

*Exploring the importance of vocabulary for English
as an additional language learners'
reading comprehension*

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Abstract

This exploratory study represents an attempt to investigate the factors that may affect the reading comprehension abilities of English as an additional language (EAL) learners. For this study, we examined a participant group of 31 (25 EAL and 6 first language English) learners studying at an international school in Japan. We assessed the participants according to four factors shown to influence reading comprehension: vocabulary knowledge, word decoding skills, reading fluency, and general linguistic ability. Our results show that differences in vocabulary knowledge show more variance in reading comprehension scores than the other factors examined in this study, highlighting the importance of vocabulary knowledge for reading comprehension. However, other factors such as reading fluency and general linguistic knowledge are also

shown to be moderate to strong predictors of reading comprehension. Based on these results, we suggest that EAL learners need targeted language support to enhance academic text comprehension.

Keywords: English as an additional language (EAL); vocabulary knowledge; general language ability; reading comprehension

1. Introduction

In recent years, pressure has been rising worldwide to provide support for learners without English as their first language (Murphy, 2014). Such pressure is evident in the UK, for instance, with schools experiencing increases as dramatic as 16.2% (2013) in the number of learners whose home language is one other than English (Strand et al., 2015). To support education in light of such increases, a better understanding of the needs of these English as an additional language (EAL) learners is an essential and urgent requirement (Hawkins, 2005).

One specific aspect of knowledge with which EAL learners have been shown to struggle is vocabulary. Typically, EAL learners start their educational careers with significantly lower levels of vocabulary knowledge compared to their first language English (FLE) counterparts (NALDIC, 2015). Moreover, EAL learners also typically take longer to master the high-frequency vocabulary essential for academic success (Coxhead & Boutorwick, 2018). While previous research (e.g., August et al., 2005; Coxhead & Boutorwick, 2018) supports the assertion that EAL learners likely have less developed vocabularies than their FLE counterparts, what remains unclear is how such discrepancies impact their ability to function in English as a medium of instruction (EMI) classrooms.

One area where this acknowledged lack of vocabulary knowledge (Murphy & Unthiah, 2015) has the potential to influence EAL learner academic success is reading comprehension, a specific and manifestly important academic skill EAL learners have been shown to struggle with (Droop & Verhoeven, 2003). Vocabulary is central to the reading process, and learners who are unable to master the vocabulary of the texts that are being used in their classes often struggle to comprehend the required classroom reading (Coxhead et al., 2010). While it is unclear precisely how much vocabulary EAL learners need to succeed academically in EMI schools, research has shown that EAL learners often struggle with two types of vocabulary that are known to be essential for academic success, that is, high-frequency and academic vocabulary (Coxhead & Boutorwick, 2018).

The exact number of words learners need to know to understand a given text is grade and subject dependent (Green & Lambert, 2019; Greene & Coxhead,

2015). However, research acknowledges that knowledge of both high-frequency and academic vocabulary, in a generic sense, is essential across all grades and subjects (Nation, 2016). Laufer (1997) suggested that, in order to understand a text, learners need to be able to automatically access at least the 3,000 most frequent word families. For EAL learners studying in a classroom where English is the medium of instruction, the number of words required is higher: Nation (2006), for instance, indicates that students need to know the first 8,000 to 9,000 word families to be able to understand the types of literary novels EAL students are expected to engage with in the classroom. This number is relatively consistent over many different types of literary works and non-fiction books (Coxhead, 2012).

Vocabulary knowledge is also vital for EAL learners to be able to succeed in technical subjects like math and science (Trakulphadetkrai et al., 2020). For example, a study by Greene and Coxhead (2015), examining the range and frequency of words found in a corpus compiled from science textbooks being used by middle-school classrooms in the USA, found that eighth-grade students would need a vocabulary of at least the first 7,000 word families to understand these texts. This number is supported by a similar study done by Coxhead et al. (2010) on high school science textbooks being used in New Zealand. They found that learners would need to know between 11,000 (for Grade 9 and 10) to 15,000 word families (for Grade 11) plus proper nouns to reach the 98% coverage Nation (2006) found to be necessary for comprehension. Given that many EAL learners reportedly fail to master even the 2,000 most frequent words right up until the ninth grade (Coxhead & Boutorwick, 2018), it is evident that they would struggle when having to comprehend such texts. However, despite the clear need for vocabulary knowledge across grades and subjects, it is still unclear to what degree discrepancies in the vocabulary knowledge of EAL learners will impact their ability to succeed academically in the EMI classroom. The current study, therefore, is designed to respond to this gap, following up on the call by a variety of researchers for more studies explicitly designed to provide a better understanding of the academic challenges faced by EAL learners worldwide (e.g., Graves et al., 2012; Henriksen & Danelund, 2015; Oxley & de Cat, 2019).

2. Literature review

2.1. The importance of reading comprehension for EAL learners

Reading comprehension difficulties are a primary reason for EAL academic underperformance (Murphy & Unthiah, 2015). In the UK, both research (Twist et al., 2007) and national test scores (Burgoyne et al., 2009) indicate that a lack of reading comprehension in English is one of the main reasons why EAL learners

consistently struggle academically in comparison to their FLE peers. Because of the various components involved in creating meaning from a written text, reading comprehension is a complex skill for EAL learners to master. Lower levels of grammatical and lexical EAL proficiency are often compounded by commensurate unfamiliarity with cultural references found in classroom texts (Hill, 2011). Such difficulties need to be considered in light of other issues that relate to learner strategies: Strategies that help to facilitate reading comprehension are an essential component for the meaningful understanding of written input (Lin, 2010), and reading comprehension itself is an integral part of the reorganization and evaluation modes of comprehension necessary for academic success (Hill, 2011). Accordingly, EAL learners are at a much higher risk of prolonged academic failure because many enter the (English language) education system after classes have begun (Fawcett & Lynch, 2000). Because of this, the acquisition of the essential skills they require to be able to read at the same level as their peers can take a considerable amount of time and effort to develop (Murphy, 2014). To address these concerns, a better understanding of the underlying factors responsible for this group of learners, struggle to comprehend texts written in English is essential.

2.2. Factors influencing EAL learners' reading comprehension

The above section has outlined the importance of reading comprehension for EAL learners; here, we detail the factors acknowledged to influence reading comprehension. While reading comprehension is a complex process and a difficult skill to assess, various influencing factors have been found to affect a learner's ability to comprehend English language texts (Melby-Lervåg & Lervåg, 2014). These factors include, but are not exclusive to: vocabulary knowledge (Qian, 2002), the ability to decode the English orthographic representation of words (Melby-Lervåg et al., 2012), reading fluency (Fraser, 2007), and general language proficiency (Trakulphadetkrai et al., 2020). The following subsections explore these different factors, attempting to summarize some of the major findings relevant to the study reported later in the current paper.

2.2.1. Vocabulary knowledge

Vocabulary knowledge has been shown to be a key predictor of reading comprehension for both EAL learners (Melby-Lervåg & Lervåg, 2014; Lervåg & Aukrust, 2010) and FLE learners (Ouellette & Beers, 2010; Tunmer & Chapman, 2012). Such vocabulary studies indicate that poor vocabulary skills can significantly limit a learner's ability to comprehend written texts (Burgoyne et al., 2009).

While higher levels of vocabulary coverage (e.g., 98% to 100%) do not necessarily result in 100% comprehension, studies indicate that vocabulary knowledge is a necessary condition for comprehension (e.g., Hsueh-Chao & Nation, 2000; Laufer, 1989; Schmitt et al., 2011). In the classroom, lack of vocabulary knowledge can make it challenging for EAL learners to use written texts to complete tasks and answer questions (Burgoyne et al., 2009), which can result in EAL learners struggling academically.

2.2.2. Word decoding skills

To effectively comprehend texts, learners need to both decode words in texts (word recognition) and use lexical information to understand meaning at both sentence and discourse levels (Hoover & Gough, 1990). The *simple view of reading* emphasizes that decoding and comprehension are separate skills and function independently of each other (Gough & Tunmer, 1986). It is, therefore, possible for learners to achieve good comprehension skills while having poor decoding skills (such as for the learners with dyslexia). There are also learners, known as poor comprehenders who have good decoding skills but poor comprehension skills (Yuill & Oakhill, 1991). Research suggests that such findings are equivocal for EAL learners. While most research shows that EAL learners struggle with reading comprehension skills despite having good decoding skills (Burgoyne et al., 2009; Hutchinson et al., 2003), some studies suggest that there are situations where EAL learners also struggle with decoding skills (García & Cain, 2014; K. Nation & Snowling, 2014).

2.2.3. Reading fluency

The National Reading Panel (2000) defines reading fluency as the ability to read a text quickly, accurately, and with proper expression, which refers to the ability to use the appropriate pauses and intonation when reading a text aloud. A fluent reader is one that can read both accurately and fast (Grabe, 2010). Fluency is seen as an essential aspect of reading comprehension because it is indicative of the amount of cognitive resources the reader has to allocate to word decoding and word recognition (Adlof et al., 2006). As readers become able to decode and recognize words faster and more automatically, they are able to allocate more of their limited cognitive resources to the task of textual comprehension (Geva & Zadeh, 2006). Accordingly, both L1 (Geva & Zadeh, 2006) and L2 (Fraser, 2007; Jiang et al., 2012) studies show strong and significant correlations between fluency and reading comprehension.

However, despite the apparent link between fluency and reading comprehension, for EAL learners, high levels of reading fluency may not correlate with good reading comprehension (Lesaux et al., 2010). A study by Rasinski et al. (2011)

with 16,143 Grade 4 through 10 students studying at schools in the USA found that improvements in fluency resulted in better reading comprehension, for all groups except EAL learners. EAL specific studies (e.g., Farnia & Geva, 2011; Lee & Chen, 2019) suggest an evolving proficiency dynamic: Where for less proficient L2 learners, fluency can contribute independently to reading comprehension, while for more proficient L2 learners reading comprehension is better explained by the interaction between reading fluency, oral proficiency, and vocabulary.

2.2.4. General language ability

While most researchers agree that language ability is multidimensional (Bachman & Palmer, 2010), renewed interest is emerging in language testing regarding how these discrete dimensions of proficiency can be united under an overarching construct (e.g., Harsch, 2014; Wang & Treffers-Daller, 2017). This notion of general language ability allows for individual learner language proficiency to be conceptualized as both unitary and divisible, depending on the purpose of the assessment and the level of abstraction (Harsch, 2014). By including both holistic and discrete measures of language proficiency in our study of EAL learners' reading comprehension, we are able to explore the extent to which measures of specific components of language ability, such as scores on a vocabulary levels test, are able to explain variance in reading comprehension over and above measures of the participants' general language ability.

While the contribution that specific language skills, such as vocabulary and word decoding skills, make to reading comprehension is widely acknowledged, the contribution of general language ability to reading comprehension appears comparatively under-researched. One potential reason for this imbalance might relate to the reported difficulty in assessing EAL learners' general language abilities. One recent study (Trakulphadetkrai et al., 2020), however, showed that the C-test was useful in understanding the specific language proficiency profiles of EAL learners. The C-test measures general language ability by making use of the reduced redundancy principle (RRP), testing learner linguistic knowledge by introducing interference and seeing how well the test taker can use their other linguistic skills to compensate (Babaii & Ansary, 2001). The C-test appears to be an effective measure of linguistic proficiency for the EAL learner because it measures both micro-level skills (word-level skills) and macro-level skills. Gaps in the text can only be completed if test takers understand and take into account the broader grammar or vocabulary of the text (Baghaei & Grotjahn, 2014). C-test scores have been reported to correlate strongly with scores on more comprehensive written and spoken tests (Eckes & Grotjahn, 2006), as well as to provide indications of global language proficiency (Dörnyei & Katona, 1992). The

current study aims to shed more light on the relationship between vocabulary and reading comprehension by including the C-test to measure the learners' general language ability along with a measure of both decoding and vocabulary skills.

2.2.5. Multiple factors

While the majority of the studies discussed above focus on the effects of a single factor on reading comprehension, studies have also looked at the effects of multiple factors with regard to their effect on reading comprehension. Melby-Lervåg and Lervåg (2014) conducted a meta-analysis on 82 studies that look at both L1 and L2 reading comprehension in relation to a number of factors, including language comprehension, phonetic awareness, and decoding skills. They found that in these studies both language comprehension and decoding were factors as to why second-language learners lagged behind their first-language counterparts in reading comprehension. Another meta-analysis of 58 studies conducted by Jeon and Yamashita (2014) found that grammatical knowledge, vocabulary knowledge, and word decoding skills were the three strongest correlates of reading comprehension for L2 learners.

In a longitudinal study of young learners (Grade 1 to 3), Bellocchi et al. (2017) looked at how seven different factors influenced learners' reading comprehension for both L1 and L2 Italian speakers. While both vocabulary and letter knowledge were shown to be significant predictors for the L1 Italian learners, the only significant predictor for the L2 Italian learners was morphosyntactic comprehension. These results were different from those obtained by Tunmer and Chapman (2012), who looked at the factors affecting reading comprehension with third-grade EAL learners studying at primary schools in New Zealand. They found that vocabulary, word recognition, and listening comprehension all made unique and significant contributions to reading comprehension.

2.3. Assessing reading comprehension

To accurately measure learners' reading ability, it is first necessary to find an assessment tool that measures the constructs that directly relate to reading comprehension (Ready et al., 2013). According to Treffers-Daller and Huang (2020), the most widely accepted description of the construct of reading comprehension is Gough and Tunmer's (1986) simple view of reading. The simple view of reading states that a learner's reading ability is defined by two different factors, that is, their ability to decode words and their linguistic comprehension (Hoover & Gough, 1990). First, decoding refers to the learner's ability to link the symbols written on the page and the appropriate entry in their mental lexicon. This process requires the learner to make use of letter-sound relationships to identify unfamiliar words in the text and

to be able to connect these printed words with the spoken counterparts in their lexical memory (Tunmer & Nicholson, 2011). Beyond allowing the learner to read the text in front of them, this process also enables them to develop detailed orthographic representations of words required for the automatization of word recognition (Ehri, 2005). A second important factor for reading ability is the learner's ability to use the lexical information they have decoded from the text to construct meaning at both the sentence and discourse level (Gough & Tunmer, 1986).

The *York Assessment of Reading Comprehension* (YARC; Snowling et al., 2009) is a comprehensive test of reading, which was developed based on the simple view of reading. The test was initially developed for 11- to 16-year-old learners studying in the UK. While the test has been validated for and used extensively to assess FLE speakers, it is also suitable for non-native speakers of English studying in an EMI secondary school context. The original sample of learners that was used to standardize the test includes data from 89 EAL learners who were studying at schools in the UK. Furthermore, this test has been used and validated as a measure of L2 English learners' reading comprehension skills in previous studies (e.g., Treffers-Daller & Huang, 2020). While the scores of non-native speakers will usually fall below those of native speakers, the test is still able to provide insight into how well EAL learners are able to meet the reading comprehension levels required for their grade level (see <https://www.gi-assessment.co.uk/support/yarc-support>).

3. The current study

While numerous studies have investigated the importance of vocabulary for reading comprehension, most have focused on adult EFL or ESL learners (e.g., Laufer & Ravenhorst-Kalovski, 2010; Qian, 2002). Even studies that have investigated young learners have usually done so in the context of EFL language classes (Henriksen et al., 2004; Stæhr, 2008). Studies that have investigated vocabulary across age groups or learning environments suggest that the relationship between vocabulary and reading comprehension may vary according to participant age (e.g., Schoonen et al., 1998), linguistic background (Geva & Farnia, 2012), and learning context (e.g., Miralpeix & Muñoz, 2018). An agreed understanding of the relationship between vocabulary and reading comprehension is further complicated by the fact that there are a number of additional factors that appear to influence reading comprehension. Those most cited in the literature are word decoding skills (Droop & Verhoeven, 2003), reading fluency (Geva & Zadeh, 2006), and general language proficiency (Trakulphadetkrai et al., 2020).

Accordingly, the current study contributes to discussions on the relationship between reading comprehension and vocabulary by considering this relationship in the context of a specific group of learners: young EAL learners. We build on earlier

studies that have investigated reading comprehension influences and investigate the relationship between vocabulary and reading comprehension in light of the three most cited areas in the literature, namely: (a) word decoding skills, (b) reading fluency, and (c) general linguistic ability. Our two research questions are:

1. To what degree does vocabulary knowledge correlate with reading comprehension, and how does this relationship compare with the way reading comprehension correlates with other factors such as the learners' word decoding skills, fluency, and general language ability?
2. Does vocabulary knowledge have a significant and independent effect on learners' reading comprehension ability?

4. Methodology

4.1. Participants

Thirty-one learners ($N = 31$) took part in the study (11 male and 20 female learners). The student population of the school was heterogeneous and the participants in this study are representative of the mix of nationalities and language backgrounds that is commonly seen in international schools. Students were grouped using their survey data as FLE or EAL speakers. Twenty-five (seven male and 18 female) students were identified as EAL speakers and six (four male and two female) were identified as L1 (English) speakers. Of the 25 who were identified as EAL, 17 (five male and 12 female) were classified as non-native speakers of English as an additional language (NNSEAL), students identified by their classroom teachers as requiring additional language support in the classroom. With the exception of one learner who had just turned 16, all of the learners in this study ranged in age from 11 to 15. Furthermore, all the participants had studied in English in the international school context for at least two years. The EAL learners came from a diverse background of first languages, including Japanese, Korean, Dutch and Croatian. The study took place at an international school in western Japan. Outside of a specific Japanese language class, instruction in the school is delivered exclusively in English. The school curriculum follows the International Baccalaureate Middle School and Diploma programs. Informed consent was obtained from the learners and their respective parents or guardians prior to the start of the study.

4.2. Survey instruments and procedure

Data collection took place over two months between December 2017 and January 2018, during two sessions. During the first session, learners were given a battery of

two language tests, along with a survey designed to provide insight into their language background. During the second session, learners were interviewed individually and given Snowling et al.'s (2009) *York Assessment of Reading for Comprehension* as well as a *Single Word Reading Test* (SWRT). The first session took about an hour to complete, while the second session took about 45 minutes per learner.

In the first session, learners were given the language survey, the C-test and the *New Vocabulary Levels Test* (nVLT; see below) during regular class time. The assessments were distributed and monitored by the learners' regular classroom teachers. While an hour was scheduled for the first session, most participants were able to complete the survey and assessments in around 45 minutes.

The C-test was used to measure learners' general language ability. The C-test is a modified version of a cloze test that requires test takers to complete the missing parts of words in a text. As discussed above, the C-test uses RRP to measure test takers' micro-level skills (word-level skills) and macro-level skills (Babaii & Ansary, 2001), and has been used effectively in the past to get a clearer picture of EAL learners' general language knowledge (e.g., Trakulphadetkrai et al., 2020). In an earlier version of the C-test, Raatz and Klein-Braley (1981) deleted the second part of every other word to present a consistent format (e.g., "The deleted parts are given in bold"). Subsequently, others (e.g., Kamimoto, 1993) suggested that a format where appropriate words are selected at random intervals throughout the text would be more effective at measuring underlying language proficiency. Kamimoto (1993) also emphasizes the importance of topic familiarity and text readability when constructing the C-test. The C-test we opted to use had been validated in a number of previous studies (e.g., Ishihara et al., 2003; Neff, 2015) and included text related to situations and contexts that would be easily understood by EAL learners studying in Japan. The C-test was also prepared following the principles for word deletion described by Kamimoto (1993), and 20 words, selected at random intervals, were deleted from each of the passages, instead of reducing every second word as is done in some C-tests.

The C-test was scored by two raters with any discrepancies discussed. Altogether, 12 responses across the three passages were highlighted. These responses ranged from misspellings (e.g., *different* vs. *diffrent*), grammatical errors (e.g., *group* vs. *groups*) and semantic differences (e.g., *where* vs. *wherever*). While some studies that use C-tests with adults only accept correctly spelt answers (Eckes & Grotjahn, 2006), studies with younger learners often overlook minor spelling errors (Linnemann & Wilbert, 2010; Trakulphadetkrai et al., 2020). For example, Trakulphaderkrai et al.'s (2020) study of young EAL learners awarded a point for grammatically and semantically correct variations as well as simple misspellings. In our study, with careful consideration of the learners' age and proficiency, we awarded points for words with minor spelling errors provided they

were grammatically correct, as this could be seen as a demonstration of comprehension by the learner. Each item on the test was worth two points, and the maximum score possible on the C-test was 100.

The other assessment that the participants completed during the first session was McLean and Kramer's (2016) *New Vocabulary Levels Test*. The nVLT was chosen over the *Vocabulary Levels Test* (VLT; Schmitt et al., 2001) because it was developed using a more modern set of word lists, that is, Nation's (2012) British National Corpus (BNC)/Corpus of Contemporary American English (COCA) word lists. The nVLT is a test of word families and includes a measure for each of the first 5,000-word bands as well as the Academic Word List (AWL). The use of multiple-choice questions also made it easier to examine the test residuals for possible mis-fitting items or participants (Kremmel, 2018). In the nVLT, each word band consists of 24 items, while the section assessing the AWL is made up of 30 items. Following earlier studies (Coxhead & Boutorwick, 2018; Read, 1988; Schmitt et al., 2001), the level of mastery was set at 86%. Learners needed a score of 21 or more on each of the frequency bands to be considered to have mastery of a specific band. For the AWL section, a score of 26 or higher was used.

The second session, in which the YARC test was conducted, consisted of participants completing two different assessments, the first of which was the SWRT, a test of word decoding. The SWRT assessment consists of 70 words grouped into bands of ten, with the words becoming progressively more difficult as test-takers advance through the test. The first band consists of words such as *see* and *look*, and the seventh band is made up of words such as *lacerate* and *pharmaceutical*. The SWRT, which can be done independently or as part of the YARC procedure, serves a dual purpose: The first is to provide information about test taker decoding skills whereas the second is as a diagnostic, positioning test takers at the correct level of the YARC test and determining the passages they are to read. The YARC test was then used to assess the learners' reading ability (accuracy, comprehension, and rate).

The YARC test consists of three levels, and each level has three sections. For the first section, the participants are asked to read two passages, one fiction and one non-fiction. These passages are read silently. After the participants have finished reading the passage, they have to answer thirteen comprehension questions, each one worth one point, about the passage. While answering the questions, the participants are able to refer back to the passage. For the second part of the YARC, the participants are asked to summarize the passage that they just read from memory. The summarization part of the assessment is worth eight or nine points, depending on the passage, with one point awarded for each of the key details from the passage that the participant is able to recall and summarize. Part three of the YARC assesses reading fluency. For this section, the

participants are asked to read a passage out loud. Depending on the level, the passage contains 129 or 137 words. One point is awarded for each word read correctly, and the reading rate is calculated by dividing the number of words read correctly by the time taken to read the passage. The test taker's age, along with the difficulty of the passage they read, and the number of words they read per second is used to determine a reading fluency score out of 130. The standardized scores for the YARC test, rather than the raw scores, were used for analysis. This was done because the YARC consists of different passages for different proficiency levels. The YARC provides a way to convert the raw scores from each of the passages to an ability score that provides an estimate of the participant's level based on the abilities being measured in that passage. To determine the test taker's reading comprehension performance in relation to standardized norms, these ability scores are then converted to standardized scores. The standardized scores were calculated out of the 130 points possible.

Thus, for each participant, five separate data points were obtained: (a) a measure of their general language ability in English, as given by the C-test; (b) a measure of their vocabulary knowledge provided by the nVLT; (c) a measure of their word decoding skills, as measured by the SWRT; (d) a measure of their reading fluency, as given by their scores on the fluency passage of the YARC assessment; and (e) a measure of their reading comprehension scores, as given by the YARC reading comprehension assessment.

4.3. Analysis

The descriptive statistics of both the response variable and the explanatory variables are provided in Table 1. We also investigated if the scores on the different assessments were normally distributed. No significant differences were found with the normal distribution for any of the test results, and the scatter plots of the response and explanatory variables showed that they were distributed in a linear pattern. Furthermore, no floor or ceiling effects were found.

Table 1 Means and standard deviations of all variables ($N = 31$)

	Mean	SD	Minimum	Maximum
Reading comprehension	108.19	12.74	79	128
nVLT	124.19	22.27	58	147
C-test	77.23	20.72	14	98
SWRT	58.06	7.97	35	69
Fluency	104.13	14.63	70	130

Note. Reading comprehension = YARC reading comprehension ability scores (maximum 130); nVLT = raw scores of the nVLT (maximum 150); C-test = raw scores of the C-test (maximum 100); SWRT = raw scores on the SWRT (maximum 70); fluency = YARC reading fluency standardized scores (maximum 130)

An initial overview of the nVLT scores (see Table 2) indicates that there was still a high number of learners who had not achieved mastery of the mid-frequency word bands or the AWL. Mirroring the results found in previous studies (Coxhead & Boutorwick, 2018), we found that prior to Grade 9 a high number of the participants were still unable to master the high-frequency words in the 2,000 and 3,000-word bands, and learners from all grade levels struggled to master the AWL. Given the importance of the AWL for the understanding of school textbooks (Greene & Coxhead, 2015; Nagy & Anderson, 1984), a lack of mastery of these vocabulary items would mean that these learners would struggle to be able to read at their grade level.

Table 2 Mastery of vocabulary by grades (all learners)

	1000	2000	3000	4000	5000	AWL
Grades 6 to 8 (<i>N</i> = 17)	100%	65%	29%	53%	53%	29%
Grades 9 to 10 (<i>N</i> = 14)	100%	100%	43%	43%	64%	57%

Note. AWL = Academic Word List

Furthermore, EAL participants were much more likely to struggle to master high-frequency vocabulary than FLE learners (see Table 3). Only one of the FLE participants (a Grade 7 student) did not show mastery of the 5,000 most frequent word families. However, there were two FLE learners who did not show mastery of the AWL, indicating that vocabulary knowledge may still be an issue even with this group of learners.

Table 3 Mastery of vocabulary by language background

	1000	2000	3000	4000	5000	AWL
FLE (<i>N</i> = 6)	100%	100%	83%	100%	100%	67%
EAL (<i>N</i> = 25)	100%	76%	28%	48%	44%	28%

Note. FLE = first language English; EAL = English as an additional language learner; AWL = Academic Word List

For each of the nVLT, C-test and YARC assessments validity was assessed using a combination of a Rasch analysis (nVLT and C-test; Beglar, 2010) and Cronbach's alpha (CA) (C-test and YARC; Trakulphadetkrai et al., 2020). For the C-test, the Rasch analysis showed a good fit to the model and there were no mis-fitting questions or learners found in the residuals. The reliability of the C-test was high with a CA coefficient of .824. Together, these show that the C-test was a reliable measure of the participants' general language ability. Overall, the majority of the nVLT scores displayed a good fit to the Rasch model. However, one Grade 10 EAL learner was shown to have a very high Outfit Score ($Z_{std} = 8.76$), so his results were removed from the analysis. The residuals showed no other problems with the fit of the learners' scores. The YARC was also shown to be highly reliable with a CA coefficient of .936.

5. Results

In order to address the first research question (*To what degree does vocabulary knowledge correlate with reading comprehension, and how does this relationship compare with the way reading comprehension correlates with other factors such as the learners' word decoding skills, fluency, and general language ability?*), bivariate correlational analyses were conducted using the scores on the assessments in relation to the learners' reading comprehension scores. Table 4 gives an overview of all Pearson correlations between the variables for all learners. It reveals that the YARC reading comprehension correlated most strongly with the nVLT (.86***), and the C-test (.83***). The learners' SWRT and fluency scores showed moderate and statistically significant correlations with reading comprehension, with r values of .67*** and .70***, respectively. The fact that both the participants' reading rates and their word decoding skills correlated moderately and significantly with their YARC reading comprehension scores means that the test potentially taps into the word decoding dimensions of reading detailed by the simple view of reading.

Table 4 Correlations between variables ($N = 31$)

	C-test	SWRT	YARC fluency	YARC comprehension
nVLT	.90*** [.79, .95]	.86*** [.73, .93]	.73*** [.50, .86]	.86*** [.73, .93]
C-test		.85*** [.70, .92]	.71*** [.47, .85]	.83*** [.68, .92]
SWRT			.74** [.52, .87]	.67*** [.42, .83]
YARC fluency				.70*** [.47, .85]

Note. SWRT = Single Word Reading Test; YARC = York Assessment of Reading Comprehension; nVLT = New Vocabulary Levels Test. ** correlation significant at $p < .01$; *** correlation significant at $p < .001$; values in square brackets indicate the 95% confidence interval for each correlation

Similar correlations were found when examining data from only the EAL learners (see Table 5). Again, for this group of learners both the nVLT and C-test correlate most strongly with reading comprehension with r values of .86*** and .87***, respectively.

Table 5 Correlations between variables for EAL learners ($N = 25$)

	C-test	SWRT	YARC fluency	YARC comprehension
nVLT	.90*** [.78, .96]	.89*** [.75, .95]	.71*** [.43, .86]	.86*** [.70, .94]
C-test		.84*** [.67, .93]	.74*** [.49, .88]	.87*** [.73, .94]
SWRT			.74** [.49, .88]	.70*** [.42, .86]
YARC fluency				.69*** [.41, .85]

Note. SWRT = Single Word Reading Test; YARC = York Assessment of Reading Comprehension; nVLT = New Vocabulary Levels Test. ** correlation significant at $p < .01$; *** correlation significant at $p < .001$; values in square brackets indicate the 95% confidence interval for each correlation

Moving on to the second research question (*Does vocabulary knowledge have a significant and independent effect on learners' reading comprehension ability?*), a partial correlation test was run (see Table 6) to determine the relationship between the participants' reading comprehension and their vocabulary ability whilst controlling for general language ability (C-test), reading fluency (fluency), and word decoding skills (SWRT). In order to help compensate for the small sample size the partial correlational analysis was done using bootstrapping (Field et al., 2012). Bootstrapping provides a more robust method for examining small sample sizes by estimating the properties of the sampling distribution from the sample data (Bruce, 2015). It does this by treating the sample data as the population and drawing smaller samples from this data, putting back the data before a new case is drawn. The correlational coefficient can then be calculated from each of these samples and the standard deviation of the sampling distribution of the bootstrapped samples can be used to estimate the standard error of the correlational coefficient (see Wright et al., 2011). From this standard error, confidence intervals and significance tests can be computed.

The partial correlational test showed that there was a strong and statistically significant partial correlation between the nVLT scores and reading comprehension ($r = .57, p < .001$) whilst controlling for the other variables. In this model vocabulary can be said to account for around 33% of the variance seen in the participants' reading comprehension scores, indicating that vocabulary does indeed have a strong and independent effect on the participants' reading comprehension.

Table 6 Partial correlational analysis of VLT and reading comprehension ($N = 31$)

Control variables	Independent variable		Reading comprehension
C-test, SWRT, & YARC fluency	nVLT	Correlation	.573***
		Significance (2-tailed)	.001
		Bootstrap ^a	
		Bias	-.057
		Std. error	.186
		BCa 95% Confidence interval	
		Lower	.194
		Upper	.762

Note. SWRT = Single Word Reading Test; YARC = York Assessment of Reading Comprehension; nVLT = New Vocabulary Levels Test. *** partial correlation significant at $p < .001$. ^a = bootstrap results are based on 2000 bootstrap samples

Further partial correlation analyses were then used to determine if the effects of general language ability, word decoding, and fluency still correlated to reading comprehension when vocabulary knowledge was accounted for (see Table 7). In all cases, when controlling for vocabulary knowledge, the other assessments did not show strong or significant correlational relationships with reading

comprehension. This would seem to indicate that these factors do not explain a significant level of the variance in reading comprehension scores after vocabulary knowledge has been taken into account. This serves to further highlight the importance of vocabulary for reading comprehension.

Table 7 Partial correlational analysis of the C-test, SWRT, fluency, and reading comprehension while controlling for vocabulary knowledge ($N = 31$)

Control variables	Independent variable		Reading comprehension	
nVLT	C-test	Correlation	.273	
		Significance (2-tailed)	.144	
		Bootstrap ^a	Bias	-.035
			Std. error	.149
		BCa 95% Confidence interval	Lower	-.027
			Upper	.721
nVLT	SWRT	Correlation	-.279	
		Significance (2-tailed)	.136	
		Bootstrap ^a	Bias	.027
			Std. error	.198
		BCa 95% Confidence interval	Lower	-.654
			Upper	.275
nVLT	YARC fluency	Correlation	.225	
		Significance (2-tailed)	.232	
		Bootstrap ^a	Bias	-.003
			Std. error	.139
		BCa 95% Confidence interval	Lower	-.043
			Upper	.488

Note. SWRT = Single Word Reading Test; YARC = York Assessment of Reading Comprehension; nVLT = New Vocabulary Levels Test. ^a = bootstrap results are based on 2000 bootstrap samples

6. Discussion

The findings presented in this paper align with a growing body of EAL learner research indicating a critical relationship between vocabulary knowledge and reading comprehension (Burgoyne et al., 2009; Melby-Lervåg & Lervåg, 2014; K. Nation & Snowling, 2004). Similar to Burgoyne et al. (2009), our results show that vocabulary knowledge had the strongest correlation to the participants' reading comprehension abilities when compared to factors such as fluency or word decoding. Accordingly, we agree with Burgoyne et al.'s (2009) assertion of the central place for strengthening vocabulary knowledge to improve EAL learners' reading ability. We also saw moderate correlations between reading comprehension and reading fluency, as Grabe (2010) predicted, and word decoding. While some previous studies have shown stronger correlations between word

decoding skills and reading comprehension (e.g., Nation & Snowling, 2004), the most probable reason for this difference is that these studies have tended to involve younger EAL learners and the relationship between word decoding and reading comprehension has been shown to decrease with age (Garcia & Cain, 2014).

One important difference between the current study and earlier studies relates to the context. While earlier EAL learner reading comprehension studies have come from predominantly English speaking countries, the current study focuses on learners in an international school context. We suggest, accordingly, that findings in the current study might not entirely align with studies such as Hutchinson et al. (2003), who looked at young EAL learners studying in the UK. While Hutchinson et al. (2003) report that their EAL learners had lower vocabulary knowledge, the learners in their study only showed a two-year lag in receptive vocabulary knowledge compared to FLE counterparts. By contrast, in the current study, our findings suggest a significantly larger gap in the levels of vocabulary knowledge between the EAL and FLE participants. This finding is consistent with other studies that have measured EAL learner vocabulary knowledge in an international school context (Coxhead & Boutorwick, 2018). One potential reason for such differences when comparing our findings and Coxhead and Boutorwick's (2018) with those of Hutchinson et al. (2003) might relate to the limited opportunities EALs have to use English outside of the classroom in the international school context. When considered in conjunction with the strong and significant correlation between vocabulary knowledge and reading comprehension outlined above, such lower levels of vocabulary knowledge among international school EAL learners underline the primary importance of vocabulary intervention for this group of learners. Furthermore, on the basis that the international school EAL learners appear to exhibit different linguistic profiles when compared to EAL learners in predominantly English language speaking contexts, additional studies are necessary to determine EAL learner needs in international contexts. We believe that the current study is an important step in this direction.

An additional strength of the current study rests with the inclusion of tests for general language ability (C-test) as well as word decoding skills (SWRT) alongside vocabulary knowledge. By including such additional tests, the current study provides a platform to investigate the potential contributions different aspects of language knowledge make towards EAL learner reading comprehension. While still a relatively new area of research, studies are beginning to examine how different aspects of language knowledge along with more holistic measures of general language proficiency correlate to skills such as listening comprehension (Wang & Treffers-Daller, 2017), reading comprehension (Droop & Verhoeven, 2003), and mathematics (Trakulphadetkrai et al., 2017). Our results add to this growing body of research and are supportive of the contribution general language ability provides to reading comprehension (Droop & Verhoeven, 2003). The strong

correlation seen in our study between general language ability and reading comprehension might relate to suggestions (Trakulphadetkrai et al., 2020) that less successful readers tend to focus on smaller units (word or sentence level) when constructing meaning from written text, whereas more proficient and successful learners may employ a wider range of top-down, global strategies for text comprehension. As the C-test requires learners to use a combination of bottom-up, word-based strategies along with top-down, text-based strategies (Babaii & Ansary, 2001), the strong and significant relationship between reading comprehension and this measure of general linguistic knowledge seen in this study suggests that the C-test could provide a useful tool for teachers to use in EAL classrooms, with a wide range of learner proficiencies, to identify learners struggling with reading comprehension.

7. Limitations and implications

The current study has some limitations that need to be considered when interpreting its findings. One potential issue concerns the vocabulary assessment tool being used in the study, which is intended for use with adult learners. Currently, there are limited assessment tools available specifically for EAL learners, and none that are designed to measure the vocabulary knowledge of the type of EAL learners that participated in this study. While some overlap of knowledge is likely, without further research, it remains a challenge to determine the extent to which the word-frequency lists developed for adults, or the methods of assessing learners' mastery of those frequency bands, are appropriate for the young EAL learners. However, previous studies (Green & Lambert, 2019; Greene & Coxhead, 2015) have shown that there are a number of important differences between the vocabulary EAL learners are likely to encounter in the classroom, compared to frequency lists developed for adult learners. Accordingly, as part of a larger ongoing project, we are developing and testing vocabulary assessment tools that can specifically be applied to young EAL learner assessment, which we aim to publish in the future. Further limitations of the current study relate to the context of the research. While our data represent assessments conducted with learners from diverse linguistic backgrounds, the study focuses exclusively on learners studying in the Japanese context. We intend to expand the scope our study in the future by investigating participants from international schools outside of Japan, in order to explore the extent to which our findings can be applied elsewhere. Furthermore, the number of participants assessed in this study was relatively small, and so we also hope to extend our research to other international schools in Japan to increase the number of learners participating in the study.

Despite the limitations discussed above, the current study offers two important implications for the classroom. First, as other researchers have advocated (e.g., Coxhead et al., 2010; Green & Lambert, 2019), EAL teachers who wish to improve

their learners' reading comprehension should focus first and foremost on improving their learners' vocabulary knowledge. Given that the current study was not an intervention study, we cannot use our results to offer suggestions regarding the specific types of vocabulary instruction teachers should follow. However, ample support from previous studies shows that a principled approach to the teaching of vocabulary, with both intentional vocabulary learning activities and sufficient opportunities for incidental learning, can aid EAL learners in improving their reading comprehension (Greene & Coxhead, 2015; Murphy & Unthiah, 2015). Second, the results of our study demonstrate the potential benefits of using vocabulary assessment as a pedagogical tool to help identify learners who may need additional support in the classroom; something other researchers in the field (e.g., Coxhead & Boutorwick, 2018; Greene & Coxhead, 2015) also endorse.

8. Conclusion

Given that our study has demonstrated that vocabulary knowledge appears so important for EAL learners, we feel that it is essential for teachers to provide vocabulary support for both EAL and FLE learners in the classroom. Furthermore, the apparent importance of vocabulary for EAL learners' reading comprehension indicates that teachers should focus on improving these learners' vocabulary knowledge. Teaching EAL learners the vocabulary they need to succeed academically is something that can be done both inside the classroom and through pullout programs. EAL and FLE learners alike should be encouraged to expand the depth and breadth of their vocabulary knowledge as both have been shown to be important factors for reading comprehension in both this and other studies (e.g., Treffers-Daller & Huang, 2020). This greater focus on vocabulary in the classroom is essential if EAL learners are to be able to comprehend the texts that they are being asked to read for class. However, it is important to stress that vocabulary must be looked at in the context of the other factors that have been shown to influence reading comprehension, such as reading fluency and general language ability. As such, it would be prudent for teachers, even in the EAL context where there is often a greater focus on having students learn the content of the course rather than the language itself, to incorporate tasks that help students to improve their overall English language abilities as well as their reading fluency.

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