability of reading comprehension passages in the Malaysian University English Test (MUET) by comparing 152 passages (98 Arts and 54 science-based texts). Three readability formulas: (1) Flesch Reading Ease; (2) Flesch-Kincaid Grade Level; and (3) Gunning Fog Index were used to analyse all the passages. The studies revealed the readability of 16 passages was high for pre-university students which underlines the importance of selecting texts with appropriate readability levels to ensure the validity of the tests.

The mentioned studies highlight the usefulness of the readability formulas such as Flesch Kincaid Reading Ease, Flesch-Kincaid Grade Level, and Gunning Fog to explain why certain texts are easy to be read and others not and whether the text is suitable for a particular education level. These readability formulas are used all over the world including in Malaysia, especially by language lecturers when preparing English test papers, as they are accessible online for free. However, the readability scores of the formulas as mentioned above are based on education level in the United States (US). Anyone outside the US wanting to assess the readability of a text needs to know that the grade level used in Flesch Kincaid correlates with the grade level (in terms of English) in a specific context of use, as the language proficiency of pre-tertiary students in the US and Malaysia is not similar. Also, none of these readability formulas can identify the level of difficulty at word level, which explains why Text Inspector readability formula was selected for this study.

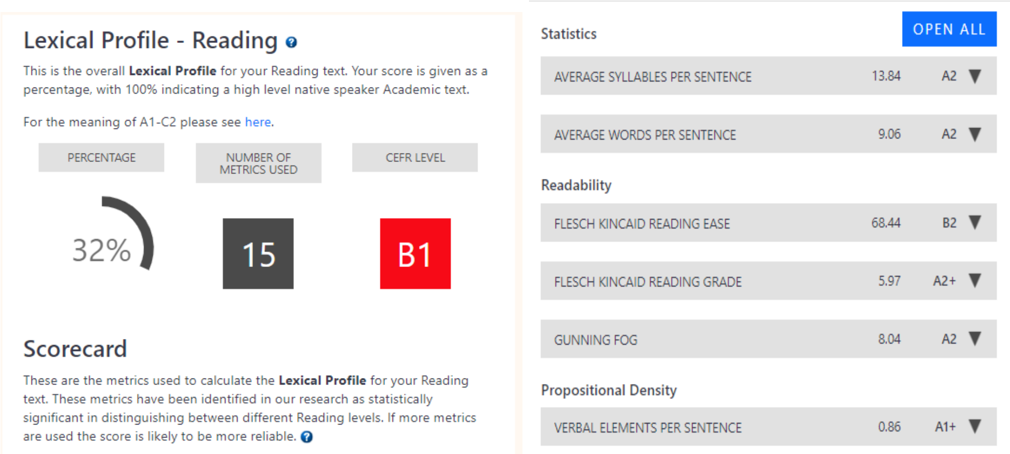
Methodology

The present study is part of a larger project examining the readability of Primary Years 1 to 6 science textbooks used in DLP. The textbooks are Science Year 1, Science Year 2, Science Year 3, Science Year 4, Science Year 5, and Science Year 6 published by Dewan Bahasa dan Pustaka. For this paper, only one unit/topic for each grade-year (Years 1 to 6) was selected and analysed using Text Inspector (with subscription), which is a web-based linguistic analysis tool that measures the vocabulary and text difficulty level in accordance with the CEFR. It has several features such as Statistics, Lexis: English Vocabulary Profile (EVP), Lexis: Academic Word List & Phrases (AWL), Scorecard and others to examine the readability of a text (Text Inspector, n.d). Each feature generates statistics based on the need to get comprehensive information regarding complexity, readability, estimated CEFR level and other key statistics from any given text.

This study uses two features of the Text Inspector: (1) Scorecard and (2) Lexis: EVP. The Scorecard generates the lexical profile score in CEFR (e.g., CEFR C2) for the readability of the text. The lexical profile of the Scorecard is based on multiple metrics:

statistics/syllables, English Vocabulary Profile (EVP), British National Corpus (BNC), Corpus of Contemporary American English (COCA), Academic Word List (AWL), and metadiscourse markers. Figure 1 is an example of the Text Inspector: Scorecard.

Figure 1
Scorecard and Analysis



Lexis: EVP analyses the text according to the EVP developed by Cambridge University Press. It identifies each word used in the text according to the CEFR on a scale of A1-C2 (see Figure 2).

The limitation of Text Inspector is in analysing a text under 100 words. This is a challenge because primary science textbooks rely on short paragraphs, visuals, and descriptions, averaging around 100 words per topic. To address this, researchers combine sentences from these sections to create a 100-word passage for analysis.

Here is an example to illustrate the application of the Text Inspector - Lexis: EVP on input text. The input sample is taken from Year 2 textbook - Unit 8. Each word is tagged with the CEFR level according to EVP (refer Figure 2):

Figure 2
Input Tagged Word According to CEFR Level

Figure 2 shows the analysis generated by Lexis: EVP. It identifies each word according to the CEFR level. The tagging such as A1, A2, B1, B2 appears next to the word. Words that are not tagged such as sieving, sized, clips, magnet are considered Unlisted, which means the level of readability is still not in the database of Lexis: EVP.

Findings

Readability of Science Textbooks

The analyses of the six topics from six textbooks show the readability level of the texts based on the CEFR according to grade (Year) level generated by Text Inspector: Scorecard. The findings showed that the language used in the science textbooks in primary school DLP is too difficult for the students to comprehend.

Table 2
Readability of the Science Texts according to CEFR Level

Year	Unit	CEFR level
Year 1	Unit 8-Absorption	C1
Year 2	Unit 8- Mixture	C1+
Year 3	Unit 8- Acid and Alkali	C1
Year 4	Unit 7 – Energy	C1+
Year 5	Unit 7 – Electricity	C1+
Year 6	Unit 6 – Force	C1

The results showed (see Table 2) that readability of all the science texts for primary level is at C1, even for primary Year 1 textbook. Based on the CEFR, only a proficient user has the reading ability to comprehend CEFR C1 text (see Table 1). These findings suggest that the difficulty for students to learn science is not only because of the difficulty of the subject itself but also the language used which is way beyond primary school students' proficiency level. As mentioned earlier, the target proficiency level set at the end of primary education is CEFR A2. However, as shown in Table 2 the level of English required to learn science at primary school is CEFR C1; this understandably raises the concern on the choice of language especially the lexical resources used to present the content of the selected textbooks. In this regard, science teachers need to be aware of the difficulty posed by the language in scientific text, and help students to understand the content and the meaning of words in the context of a science textbook. "Teacher talk" will have to take centre stage in science classrooms to help students understand scientific terms and concepts which otherwise may affect their comprehension.

The Science of Reading Comprehension

Studies have shown that the percentage of known vocabulary necessary for second language learners to comprehend written texts is between 95% (Laufer, 1989) and 98% (Hu & Nation, 2000; Schmitt et al., 2011), which can be regarded as the science of reading comprehension. The data generated by Text Inspector: Scorecard and Lexis: EVP showed that the texts at C1 readability have words beyond A2 between 29.62% to 52.69% (see Table 3). These are the percentages of words that can be assumed not to be understood by primary school students.

Table 3 shows the analysis of the words tagged beyond CEFR A2 from one unit/topic each taken from Years 1-6 science textbooks. The words tagged at CEFR A1 and A2 are common, frequent words that may not have serious implication on comprehension (see e.g., Figure 2); hence, the percentages are not shown here. Some examples of A1 words are can, in, the, we, why; and A2 words are by, large, picking, wood and others. As mentioned earlier, A1 and A2 lexis are analysed but not presented in the analysis as they are high frequency words that have less implication on comprehension. Only words that are tagged beyond CEFR A2 are presented in the analysis.

Table 3

List of Percentage and Words beyond CEFR A2 from Years 1 – 6 Science Textbooks

Source of Text	Level	List of words	Percentage of words beyond CEFR A2
Year 1 Unit 8 / Topic: Absorption	B1 (14.81%)	after, cotton, due, importance, iron, least, objects, prevent, protect, situation, used to, what, why, windscreen, your	29.62%
	B2 (8.64%)	absorb, absorbed, absorbs, lives, objects, observe, state, store, wiping, wound	
	Unlisted (6.17%)	absorbent, barrel, bathing, non	
Year 2 Unit 8 / Topic: Mixture	B1 (13.11%)	attraction, corn, flour, materials, methods, sand, separate	45.90%
	B2 (9.84%)	decayed, mixture, mixtures, nuts, separated, separates	
	C1 (3.28%)	dissolve, magnetic	
	Unlisted (19.67%)	clips, debris, filtration, floatation, Kanang, kernels, Kugan, magnet, muruku, raisins, sieving, sized	
Year 3 Unit 8 / Topic: Acid and Alkali	B1 (17.65%)	besides, bitter, burning, industry, properties, senses, sour, taste, tastes, tested, touch, touched	36.76%
	B2 (5.88%)	agriculture, salty, sensation, substances	
	C1 (4.41%)	neutral, slippery, tasteless	
	Unlisted (8.82%)	acidic, alkaline, coarse, indicator, indicators, litmus	

Year 4 Unit 7 / Topic: Energy	B1 (21.51%)	ability, blowing, burned, burns, earth, electrical, energy, flowing, fuel, fuels, heat, main, natural, ocean, power, produce, rocks, switching on, used to, waves	52.69%
	B2 (15.05%)	beneath, chemical, flame, generate, nuclear, obtained, solar, source, sources, stored, substance, substances, surface, transforms	
	C1 (3.23%)	coal, derived, panels	
	Unlisted (12.90%)	biomass, dam, faeces, fossil, geothermal, kinetic, petroleum, rotate, rotates, turbine, uranium, windmill	
Year 5 Unit 7 / Topic: Electricity	B1 (17.92%)	ability, earth, electrical, energy, flows, fuel, fuels, heat, humans, main, materials, natural, object, produce, produced, provide, provides, vehicles, wave	49.06%
	B2 (16.98%)	blades, chemical, enables, function, generate, generating, nuclear, obtained, organic, solar, source, sources, state, stored, supply, thus, warmth, yacht	
	C1 (1.89%)	appliances, coal	
	C2 (1.89%)	circuit, originates	
	Unlisted (10.38%)	biomass, brighten, burnt, dam, done, fossil, kinetic, petroleum, turbine, turbines, windmills	
Year 6 Unit 6 / Topic: Force	B1 (13.00%)	action, acts, direction, effect, effects, forward, involve, involved, involves, nearer, object, onto, upon	31%
	B2 (12.00%)	cause, force, forces, generated, gradually, holds, movement, observe, opposes, rope, slow down, surfaces	
	C1 (1.00%)	striker	
	Unlisted (5.00%)	carrom, climber, frictional, stroller	

The analyses showed the percentages of words tagged beyond CEFR A2 level in a text raise the concern on reading comprehension. The finding shows that a unit/topic in primary science textbooks, regardless at which educational grade, may contain about 30% of words beyond CEFR A2, indicating that students may not understand the meaning of almost one-third of the words in a topic/unit. The science of reading comprehension posited that to read and understand a text, one must understand between 95% and 98% of words in the text (Hu & Nation, 2000; Laufer, 1989; Schmitt et al., 2011). Based on the science of reading comprehension, the analysis shows that the percentages of words that are beyond CEFR A2 are more than 5%, and such range of percentages may impede reading comprehension of primary school students as they do not have the proficiency of CEFR C1.

The findings imply that the potential sources of difficulty for primary students in understanding science textbooks is a consequence of the lexis of science, since the language of science consists of technical words (e.g., absorbent, biomass, and filtration) and non-technical words (e.g., attraction, bitter, and properties). A closer examination of words in Table 3 shows that most of them are non-technical words, and ordinary English words used outside of a scientific context. However, when the words are used in science, they can be homonyms (e.g., clips, panels, and wound) or they can have different shades of meaning (decayed, stored, and slippery). Understanding homonyms and different shades of meanings is difficult for those whose proficiency level is at CEFR A2 or B1. In addition, the words are tagged beyond CEFR A2, which indicate that although they are ordinary words, they are not frequently used in everyday contexts (See Table 3).

There are also words tagged as Unlisted. These words are not individually tagged with a specific CEFR level in the EVP which indicates that they are the least frequently used words. A close examination of the Unlisted words shows that they consist of both technical and non-technical words. The findings indicate that understanding science requires rather more than simple comprehension of its technical vocabulary. According to Gardner (1974) the language of science is difficult in view of the nature of science itself which comprises “various intellectual processes, such as stimulus discrimination, description, classification, correlation and explanation,” (p. 63) involving the use of both ordinary English and technical vocabulary.

Conclusion

This paper examines the readability of science textbooks written in English which are used in DLP in primary schools to ascertain the level of readability according to the CEFR level using Text Inspector. The overall results show that the readability of science textbooks does not significantly differ from Year 1 to Year 6. They are at CEFR C1, a level of language difficulty far beyond the proficiency of primary school students. It is important to note that not all texts on the chosen topics are at CEFR C1, but most are not lower than CEFR B1. In this respect, the readability of these science textbooks is inappropriate for the target students in primary schools. The aspirational target set for primary 6 students is A2 to be achieved by 2025 (Ministry of Education Malaysia, 2015c) from pre-A1 set for Primary 1. CEFR level B2/C1 is the aspirational target set for university students. It is indeed difficult to see how students are expected to comprehend science in English when they do not even have English proficiency required to process the text. Literature on readability also highlighted that the language used in science textbooks written in English is too difficult for students to comprehend (see e.g., Gyasi, 2013, Hu et al., 2021,).

An important issue to be addressed with respect to text comprehension is the percentage of words above the CEFR A2 target level. The analysis of selected texts shows that almost one third of the words analysed are beyond CEFR A2, namely, B1, B2, C1 and C2, which raises the question how students can understand science in English when the content language is above their proficiency level. There are also words categorised as Unlisted, which includes those that have not been assessed for difficulty according to the CEFR level. Unlisted words can range from CEFR A2 to C1 and are not yet included in the database of EVP (see Unlisted in Table 3). The findings indicate that the adoption of science textbooks in primary schools under the DLP needs to be reviewed carefully. It is necessary to ascertain the readability level before they are submitted for review to ensure that books adopted are within the proficiency level of the intended students. In addition, a glossary for difficult scientific words should be provided to support text comprehension.

Past studies indicate that students' reading comprehension is highly correlated with their science performance (Cromley 2009; Neri et al., 2021). This explains why it is crucial to address the issue of text complexity arising from linguistic elements in the primary science textbooks adopted for use in DLP. Teachers play a vital role as mediators of knowledge to enable primary school students from Years 1 to 6 to develop sufficient understanding of the scientific knowledge appropriate for their age and level. To perform this mediating function adequately, teachers first need to know what non-technical words are beyond their students' level of proficiency, so that they can manage them in their science classroom to improve comprehension. It is also important for teachers to deal with technical scientific terms which are abstract and polysemous because they can affect students' understanding of the textbook.

With regard to the proficiency level of teachers, the Ministry of Education stipulates that those who meet the English language requirement and whose ability is certified by the headmaster are allowed to teach science and mathematics in English. For now, teachers are required to obtain a score of at least C in English in SPM (Ministry of Education Malaysia, 2020). It is also important to note here that SPM is a national exam taken by all Form 5 secondary school students in Malaysia before continuing their studies at tertiary level. Form 5 English may not be adequate, but this is believed to be a temporary measure in view of the urgency to implement DLP. At present, English teachers are required to have the proficiency of MUET Band 5 (equivalent to CEFR C1) (Ministry of Education Malaysia, 2019). We would like to suggest to Ministry of Education that science teachers need to obtain MUET Band 4 (equivalent to CEFR B2) before they can teach science and mathematics in English under DLP.

The findings of this study have unpacked the often-cited challenges on readiness of teachers and students in managing EMI (see, e.g., Ananthan & Mohd Said, 2019; Ellili-Cherif, 2014; Poon & Lau, 2016) in the classroom with respect to lexis and sentence structure which contribute to text complexity. The findings suggest a need for a staged introduction to scientific terminology by including corresponding forms in L1 and in English. Students have to know the scientific concepts before attempting to read texts containing them. Past studies have shown a significant gap between policy intent and implementation (see e.g., Kirkpatrick, 2016) which suggests that despite the overt planning, there is insufficient capacity at the level of classroom implementation.

Finally, while acknowledging the limitations of textbooks as a data source in view of their potential for replacement, the complexity of scientific language remains a challenge. These findings call for innovative approaches to the language of science within the DLP. This study lays the groundwork for future research investigating strategies to enhance language accessibility in primary science textbooks for students with diverse linguistic backgrounds.

Acknowledgements

The authors would like to acknowledge the financial support from Universiti Teknologi Malaysia under UTM Encouragement Research (UTMER) (PY/2020/04159); and Universiti Poly-Tech Malaysia for Skim Geran Penyelidikan Dalaman KUPTM (URG) SESI 2/2020 (KUPTM.DVCRI.RMC.15.MS (08).

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