LEXICAL KNOWLEDGE AND BILINGUAL READING: WITHIN- AND CROSS-
LANGUAGE ASSOCIATIONS OF PARADIGMATIC AND SYNTAGMATIC
KNOWLEDGE IN ENGLISH AND MANDARIN

by

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Abstract

The cross-language relationship of lexical knowledge between typologically dissimilar languages has not received much attention in previous studies. The relationship between lexical depth and reading comprehension in English and Mandarin was thus investigated in two studies. In Study 1, 139 Mandarin-English speaking children ($n=87$, aged 8-9 years; $n=52$, aged 10-11 years) completed parallel measures of two aspects of lexical depth, paradigmatic and syntagmatic knowledge in both English and Mandarin, along with measures of lexical breadth and non-verbal reasoning. Regression analyses showed a cross-language relationship for paradigmatic but not syntagmatic knowledge for both the younger and older children. In Study 2, the same children were measured for working memory, word reading, morphological awareness and reading comprehension in both languages in addition to the measures used in Study 1. Paradigmatic knowledge was found to be a significant predictor of reading comprehension in both languages but syntagmatic knowledge was a unique predictor only for comprehension in Mandarin for both age cohorts. A cross-language relationship was only observed in the older children between Mandarin paradigmatic knowledge and English reading comprehension. Study 1 results provide evidence of a link between the mental lexicons of both languages in Mandarin-English speaking children at the paradigmatic level. Study 2 findings point to the importance of lexical depth in reading comprehension in both English and Mandarin. The cross-language paradigmatic
knowledge-reading comprehension link was found in bilingual children learning contrasting languages but was limited to older children. These findings have implications for instructional practice to facilitate lexical development in bilingual children.
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Chapter 1. Introduction

The mental lexicon is concerned with the mental organization and classification of word meanings as well as their networks with other words (Aitchison, 2003; Richards & Schmidt, 2002). Lexical access is the processes with regard to the retrieval of these words and their properties and networks (Caramazza, 1997). From these definitions, a distinction can be made between word forms and their associations. This corresponds to the view of many researchers that lexical knowledge is a multidimensional construct, consisting of a breadth dimension (i.e., number of word forms in the lexicon) and a depth aspect (i.e., meanings, properties, and associations with other words) (e.g., Beck & McKeown, 1991; Haastrup & Henriksen, 2000; Laufer & Parbakht, 1998; Nagy & Herman, 1987; Ouellette, 2006; Qian, 1999; Read, 2000; Wesche & Paribakht, 1996).

A range of linguistic and cognitive skills such as morphological skills, reasoning abilities, and reading comprehension, which are fundamental to attaining academic success (e.g., Carlo, August, & Snow, 2005; Kieffer & Lesaux, 2007; Vermeer, 2001) are dependent on lexical knowledge (e.g., Carlisle & Nomanbhoy, 1993; Hiebert & Kamil, 2005; Griffin, Burns, & Snow, 1998; Ricketts, Nation, & Bishop, 2007; Smith, Jones, Landau, Gershkoff - Stowe, & Samuelson, 2002; Tannenbaum, Torgesen, & Wagner, 2006). These findings thus underscore the importance of acquiring word meanings for success in reading. Despite its significance in reading, lexical knowledge and lexical access have only just begun to stimulate research interest (Geva, 2006). Thus far, researchers put forth that the focus of this line of research has been largely on English reading and on the breadth of word knowledge (Qian, 2002; Wesche & Parikbhat, 1996). Although there is emerging research on the relationship between the depth of knowledge of words and reading outcomes in English (e.g., Ordóñez, Carlo, Snow, & McLaughlin, 2002; Ouellette, 2006;
Proctor, Silverman, Harring, & Montecillo, 2012; Qian, 2002), the nature of this relationship needs to be further clarified. In addition, the question of whether a similar relationship between lexical depth and reading can be found in languages other than English, still needs to be answered.

On a related note, while cross-language relationships have been documented for a range of reading-related skills such as phonological awareness and morphological awareness across typologically different languages, the cross-language association of lexical skills has rarely been examined. Reading paradigms have shown a link between the first- (L1) and second-language (L2) mental lexicons of bilinguals (e.g., Channell, 1998) but mostly in cases where the L1 and L2 share the same writing system (e.g., Ordóñez et al., 2002). It is not known whether this link is also present between languages that have different typologies.

In light of these gaps in current literature, the main aim of this dissertation is to explore depth of lexical knowledge across languages, and its relationship to reading comprehension within and between Mandarin and English. Two related studies are presented in this dissertation. The first study examines how lexical depth is related in English and Mandarin. The second study examines the relationships between depth of lexical knowledge and reading comprehension, within both English and Mandarin, as well as between the two languages. The patterns of relationships are investigated in groups of children: (1) ages 8-9 (primary three) and (2) ages 10-11 (primary five).

English and Mandarin are chosen because they represent two typologically different scripts. English is an alphabetic language where words map onto phonemes (e.g., cat maps onto the sounds /kl, /a/, and /t/) and graphemes (letters). Mandarin is a morpho-syllabic language where morphemes are represented as characters instead of letters (e.g., 猫 instead of cat). Each character represents a syllable. Inflections, and derivations form the bulk of morphologically complex words
in English (Ku & Anderson, 2003). Inflections are formed by combining inflectional suffixes with root words that result in a change in tense, gender, number, or case of the root word (e.g., girl – girls). Derivations are formed by adding an affix (e.g., -ing or -者) to a root word which changes the part of speech of the word (e.g., go – going). However, in Mandarin, words are formed primarily by compounding (Li & Thompson, 1981). For instance, the word beef, 牛肉 is formed by constituent morphemes of cow /牛/ and meat /肉/.

The studies are conducted with bilingual children educated in Singapore. English and Mandarin are two of the four official languages of Singapore and English is the medium of instruction in schools. All core curricula are taught in English whereas Mandarin is taught as a single subject (Gopinathan, 1999). A standardized educational curriculum is implemented across all schools in Singapore, which reduces the confounding effects of educational and linguistic experience in the current investigation of lexical knowledge.

This dissertation is composed of 11 chapters. The rationale for the current research is introduced in Chapter 1. The construct of lexical knowledge is reviewed in Chapter 2. The subsequent four chapters present the first study which examines the cross-language relationships between two aspects of lexical depth: paradigmatic and syntagmatic knowledge. A second study that investigates the within- and cross language relations between these two types of knowledge and reading comprehension in English and Mandarin is presented in the next four chapters. The last chapter, Chapter 11, summarizes the two studies.

**Rationale of this Research**

The objectives of this research project are both theoretical and practical in nature. Theoretically, the studies will add to our understanding of the construct of lexical knowledge, and
how aspects of this multi-faceted construct relate to one another between languages as well as to reading comprehension. From a practical perspective, considering the importance of lexical knowledge in reading, uncovering processes that children can draw upon from their L1 and L2 to facilitate reading in both languages will benefit instructional practice.
Chapter 2. Lexical Knowledge

Instead of a simple binary characterization, lexical knowledge can be thought of as spanning across a spectrum (e.g., Beck & McKeown, 1991; Laufer & Parbakht, 1998; Nagy & Scott, 2000). Researchers have also proposed that knowledge of a word encompasses several dimensions (e.g., Daller, Milton & Treffers-Daller, 2007; Meara, 1990; Meara, 2005; Nation, 1990; Qian, 2002), which has led to a plethora of frameworks being put forth to characterize this multidimensional construct. Nation (1990) identified eight different dimensions of lexical knowledge, including word form, syntactical structure, word meaning, word function, and associations with other words. Qian (2002) streamlined the model to encompass only four dimensions. The first dimension, vocabulary size, refers to the number of words an individual knows, whereas the second dimension, vocabulary depth, encompasses aspects such as collocational knowledge and knowledge of concepts. The third dimension, lexical organization, is concerned with the links words have with other words in the lexicon. Finally, the last dimension, automaticity of receptive-productive knowledge, makes reference to the processes that are used to access semantic knowledge.

However, the dominant view is that lexical knowledge comprises of three dimensions, as evidenced in the multitude of three-dimensional models put forth (Gyllstad, 2013). In most of these three-dimensional models, such as that proposed by Daller, Milton, and Treffers-Daller (2007) as well as Meara (2005), the dimensions of lexical breadth (number of words in the lexicon), depth (knowledge of relations of words to other words) and lexical access (i.e., automaticity of receptive-productive use) are consistently associated with the construct of lexical knowledge. The following sections will review these three dimensions in detail.
Breadth of Lexical Knowledge

Breadth of lexical knowledge, also known as vocabulary size, refers to the number of words of which the learner has at least some knowledge (Nassaji, 2004; Nation, 2001; Qian, 2002). Two measures have consistently been used in the measurement of breadth of knowledge. The first is the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997) which adopts a picture-identification format and the second is the Vocabulary Levels Test (VLT; Nation, 1990) where test-takers are required to match words with short definitions. The PPVT is a popular assessment tool for young children and has been used with both L1 and L2 learners (e.g., Ordonez et al., 2002; Senechal, Thomas, & Monker, 1995). The VLT, on the other hand, has been commonly used with L2 adolescent learners and is widely regarded as a good measure of lexical breadth (e.g. Laufer & Paribakht, 1998). The format of these tasks provides an estimate of the number of words one has some knowledge (Henriksen, 1999).

Lexical Depth

Depth of word knowledge refers to how well words are known (Freebody & Anderson, 1983; McGregor, Oleson, Bahnsen, & Duff, 2013; Read, 1993, 2000) and includes knowledge of words that have similar or contrary meanings, as well as multiple meanings (e.g., Nagy & Scott, 2000; Nation, 2001). This dimension of lexical knowledge has been operationalized in many ways though the commonality among these operationalizations is that it can be broken down into different components (Read, 2000). Some researchers (e.g., Leider, Proctor, Silverman, & Harring, 2013; Li & Kirby, 2014; Proctor et al., 2012) have situated depth of word knowledge within the Lexical Quality Hypothesis (Perfetti, 2007) where the dimension is posited to be made up of morphological, syntactic and semantic knowledge. Others have conceptualized the depth dimension as comprising of two fundamental types of knowledge, paradigmatic and syntagmatic
relations among words (e.g., Chapelle, 1994; Cruse, 1986; Haastrup & Henrikson, 2000; Jakobson, 1971; Schwartz & Katzir, 2012). Paradigmatic relations are concerned with the understanding of the hierarchical semantic relationships among words and how these words relate to one another (Schwartz, Moin, & Leikin, 2012). On the other hand, syntagmatic knowledge is associated with descriptions of words with regard to appearance (e.g., *a tall man*), their use (e.g., *a glass is for drinking*), and other attributes (Schwartz et al., 2012). This type of knowledge is associated with how words are used together (Kuczaj, 1999). While components of depth identified in the *Lexical Quality Hypothesis* have been examined extensively (e.g., Kieffer & Lesaux, 2008; Li & Kirby, 2014; Pasquarella, Chen, Lam, Luo, & Ramirez, 2011), investigations of syntagmatic and paradigmatic relations in children have been less forthcoming. The present study is thus focused on these two types of knowledge.

**Paradigmatic Relations.** Researchers have identified three types of sense-relations as reflecting paradigmatic knowledge (e.g., Henriksen, 1999; Ly & Jung, 2012; Schwartz & Katzir, 2012; Wolter, 2001), corresponding to *Coordination and Antonymy, Hyponymy and Hypernymy, and Synonymy*.

**Coordination and Antonymy.** *Coordination* and *Antonymy* are relations among words that belong to the same word class. Three subtypes can be derived with respect to this type of relation. The first subtype consists of *complementary antonyms*, which are words with opposite meanings and have no middle ground (Carter, 1998; Singleton, 2000). For instance, one is either male or female. The second subtype of relations is that between *gradable antonyms*. These antonyms, unlike *complementary antonyms*, lie on a continuum (Carter, 1998). For example, something may not be ugly but that does not necessarily imply that it is beautiful. Therefore, beautiful and ugly
are graded antonyms. Words that share *converse relationships* form the third subtype (Carter, 1998). For instance, words such as parent and child are converse antonyms.

**Hyponymy and Hypernymy.** Relationships between superordinates (*hypernyms*) and subordinates (*hyponyms*) form the second type of paradigmatic relations. The relations in this category are organized in a hierarchical nature. For example, *animal* is the superordinate category that encompasses subordinate words such as *rabbit, cat,* and *cow* (Carter, 1998). Partonomic links among words also fall in this category. Words that share partonomic links have part-whole relationships and are also referred to as *meronyms* (Hasan, 1984). Word pairs such as *bow* and *violin* are examples of *meronyms*.

**Synonymy.** Synonyms refer to words of similar meanings and can be classified into *strict* and *loose synonyms*. *Strict synonyms* refer to words that are perfect substitutes for one another (Jackson, 2014). According to Lyons (1995), it is virtually impossible to find *strict synonyms* in a language because these words have to be exactly the same in meaning, can be used interchangeably across all contexts and also share identical semantic qualities such as style and grammatical structure. *Loose synonyms*, on the other hand are more common (Coulthard, Knowles, Moon, & Deignan, 2000; Lyons, 1995). They refer to words that are close in meaning but there are still nuances in what they express and how they are used (e.g., *lie* and *misleadleat* and *consume*) (DiMarco, Hirst, & Stede, 1993; Jackson, 2014).

Paradigmatic associations usually occur among words belonging to the same word class (e.g., adjective-adjective). Children who have acquired this type of knowledge of relations among words demonstrate the ability to meaningfully organize and understand words without the use of context and this ability is thought to be enhanced with more experience in formal education (e.g., Anglin, 1985; Ordóñez et al., 2002; Schwartz & Katzir, 2012).
**Syntagmatic Relations.** According to Cronbach (1942), the sense of how words collocate reflects syntagmatic knowledge. Syntagmatic associations occur among words of different word classes (e.g., verb-noun) and are highly contextualized in that they can vary depending on how they are used (Schmitt, 2014).

**Collocations.** Collocations refer to word units that are regularly used together (Cruse, 1986; Zhang, 1993). They can be classified into two types: *lexical collocations* and *grammatical collocations* (Benson, Benson, & Ilson, 1997; Coulthard et al., 2000). *Grammatical collocations* involve the combination of a noun, adjective, or verb with a preposition (Bahns, 1993). Examples of grammatical collocations include noun + preposition (e.g., *belief in*), preposition + noun (e.g., *by choice*), and adjective + preposition (e.g., *happy with*) combinations. *Lexical collocations*, on the other hand, refer to combinations between nouns, adjectives or verbs (Alsulayyi, 2015). Verb + noun (e.g., *give credit*), adjective + noun (e.g., *bright light*), and verb + adverb (e.g., *live simply*) combinations are some examples of this type of collocations. In the present study, however, only lexical collocations are examined because the focus is on lexical knowledge.

Collocations typically meet three criteria. The first criterion is that of *non-compositionality* (Manning & Schutze, 2002). According to Manning and Schutze (2002), the meaning of collocations cannot be totally predicted from the meaning of their parts. For instance, in the collocation *bright smile, bright* takes on the meaning of *happy, joyous*, rather than its basic meaning of *luminous*. Second, constituents of collocations cannot be replaced by words of similar meanings (Boonyasaquan, 2005). For instance, even though *powerful* and *strong* are close in meaning, the former cannot be used in place of the latter with the noun *coffee*. Finally, collocations cannot be modified. For instance, *yellow fever* cannot be modified to become *yellower fever*. According to Hill (2000), collocations can present themselves as *unique collocations*, where their
constituents cannot be changed (e.g., red tape), strong collocations where word pairings are considered to be conventional (e.g., do homework), medium collocations which include those that are neither strong or weak collocations (e.g., heavy smoker), and weak collocations where there are many other collocational possibilities (e.g., day could be collocated with rainy, sunny, cloudy etc.). Hill (2000) also proposed that medium collocations should be the focus in collocational instruction because of their common occurrence in academic learning. In light of this, the current study will focus on examining knowledge of medium collocations.

**Measurement of Lexical Depth.** While no standardized measures of lexical depth are available, several popular test formats have been used to examine lexical depth. The most popular measure takes the form of the *Word Associates Test* (WAT; Read, 1993, 1998; Verhallen & Schoonen, 1998). Versions of the WAT by Read (1998) and Qian (2002) were first developed with adult learners in mind, and seek to measure paradigmatic and syntagmatic knowledge in a receptive format. In these tasks, participants are given a target word (e.g., bright) and asked to choose from a range of options synonyms (e.g., clever famous happy shining) and correct collocations (e.g., colour hand poem taste) of the word. There are versions developed for elementary children such as that by Verhallen and Schoonen (1998). Children are presented with a target word (e.g. banana) and asked to pick out three words from six options that they think are most associated with it (e.g., yellow peel fruit nice monkey slip). All six options are related to the target word, either syntagmatically or paradigmatically. As the objective is to test whether children use syntagmatic or paradigmatic relations to associate words, participants are not given specific instructions on the basis with which to make the choices. While this format of testing provides insight into the way the lexicon is organized (either syntagmatically or paradigmatically), it is less effective in the showing children’s extent of knowledge of each of these two types of relations. In addition to the
WAT, other tests such as the Semantics subtest of the Clinical Evaluation of Language Fundamentals (CELF; Wiig, Secord, & Semel, 2004) and the Similarities subtest of the Wechsler Intelligence Scales (WISC) battery (Weschler, 2003) have been used in the evaluation of depth. The former task requires participants to pick two of four words that are semantically related (e.g., car train dog vegetable) whereas the latter requires children to identify similarities between two items for each item on the task. However, unlike the WAT, these two tasks only assess paradigmatic knowledge.

Qualitative methods have also been employed in the investigation of these two types of knowledge among young children. One such method is the Word Definition Task (Richard & Hanner, 1985; Verhallen & Schoonen, 1993). In this productive task, participants are given concrete, high-frequency nouns and asked questions to elicit descriptions of the words. These questions are targeted at getting participants to provide paradigmatic information such as definitions (e.g., What is the meaning of this word?) and part-whole relations (e.g., What is this a part of?) as well as syntagmatic information (e.g., What is this used for?). This method has been adopted in many recent studies examining lexical depth in bilingual children (e.g., Ordóñez et al., 2002; Schwartz & Katzir, 2012; Verhallen & Schoonen, 1993). The number of responses corresponding to paradigmatic (e.g., a lemon is a fruit) and syntagmatic information (e.g., a knife is used for cutting) are typically summed up and the quality of responses are analyzed to gain a holistic view of the depth of one’s understanding of these two types of relations (Verhallen & Schoonen, 1993).
Relationship between Syntagmatic and Paradigmatic Knowledge

Researchers have often used a horizontal axis and a vertical axis to represent syntagmatic and paradigmatic knowledge, respectively (e.g., Green & LeBihan, 1996). Extensive research points to the development of syntagmatic knowledge before paradigmatic knowledge (e.g., Miller & Johnson-Laird, 1976). For example, Snow (1990) found that older participants tended to use more paradigmatic information in defining a word. This finding is congruent with that of many subsequent studies (e.g., Cronin, 2002; Palermo, 1971; Söderman, 1993; Wolter, 2001). Lippman (1971) proposed that a preference for paradigmatic as opposed to syntagmatic responses is a characteristic of more proficient learners of a language. Researchers have attributed this shift in associations to changes in how the lexicon is organized (e.g., Nelson, 1977), possibly a result of school experience and reading development (Cronin et al., 1986).

Relationship between Lexical Breadth and Depth

According to Qian (2002), despite the distinction between lexical breadth and depth, their interrelation should be acknowledged. The nature of this link is a positive one. An individual who has knowledge of only a small number of words would have difficulty developing depth of knowledge of words due to the inability to draw links with other words that share paradigmatic and syntagmatic relations. On the other hand, a learner who has a large repertoire of words in the lexicon might not be able to fully utilize this vast knowledge if their grasp of the deeper meanings and associations of these words is superficial. Empirical support for this view was put forth by Nurweni and Read (1999) who found a strong correlation between English lexical breadth and depth measures in their study, but only among proficient students. The study conducted by Akbarian (2010) with university students also yielded strong correlations between the VLT (breadth) and the WAT (depth) in English. Finally, Schmitt and Meara (1997) also found a strong
The findings reviewed above might lead one to question the distinction between breadth and depth of lexical knowledge. Indeed, Vermeer (2001) puts forth the postulation that there might not be a need to make a distinction between breadth and depth. However, others have argued against this claim. Research with Chinese learners of English has shown that despite having acquired a good range of vocabulary, these learners still present problems with collocation tasks (e.g., Liu, 2000). Qian (2002) also found depth measures to be unique predictors of reading even after partialling out the contributions of breadth measures. In addition, Tannenbaum et al. (2006) found breadth and depth measures to be separate constructs using a factor analysis. Greidanus, Bogaards, van der Linden, Nienhuis, and de Wolf (2004) thus caution that in view of a lack of research in vocabulary depth, it should not be concluded that these two dimensions can be combined into one.

Despite the fact that many researchers acknowledge the distinction between the two levels of lexical knowledge (e.g., Oullette, 2006; Proctor et al., 2012; Qian, 2002; Schwartz et al., 2012), many studies still use only lexical breadth measures as a proxy of one’s lexical competence (e.g. August, Carlo, Dressler, & Snow, 2005; McBride-Chang, Cheung, Chow, Chow & Choi, 2006). The role of lexical depth has been largely neglected in reading investigations until recent years. This has been identified as a major limitation to gaining insight into how lexical skills relate to reading (Wesche & Paribakht, 1996). Using only lexical breadth measures does not fully capture the nature of the construct (Verhallen & Schoonen, 1998). In addition, it is also argued that using only breadth measures does not take into account that there are differences in the extent to which words are known (Nagy, 1988; Schmitt & Meara, 1997).
Lexical Access

The third dimension of lexical knowledge corresponds to lexical access. Researchers generally acknowledge the distinction between receptive and productive lexical knowledge with respect to this dimension (e.g., Henriksen, 1999; Laufer et al., 2004; Laufer & Nation, 1995; Melka, 1997; Schmitt, 2014). According to Laufer and Goldstein (2004) as well as Nation (1990), receptive knowledge refers to the grasp of words that one hears of or encounters in reading whereas productive knowledge refers to words that can be produced in an appropriate context either verbally or in written form. There is contention about whether receptive and productive knowledge present as binary dimensions or lie on a continuum (Laufer & Goldstein, 2004; Pignot-Shahov, 2012). The latter has been the more popular view (e.g., Henriksen, 1999; Palmberg, 1987; Teichroew, 1982), where one starts with a receptive knowledge of words before progressing to being able to produce the word in a given context. On the other hand, proponents of the binary view (e.g., Meara, 1990; Schmitt & Meara, 1997) argue that words that one can use are different from those of which one has receptive knowledge because they are represented differently in the lexicon. For instance, one may know the meaning of the word retaliate but not know how to use it to construct a sentence.

Thus far the receptive-productive distinction has not received as much attention as the other two dimensions of lexical depth (i.e., breadth and depth). The many studies that have reviewed the contributions of breadth and depth of lexical knowledge to reading often compared the contributions of receptive measures of lexical breadth (e.g., PPVT & VLT) and productive measures of lexical depth (e.g., Ordóñez et al., 2002; Vermeer, 2001). In receptive tasks, participants are required to identify a word and its constituent meanings. On the other hand, the productive format requires participants to provide responses to target items or questions posed
(Webb, 2008). The processes involved are thus very different. As a result, it is difficult to compare contributions of lexical breadth and depth to reading when the tasks measuring the constructs are concerned with different aspects of the receptive-productive dimension. This is an issue in research with bilingual children in light of studies showing a substantial gap in receptive and productive vocabulary among bilingual children (e.g., Allman, 2005; Gibson, Oller, Jarmulowicz, & Ethington, 2013; Oller & Eilers, 2002; Windsor & Kohnert, 2004). In addition, research has also shown weak correlations between Spanish receptive and productive vocabulary measures (e.g., Lesaux, Crosson, Kieffer, & Pierce, 2010). Therefore, there is a need to ensure that depth and breadth measures within a study match on this dimension to better understand how lexical depth is related across languages.
Chapter 3. Study 1

The Cross-language Relationships of Paradigmatic and Syntagmatic Knowledge between English and Mandarin

The strong documented relationship between lexical ability and reading (e.g., Kastner, May, & Hildman, 2001; Kieffer & Lesaux, 2007; Schmitt, 2008; Swanson, Rosston, Gerber, & Solar, 2008; Zhang & Anual, 2008) has led to interest in bilingual children’s processing abilities (e.g., Bialystok, Luk, Peets & Yang, 2010; Poulin-Dubois, Bialystok, Polonia, & Yott, 2013). This is because dividing attentional resources between two languages appears to result in a smaller vocabulary size in each language (Roberts, Garcia, Desrochers, & Hernandez, 2002) for both sequential and simultaneous bilinguals (e.g., Eilers, Pearson, & Cobo-Lewis, 2006; Páez & Rinaldi, 2006; Pearson, Fernández, & Oller, 1993), which may have an adverse impact on reading outcomes (Bialystok et al., 2010). Increasingly, researchers acknowledge the need to consider the interaction of lexical knowledge between the two languages of bilinguals rather than view each language in isolation in order to obtain a better understanding of the extent of their lexical knowledge (e.g., Bedore, Peña, Garcia, & Cortez, 2005; Pearson et al., 1993). This is in consideration of the distributed characteristic of bilingual development (Cobo-Lewis, Pearson, Eilers, & Umbel, 2002). A core assumption of this phenomenon is that there are aspects of lexical knowledge that are language-specific and others that are common across languages (Bedore et al., 2005; Pearson, Fernández, & Oller, 1995).

The question of what constitutes language-general aspects of lexical knowledge and what can be classified as language-specific knowledge however, still needs to be clarified. Researchers have attempted to answer this question by examining the cross-language relationships of lexical knowledge (e.g., Nagy, 1992; Ordóñez et al., 2002; Proctor, August, Carlo, & Snow, 2006) in
bilinguals. However, such research has been limited to bilinguals whose L1 and L2 are alphabetic languages, which often have similar linguistic typologies (e.g., Ordóñez et al., 2002). Therefore, in the present study, the question of whether cross-language associations of lexical depth also extend to dissimilar languages, such as in the case of English (an alphabetic script) and Mandarin (a morpho-syllabic script), is examined. Ultimately, it is hoped that the findings of this study will add to our understanding of how lexical knowledge in the L1 and L2 interacts among bilingual children.

The Cross-language Relationship of Lexical Knowledge

There is considerable support for the cross-language relationships of reading skills, including phonological processing (e.g., Cisero & Royer, 1995; Dickinson, McCabe, Clark-Chiarelli, & Wolf, 2004; Durgunoglu, Nagy, & Hancin-Bhatt, 1993) and more recently, morphological awareness (e.g., Saiegh-Haddad & Geva, 2008; Zhang, 2014). Researchers have argued that cross-language relationships of skills are largely dependent on distance between the linguistic typologies and orthographies of the two languages in question (e.g., Koda, 2005, 2008). Therefore, many studies investigating cross-language associations of lexical knowledge have focused on typologically similar languages that share cognates. Cognates are words across languages that bear resemblance semantically with varying degrees of overlap in orthography and phonology (e.g. *edifice* – *edificio*) (Holmes & Guerra Ramos, 1995; Otwinowska, 2015). For instance, Cunningham and Graham (2000) found that Spanish-English children performed better on the PPVT task as compared to English monolingual children because they did better on cognate items. In another study, Arnaud (1982) found a positive correlation between English and French lexical breadth among French-English bilingual children. Nagy, Durgunoglu, and Hancin-Bhatt (1993) also found that Spanish-L1 students who could identify Spanish cognates when reading
English texts performed better on a multiple-choice test that tested their understanding of these words in English as compared to students who had more difficulty recognizing cognates. This finding again provides evidence of a relationship between languages that share common lexical units such as cognates.

However, the literature on the cross-language associations of lexical depth is limited. To my knowledge, only one published study conducted by Ordóñez et al. (2002) has explicitly examined the cross-language relationship of paradigmatic and syntagmatic knowledge between languages with the same writing system. In this study, Spanish-English bilingual children in grades three and four were administered a word definition task where they were asked to describe six high frequency nouns (nouns corresponded to animals or objects) in both English and Spanish. Their responses in both languages were coded for knowledge of paradigmatic (e.g., *a boat is a machine*) and syntagmatic knowledge (e.g., *an envelope is made of paper*) on a scale of 0 to 5 based on the quality of responses. Regression analyses were conducted to examine whether the two types of knowledge were related across languages, controlling for lexical breadth in the two languages and non-verbal ability. It was found that paradigmatic knowledge predicted the same type of knowledge in the other language. A cross-language relationship of syntagmatic knowledge was observed only after the effects of lexical breadth have been controlled for but the magnitude of this relationship was smaller than that of paradigmatic knowledge.

The cross language relationship of lexical depth between languages that have different writing systems, such as English and Mandarin has rarely been explored. This can probably be attributed to differences in linguistic typologies and the absence of cognates between these languages. Thus, a cross-linguistic link between them is thought to be less likely (see *Contrastive Analysis Hypothesis*; Lado, 1957). However, Jiang (2000) argues that cross language relationships
can occur between dissimilar languages for adult L2 learners who have well-established L1 lexicons, which allow them to effectively apply L1 lexical knowledge to L2 learning using translation. Still, it remains unclear whether similar crossover patterns can be observed in bilingual children from similar L1 backgrounds who are still developing their L1. To date, Pajoohesh (2007) is the only study that has provided evidence of cross-language associations of paradigmatic knowledge between dissimilar languages. The study found that English-Farsi bilingual children had comparable performance on paradigmatic tasks in both English and Farsi. However, this study did not control for the effects of lexical breadth, which has been shown to be related to depth of knowledge. Syntagmatic knowledge was also not examined in this study. Therefore, there is a need for further research to understand cross-language associations between dissimilar languages.

Despite the lack of research supporting cross language relationships of lexical knowledge across dissimilar languages, the Revised Hierarchical Model (RHM) of bilingual processing (e.g., Kroll & Stewart, 1994) suggests that cross language relationships at the semantic level are possible, even between languages that do not share cognates. Inherent in this model are two hypotheses with regard to bilingual processing of words. They are based on the notion that concepts across languages are largely common, although the lexical forms may differ. The first hypothesis is the Word Association Hypothesis; it posits that words referring to the same concept across two languages (e.g., school and 学校) are directly related to one another in the process of learning (Jiang, 2000; Potter, So, von Eckardt, & Feldman, 1984). Models based on this hypothesis suggest that in order to access the semantic properties (e.g., meaning, word class) associated with a word that one encounters in his or her L2, an individual must first retrieve the word in their L1 (Menenti & Indefrey, 2006). The second hypothesis, the Concept Mediation Hypothesis (Potter et al., 1984) supports a related but contrasting school of thought; it proposes that corresponding words for a
concept have direct links to a common conceptual store. This hypothesis suggests that there is less reliance on the L1 because of the direct connection from the L2 to the conceptual representation of the word. Despite differences between the two hypotheses, the common assumption held by both is that while representations of word forms are largely confined within each language, there exist conceptual representations that are common across languages because these remain relatively unchanged (Potter et al., 1984; Snodgrass, 1984).

What then constitutes conceptual knowledge that is in common across languages? Wolter (2006) proposes that between syntagmatic and paradigmatic knowledge, the latter is likely to be more representative of the knowledge that resides in the shared conceptual store across languages. Paradigmatic associations involve combinations of words that are from the same word class, which usually evoke concepts whose meanings can be inferred from those of their constituent units (e.g., *fire engine*). Therefore, the knowledge of the constituent parts in the other language can facilitate understanding of the word. Paradigmatic relations also remain similar regardless of the distance between languages. For instance, a dog, despite being represented by different word forms in different languages (e.g., *perro* in Spanish and *狗* in Mandarin), would still belong to the superordinate category of *animal*. This type of knowledge is common across languages and thus is more likely to be related across languages.

On the other hand, syntagmatic knowledge, as represented by collocations, involve combining words across different word classes. In some cases, when a word is collocated with other words, the result is a change in the underlying concept of the original words (e.g., *blue moon*). Wolter (2006) terms this a *lexical interaction* where the combination of words does not create a linear increment in meaning but instead leads to a change in the overall concept. Knowledge of meanings (in another language) of the individual units making up such word combinations, would
be less useful in helping learners understand the meaning of that combination, making this type of knowledge more localized within a language and less inclined to be related across languages (McKeown & Radev, 2000; Smadja, 1993).

To date, empirical research with regard to Wolter (2006)’s claim is still insufficient. There has only been one study that examined the cross language associations of syntagmatic and paradigmatic knowledge but it was between languages with cognates, specifically Spanish and English (Ordóñez et al., 2002). The empirical evidence for this claim still remains elusive with regard to dissimilar languages such as English and Mandarin.

**Language Exposure and Cross-language Relationships**

Inherent in the RHM is the idea that the strength of cross-language relationships is dependent on language exposure and proficiency levels in L1 and L2 (Kroll and Curley, 1988). The *Word Association Hypothesis* has been found to support the cross-language patterns of lexical knowledge of beginner L2 learners and the *Concept Mediation Model* appears to be more applicable to learners with high proficiency in the L2. Kroll and Curley (1988) found that individuals who were in the early stages of learning their L2 performed consistently with the *Word Association Hypothesis* when given picture naming and translation tasks, thus suggesting that beginner learners of a language were more likely to access shared concepts between L1 and L2 through their (more proficient) L1. On the other hand, the performance of proficient L2 learners was in line with the *Concept Mediation Hypothesis*. Proficient learners of a language appear to be able to access shared concepts directly. Chen and Leung (1989) replicated these findings with Cantonese-English bilinguals of differing proficiency levels. Dufour and Kroll (1995) thus proposed that learners move from a greater reliance on word association processes to concept mediation as their proficiency level increase. Based on this line of reasoning, it is logical then to
assume that cross-language relationships would more likely be observed in younger children who, as compared to older children, have less exposure to and thus lower proficiency in both languages.

The Present Study

Therefore, this study is designed to investigate the cross-language relationships of lexical depth, namely, paradigmatic and syntagmatic knowledge among Mandarin-English bilingual children of two ages. Mandarin and English present dissimilar languages, which allow for the investigation of whether the cross-language link is also present for languages that do not share the same script. Primary three (ages 8-9) and primary five children (ages 10-11) are also compared to investigate the effects of language exposure and proficiency on cross-language relationships of lexical knowledge.

Within- and cross-language lexical breadth measures are controlled for to distinguish the effect of lexical breadth. Ordóñez et al. (2002) pointed out the need to consider the interaction between lexical breadth measures in both languages. This is in relation to Lambert’s (1980) claim that bilingualism could be additive (i.e., acquiring a new language does not erode the first language) or subtractive (i.e., the acquisition of a new language displaces the first language). In addition, Sheng, Lu, and Kan (2011) found that the conceptual vocabulary scores (i.e. combined scores of vocabulary scores in both languages) of young Mandarin-English bilinguals were significantly greater than their single-language vocabulary scores, indicating the interaction between the L1 and L2 vocabularies of bilinguals. Therefore, the contributions of lexical breadth in both English and Mandarin are both controlled for in the present study. In addition, instead of using a productive task to investigate depth, the present study employs depth measures of a receptive nature (i.e., identification-type tasks). This is to examine whether patterns of relationships between receptive
syntagmatic and paradigmatic knowledge across languages are similar to those in the literature where productive measures of depth have been used.

In summary, two overarching questions guide the present study:

1. Are paradigmatic and syntagmatic knowledge related between English and Mandarin among primary three and primary five bilingual children?
2. Do the magnitude of cross-language patterns differ across the two different age cohorts?

With respect to the research questions, the following two hypotheses are put forth:

1. It is expected that cross-language relationships of paradigmatic knowledge will be stronger than syntagmatic knowledge in both cohorts. This is consistent with Wolter (2006)’s hypothesis that as compared to syntagmatic knowledge, paradigmatic knowledge is less subjected to conceptual modification across languages and will more likely be related across languages.

2. Cross-language relationships are predicted to be larger in the younger cohort as compared to the older children. This prediction is based on findings showing that children with less exposure to L2 access concepts via the L1 whereas children with more exposure to L2 bypass the L1 and retrieve concepts directly (Chen & Leung, 1989; Dufour & Kroll, 1995; Kroll & Curley, 1988).
Chapter 4. Method of Study 1

Participants

A cross-sectional design was adopted for the present study. Data were initially collected from 146 children (90 primary three and 56 primary five children). However, seven children (3 primary three and 4 primary five children) were excluded from the study because of incomplete data. The final sample was comprised of 87 primary three (Mean age = 8.72 years, SD = .26 years) and 52 primary five (Mean age = 10.78 years, SD = .28 years) Mandarin-English bilingual children in Singapore. Participants were recruited from 13 different Before and After School Care centres located across the country. Between five to fifteen participants from each centre took part in the study. All children received formal literacy instruction in both English and Mandarin in Singapore government schools. Consent was received from all parents and principals of the centres and assent was obtained from the children before the commencement of the study.

Among the 87 primary three children, 62 children were classified as English-as-first-language (EL1) children (mean age = 8.68 years, SD = .27 years) whereas the remaining 25 children were identified as Mandarin-as-first-language (ML1) children (mean age = 8.73 years, SD = .27 years). Classification was done based on a demographic information collected using a language background questionnaire (Appendix K) filled out by consenting parents. For the EL1 children, their parents reported English as the language most commonly spoken at home (>75% of the time) and the language that the child had been exposed to since birth. In addition, the parents of children in this group rated them as having higher proficiency in English as compared to Mandarin (with a mean difference of 2 points between self-reports of proficiency in the two languages on a 7-point scale). Parents of children identified as belonging to the ML1 group reported Mandarin as the language most commonly spoken language at home and the more
proficient language. Parents of ML1 children also reported that their child had been exposed to Mandarin since birth. Using the same classification method to identify EL1 and ML1 children, 36 participants in the primary five group were identified as EL1 children (mean age = 10.76 years, SD = .26 years) and the remaining 16 as ML1 children (mean age = 10.91 years, SD = .38 years).

The mean scores and standard deviations of performance of the EL1 and ML1 children on measures of Mandarin and English lexical breadth, paradigmatic and syntagmatic knowledge and non-verbal reasoning are presented in Table 1. Given the disparity in the number of children in each language group, Mann-Whitney U analyses were conducted to compare the performance of the EL1 and ML1 children in each grade on these tasks. With the exception of Mandarin lexical breadth [U = 416, p < .01], there were no significant differences between the two language groups in performance on the other tasks for the primary three participants (p’s > .05). There were no significant differences between the two language background groups on all tasks for the primary five participants. Considering that the performance of EL1 and ML1 participants on the tasks in each grade was largely similar, the data for all participants in each grade was analysed as a group (p’s > .05). Separate analyses were conducted for each age group to examine the patterns of predictions between the two age groups.

Measures

Participants completed measures of non-verbal reasoning, English and Mandarin lexical breadth as well as English and Mandarin syntagmatic and paradigmatic knowledge in this study. These tasks are described below and their reliabilities are reported in Table 2.

**Measurement within and across languages.** Experimental measures were used to assess the constructs of interest in the present study because current standardized measures were deemed
to be culturally inappropriate for the sample and there was a lack of locally developed measures that were relevant to the objectives of the study. With the use of experimental measures, three measurement issues had to be addressed. The first was with regard to item suitability and difficulty within each language version of the various tasks. Considering this factor, items were sampled from ten locally produced reference books and rated by six current teachers (three English-language and three Mandarin-language teachers) who have had experience teaching the grade-levels that the two groups of children were recruited from. Items of different frequencies were sampled to ensure that the test could differentiate between participants of different proficiency levels. The items were also piloted with 20 primary four children (ages 9-10) to ensure the suitability of the items and administration format.

The second issue that had to be addressed was the comparability of measures between the two languages. Items from both language versions of the different tasks were matched in frequency to ensure that difficulty level was similar across languages, as much as possible. The frequencies of items in each language were matched using the SUBTLex databases for English (Brysbaert & New, 2009) and Mandarin (Cai & Brysbaert, 2010). However, considering that it might be easier to derive at the meanings of the Chinese words as compared to English words of similar frequencies due to the transparent semantic structure of Mandarin, teacher ratings of item difficulty were also considered to ensure equivalence of items. The same instructions and format were also used in the different language versions.

Finally, it was important to ensure that the tasks measured the intended construct. To address this issue, think-aloud protocols were conducted with three students during the pilot phase of the study to ensure that participants understood the requirements of the tasks and were using the type of knowledge that each task was designed to assess. The three students were asked to verbalize
their thought processes as they completed the tasks. Any item that was deemed ambiguous or did not measure the intended construct the task was designed for was revised. Item characteristic curves (ICC) were also plotted using IRTPRO 2.1 to ensure that items reflected the hypothesized relation between ability levels and true scores of participants (i.e., participants of higher ability would have a higher probability of getting an item correct).

**Language Background Questionnaire.** Parents of all participants were asked to complete a questionnaire that was aimed at collecting information on participants’ language background, usage patterns of English and Mandarin as well as other demographic information such as parental educational level and income (Appendix K). The questionnaire consisted of 13 questions and was adapted from Yeong and Rickard Liow (2011). The following sections of the questionnaire were of particular interest in this study because they provided information on identifying English-L1 and Mandarin-L1 children within the two groups (Li, Sepanski, & Zhao, 2006):

1. The first language of the child: Parents were asked to list the order in which their children learnt English and Mandarin and indicate the age of exposure to these languages.

2. Child proficiency in English and Mandarin: Parents were asked to rate their children’s level of proficiency in speaking and writing in both English and Mandarin on a scale of 1 to 7 (1 being poor and 7 being very good).

3. Home usage patterns of English and Mandarin: Parents indicated the frequency with which they spoke each of the two languages with their children on a 5-point scale (all the time, most of the time, half of the time, less than half of the time, never).

**Non-verbal Reasoning.** Subtests 2 and 4 of the Matrix Analogies Reasoning Test-Short Form (MAT-SF; Naglieri, 1985) were used to assess non-verbal reasoning. A total of 32 items
were administered, 16 from each subtest. In this task, participants were shown a sequence of patterns and asked to complete the sequence by choosing one of six options. For each of the two sections, testing was discontinued when participants made four consecutive errors.

**Lexical Breadth.** English and Mandarin lexical breadth were measured using the receptive vocabulary task of the *Bilingual Language Assessment Battery* (BLAB; Rickard Liow & Sze, 2009). Participants were presented with four pictures and asked to choose the picture that best represented the target word read out by the researcher. The task was chosen over the PPVT because the BLAB was a locally developed task that featured culturally appropriate pictures (Rickard Liow & Sze, 2009). In view of time constraints, 40 of the hundred items in each language version of the battery were selected for administration. As mentioned earlier, item frequency and teacher ratings were considered in the selection of items. Three English language teachers and three Mandarin language teachers were asked to rate the 100 items on English and Mandarin versions of the BLAB, respectively, on a 10-point rating scale (1-very easy, 10-very difficult). They were asked to rate the items twice, first in consideration of suitability of the items for primary three children (8-9 years) and second, with regard to primary five children (10-11 years). The resulting 40 items were chosen based on these ratings (items were sampled across different levels of perceived difficulty for both levels; 15% × items with ratings 1-3, 15% × items with ratings 7-10, 70% × items with ratings 4-6). Items on the English and Mandarin tasks were also matched (as much as possible) on frequency. The same 40 items were used for both age groups.

**Syntagmatic Knowledge.** Experimental measures of English (Appendix A) and Mandarin collocations (Appendix B) were used in the present study to assess syntagmatic knowledge. The format of both the English and Mandarin tasks was adapted from the adult version of the WAT (Read, 1998). Participants were read a target word and provided with four options from which they
were asked to pick two that were associated with the target word. One point was awarded for every correct option picked. There were 20 items for each language version of the task with a total possible score of 40. In half of the items, the target word was an adjective and the options were nouns. In the other half, the target word was a verb whereas the options were nouns. Adjective + noun and verb + noun collocations were chosen for two reasons. First, a review of the textbooks and reference books used in English instruction in Singapore showed these two types of collocations to be common in the curriculum. Second, because the present study was an investigation into lexical depth, only lexical collocations (and not grammatical collocations) were chosen. The same items were used for both age groups.

To ensure that both types of lexical collocations used in the task (i.e., Adjective + noun and verb + noun collocations) measured a common construct, Confirmatory Factor Analysis (CFA) was conducted to compare the model fit of a one-factor to a two-factor model for the measure in English. Results showed the one-factor model had superior fit ($\Delta-2LL = 41.38$, $\Delta df = 1$, $p < .01$), suggesting that the two types of collocations loaded on a common factor. Multidimensional Scaling (MDS) analyses showed the English and Mandarin measures of syntagmatic knowledge to be structurally equivalent (Kruskal’s stress and weirdness values were close to 0). Given results of CFA and MDS, composite scores (sum of all correct items) were used in subsequent analyses.

**Paradigmatic Knowledge.** Paradigmatic knowledge was measured using an experimental task that was adapted from the Semantics subtest of the Clinical Evaluation of Language Fundamentals (CELF) (Wiig et al., 2004). It was comprised of 20 culturally-appropriate items, each of which consisted of four words (e.g., violin, table, guitar, and spoon) that were read to participants. Participants were asked to pick out two words that were related to each other. An item was scored as 1 (correct) if the correct pair of words was picked and 0 (incorrect) if at least one of
the two options picked was incorrect. This format of testing was chosen over the WAT because the segment in the WAT with respect to paradigmatic knowledge only assessed knowledge of synonyms. The format of CELF, however, allowed for a more comprehensive assessment of the construct of paradigmatic knowledge. The same items were used for both age groups.

Four types of semantic relations were included in the task in order to better measure the construct of paradigmatic knowledge. These four types of semantic relations were derived from the three aspects of paradigmatic knowledge, namely, *Coordination* and *Antonymy*, *Hyponymy* and *Hypernymy*, and *Synonymy*, reviewed in the introduction section. The four types of relations included in the measure were part-whole relations (e.g., *door* and *knob*), group membership (e.g., *fork* and *spoon*), synonyms (e.g., *happy* and *delighted*), and antonyms (e.g, *hot* and *cold*). Among the items on the task, two questions tested participants’ knowledge of part-whole relations, two questions assessed knowledge of group membership, seven items assessed knowledge of synonyms, and nine items measured knowledge of antonyms (Appendix C). All items were sampled from local textbooks and reference books to ensure that they were culturally and age-appropriate. A parallel measure made up of different items (but with the same format) was developed to assess paradigmatic knowledge in Mandarin (Appendix D). Items for the Mandarin task were also sampled from local reference and textbooks.

CFA of the English task showed a unidimensional model to be a better-fitting model as compared to a three-dimensional model ($\Delta \text{LL} = 81.64$, $\Delta df = 1$, $p < .01$), providing support that all the items measured a common construct. MDS analyses showed that the parallel measures of paradigmatic knowledge in English and Mandarin were structurally equivalent (Kruskal’s stress and weirdness values were close to 0). Composite scores (sum of all correct items) were used in subsequent analyses.
Procedure

Testing was carried out over two or three sessions, each lasting between 40 and 60 minutes. Short breaks of 5 to 10 minutes were given to prevent fatigue effects. In each session, the children were tested individually or in small groups in a quiet corner in the centres they were recruited from by trained undergraduate and graduate research assistants. The order of language and tasks was counterbalanced across participants.
Chapter 5. Results of Study 1

Theoretical frameworks differentiate between breadth and depth of lexical knowledge (e.g., Qian, 1999). In addition, frameworks of lexical depth also differentiate between paradigmatic and syntagmatic knowledge (e.g., Schwartz et al., 2012). Therefore, the breadth and depth measures in this study were considered separately in the analyses to allow for the examination of the contribution of each type of lexical depth to reading comprehension after controlling for breadth of knowledge.

Descriptive Statistics

The descriptive statistics and reliability coefficients of the tasks administered are presented in Table 2. There were no floor or ceiling effects observed with all measures. No univariate and multivariate outliers with respect to the measures used were identified. The data were also examined for normality. Skewness and kurtosis values that fell outside the acceptable range of statistic/SE < ± 2.0 were transformed following the guidelines by Tabachnick and Fidell (1996). Specifically, for the primary three children, Mandarin syntagmatic knowledge and English lexical breadth were moderately negatively skewed. Mandarin paradigmatic knowledge was moderately negatively skewed for the primary five children. A reflected square root transformation followed by re-reflection was carried out for these measures to improve normality. The skew for these measures fell within acceptable limits after the transformation was performed. The values reported in the table of descriptives are raw scores but transformed values were used for subsequent inferential analyses.
Comparisons among Lexical Breadth and Depth Tasks within Each Age Group

Comparisons were conducted between the two types of lexical knowledge using proportion of correct scores (number correct/total number of items) on each task (proportion scores were used because the total number of items on the syntagmatic and paradigmatic tasks were different) within each age group. Comparisons showed that the younger participants performed significantly better in both the English syntagmatic knowledge task \( t(82) = 6.96, p < .01 \) and Mandarin syntagmatic task \( t(86) = 5.13, p < .01 \) as compared to the paradigmatic tasks in the other language. Conversely, the older participants had comparable scores on the paradigmatic and syntagmatic tasks in both languages \( (p's > .05) \).

Comparisons among Lexical Breadth and Depth Tasks across Ages

Comparisons between the younger and older children on measures of lexical breadth, paradigmatic and syntagmatic knowledge were conducted using the Mann Whitney U test. The non-parametric test was used in view of the unequal participant numbers in the two groups \( (n = 87 \) and \( n = 52 \)). Analyses showed significant differences between the two age groups on all measures in both languages \( (p's < .01) \). The older children had significantly higher scores than the younger children on all measures in both languages. The significant differences on all tasks between the two age groups further justified conducting analyses for each group separately.

Within- and Cross-language Correlations

Table 3 shows matrices of the simple correlations among the lexical breadth and depth measures as well as with non-verbal reasoning for the two age groups. Correlations among measures within the same language were generally higher than that across languages for both groups \( (p's < .01 \) using Fisher r-to-z transformations). In the primary three group, English lexical
breadth had a stronger correlation with English paradigmatic knowledge as compared to English syntagmatic knowledge ($p < .01$ using Fisher r-to-z transformations). In addition, the correlations between English and Mandarin syntagmatic knowledge (.03) as well as between English lexical breadth and Mandarin syntagmatic knowledge (.11) were weak and not significant. Lexical breadth across the two languages was small but significant (.26). The correlation between English and Mandarin paradigmatic knowledge was significant (.53). Among the older children, all measures in English and Mandarin (excluding non-verbal reasoning) shared moderate-to-large correlations with one another. English and Mandarin syntagmatic knowledge shared a moderate significant correlation (.41), so did paradigmatic knowledge in the two languages (.54). Lexical breadth across languages were also significantly correlated (.55).

**Cross-language Relations of Paradigmatic Knowledge**

**Predicting English Paradigmatic Knowledge.** In the first set of regression models, English paradigmatic knowledge was regressed on control variables of non-verbal reasoning, and lexical breadth in English and Mandarin, and finally the variable of interest: Mandarin paradigmatic knowledge. The final regression models predicting English paradigmatic knowledge for the two age groups are shown in Table 4.

Most important in this study, Mandarin paradigmatic knowledge explained 7% of unique variance [$\Delta F(1, 81) = 13.52, p < .01$] in the younger cohort, and 5% in the older cohort [$\Delta F(1, 40) = 4.95, p < .05$] in English paradigmatic knowledge when it was entered in the last step. Final beta weights showed that Mandarin paradigmatic knowledge was also a unique predictor of English paradigmatic knowledge, in both the younger [$\beta = .35, t(86) = 3.68, p < .01$] and older groups [$\beta = .28, t(45) = 2.22, p < .05$]. In addition, English lexical breadth was a unique predictor among
both the primary three [$\beta = .55, t(86) = 6.69, p < .01$] and primary five children [$\beta = .44, t(45) = 3.59, p < .01$]. Non-verbal reasoning was a unique predictor only in the primary five group [$\beta = .24, t(45) = 2.06, p < .05$].

Given that both age groups consisted of both EL1 and ML1 participants, follow up analyses using interaction terms were carried out to examine whether language status had an effect on the relationships observed in both groups. A language status vector (as outlined in Pedhazur, 1997), with EL1 participants coded as 0, and ML1 participants coded as 1, was created and this vector, together with interactions between this vector and each of the three lexical measures were entered into the regression models. All three interaction terms yielded non-significant beta values in both the younger ($-.43 \leq \beta \leq .25, ps > .05$) and older children ($-.53 \leq \beta \leq .22, ps > .05$), indicating that language status (EL1 or ML1) had no effect on the predictions.

**Predicting Mandarin Paradigmatic Knowledge.** In order to examine the prediction for Mandarin paradigmatic knowledge, a series of regression models with Mandarin paradigmatic knowledge as the outcome variable were conducted. The final models for the two age groups are presented in Table 4. In the younger group, English paradigmatic knowledge accounted for an additional 8% in Mandarin paradigmatic knowledge [$\Delta F(1, 81) = 13.52, p < .01$], when it was entered last in the model. In the older group, English paradigmatic knowledge explained 7% of variance in Mandarin paradigmatic knowledge [$\Delta F(1, 40) = 4.95, p < .05$]. English paradigmatic knowledge was a unique predictor of Mandarin paradigmatic knowledge [$\beta = .41, t(86) = 3.68, p < .01$], along with Mandarin lexical breadth [$\beta = .51, t(86) = 6.31, p < .01$] in the younger group. In the older group, English paradigmatic knowledge [$\beta = .38, t(45) = 2.22, p < .05$], along with
non-verbal reasoning [\( \beta = 0.28, t(45) = 2.04, p < 0.05 \)] and Mandarin breadth, [\( \beta = 0.31, t(45) = 2.17, p < 0.05 \)], were unique predictors of Mandarin paradigmatic knowledge.

Non-significant beta values of the three interaction terms of language background (EL1 and ML1) with respect to the three lexical measures in the younger (.08 \( \leq \beta \leq 0.23, p_s > .05 \)) and older children (-.15 \( \leq \beta \leq 0.06, p_s > .05 \)) showed that language background did not have an effect on the relationships among the lexical measures.

**Comparing the Strength of Regression Coefficients between the Age Groups.** Next, the regression coefficients associated with paradigmatic knowledge as a predictor in the English and Mandarin models between the groups were compared. This was done to examine whether the contribution of paradigmatic knowledge between languages differed in the two age groups.

The raw scores of all predictors in the models predicting paradigmatic knowledge in English and Mandarin (Table 4) were first converted to z-scores and the data of both age groups were combined into one dataset. A dummy variable for group membership was then created (0 for the younger children and 1 for the older children). Interaction terms between group membership (0 = younger or 1 = older group) and Mandarin paradigmatic knowledge and between group membership and English paradigmatic knowledge were created. The models predicting English and Mandarin paradigmatic knowledge were then re-computed. For the English model, group membership and the interaction between group and Mandarin paradigmatic knowledge were entered into the model after the four predictors in the original model (i.e., non-verbal reasoning, English and Mandarin breadth of knowledge, and Mandarin paradigmatic knowledge). This was to test whether the regression weights associated with Mandarin paradigmatic knowledge were significantly different between the two age groups. Similarly, group membership and its
interaction with English paradigmatic knowledge were entered after the four original predictors in the Mandarin model to compare the regression weights of English paradigmatic knowledge between the two age groups.

Results of the two regression models are presented in Table 5. Of interest in this set of analyses were the amount of explained variance and beta weights associated with the interaction between paradigmatic knowledge and age group in each language. The interaction between Mandarin paradigmatic knowledge and age group explained an additional 2% of variance in English paradigmatic knowledge [$\Delta F(1, 125) = 4.05, p < .05$] and was a unique predictor of English paradigmatic knowledge [$\beta = -.18, t(132) = -2.01, p < .05$]. This result indicated that Mandarin paradigmatic knowledge was a significantly stronger predictor of English paradigmatic knowledge in the younger group as compared to the older group. However, the interaction between English paradigmatic knowledge and age group did not account for significant unique variance in Mandarin paradigmatic knowledge and was not a unique predictor [$\beta = -.12, t(132) = -1.46, p > .05$]. The strength of prediction of English on Mandarin paradigmatic knowledge was not significantly different between the two age groups.

Cross-language Relations of Syntagmatic Relations

Predicting English and Mandarin Syntagmatic Knowledge. Next, regression models were fitted to examine the cross-language relations of English and Mandarin syntagmatic knowledge in both age groups (Table 6). In the prediction model for English syntagmatic knowledge, Mandarin syntagmatic knowledge did not explain additional variance and was not a unique predictor in both age groups. English breadth was a unique predictor in both the younger [$\beta = .40, t(86) = 3.42, p < .01$] and older groups [$\beta = .61, t(45) = 4.53, p < .01$]. Non-significant
beta values of the three interaction terms between language background (EL1 and ML1) and the three lexical measures among both the younger and older children showed that language status did not have an effect on the predictions.

In the Mandarin model, English syntagmatic knowledge was also not a significant predictor in both age groups. Mandarin lexical breadth was the only unique predictor in both the younger \( \beta = .54, t(86) = 5.55, p < .01 \) and older groups \( \beta = .67, t(45) = 3.42, p < .01 \). Language status was also found not to have an effect on the predictions. This was demonstrated in the non-significant beta values of the three interaction terms (between language background and the three lexical measures) in the younger \( -.29 \leq \beta \leq -.19, ps > .05 \) and older children \( -.12 \leq \beta \leq .47, ps > .05 \).

In summary, cross-language relationships of paradigmatic knowledge were observed for both age groups. Mandarin paradigmatic knowledge was also a stronger predictor of English paradigmatic knowledge in both age groups. Finally, there was no evidence of cross-language relationships of syntagmatic knowledge in both age groups.

**Commonality Analyses**

Given that there were negative beta weights associated with lexical breadth in some models, there was a possibility that there were suppression effects. Commonality analyses were thus conducted separately for the two types of knowledge in each age group. This was done to examine the shared and unique variance among the measures of lexical breadth and depth in relation to the outcome variables (English and Mandarin paradigmatic knowledge, and English and Mandarin syntagmatic knowledge). The commonality analyses were conducted using the same variables that were used in the regression analyses.
Predicting English and Mandarin Paradigmatic Knowledge. The beta weights, structure coefficients, total, shared, and unique variance for the within- and cross-language predictors of English paradigmatic knowledge for both age groups are displayed in Tables 7 and 8. Beta weights were the largest for English lexical breadth and Mandarin paradigmatic knowledge in both age groups. For the younger children, the majority of variance in English paradigmatic knowledge was unique to Mandarin paradigmatic knowledge (11.77%) and English lexical breadth (38.99%). Interestingly, the English breadth measure also shared a significant amount of variance with Mandarin paradigmatic knowledge (11.28%). The small amount of unique variance accounted for by Mandarin lexical breadth and negative variance associated with the shared variance between English and Mandarin breadth (−.77%) suggested that Mandarin lexical breadth was a suppressor of the relationship between English breadth and English paradigmatic knowledge. A follow regression analysis that removed Mandarin lexical breadth showed no change in the contributions of English lexical breadth and Mandarin paradigmatic knowledge to English paradigmatic knowledge1.

Among the older children, Mandarin paradigmatic knowledge contributed 9.08% of unique variance to its English counterpart, whereas English lexical breadth alone explained 31.82% of variance in English paradigmatic knowledge. The shared variance between English and Mandarin lexical breadth was also significant (14.24%), so was that among the breadth measures and Mandarin paradigmatic knowledge (11.52%). The proportion of unique variance contributed by Mandarin lexical breadth was virtually zero in both age groups (Table 8).

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1 Follow-up regressions conducted without identified suppressors in the commonality analyses were not presented in this dissertation because they did not change the patterns of predictions among the variables. Rather, the change in beta weights were reported in text.
Tables 9 and 10 show the commonality coefficients associated with Mandarin paradigmatic knowledge for both groups. The patterns predicting Mandarin paradigmatic knowledge were similar to the English model for both age groups. Beta weights were the largest for Mandarin lexical breadth and paradigmatic knowledge in both age groups. In the primary three group, although English paradigmatic knowledge accounted for a significant amount of unique variance in Mandarin paradigmatic knowledge (15.41%), Mandarin lexical breadth explained the largest amount of unique variance (45.32%). English lexical breadth appeared to act as a suppressor variable in the relationship between Mandarin lexical breadth and paradigmatic knowledge, given the negative variance it shared with Mandarin lexical breadth (-.48%). A subsequent regression analysis that removed this variable showed that the strength of prediction by Mandarin breadth was diminished, but was still significant (β =.50, p < .05).

English paradigmatic knowledge, non-verbal reasoning, and Mandarin lexical breadth accounted for comparable amounts of variance in English paradigmatic knowledge among the primary five children (16.36%, 12.96%, and 17.33%, respectively). The negative variance accounted for jointly by English paradigmatic knowledge and English lexical breadth in the older group suggested English lexical breadth acted as a suppressor of the relationship between English and Mandarin paradigmatic knowledge as well as that between Mandarin lexical breadth and paradigmatic knowledge. Follow-up analyses that removed English lexical breadth decreased the association between Mandarin and English paradigmatic knowledge as well as English lexical breadth and English paradigmatic knowledge in the primary five group. However, the both
predictors were still significant ($\beta = .27$ for Mandarin breadth and $\beta = .30$ for English paradigmatic knowledge, $p$’s < .05).²

**Predicting English and Mandarin Syntagmatic Knowledge.** The contributions of the predictors to English syntagmatic knowledge in both age groups are displayed in Tables 11 and 12. Slightly different patterns of contributions were observed in the two groups. In the younger group, majority of the variance was accounted for by English lexical breadth (45.93%). Non-verbal reasoning also accounted for a significant amount of unique variance (12.97%). Mandarin syntagmatic knowledge only accounted for 2.81% of the variance in English syntagmatic knowledge.

In the older group, Mandarin syntagmatic knowledge accounted for 4.25% of the variance in English syntagmatic knowledge but the majority of the variance was accounted for by English lexical breadth (55.25%). Non-verbal reasoning only contributed to 2.41% of unique variance. It was noted that there was significant amount of overlap in the variance accounted for by English and Mandarin breadth and Mandarin syntagmatic knowledge (25.26%). Again, the variance accounted for by the cross-language lexical breadth measure was negligible in both groups.

In predicting Mandarin syntagmatic knowledge, Mandarin lexical breadth (71.15%) and non-verbal reasoning (17.70%) accounted for most of the variance in Mandarin syntagmatic knowledge for the younger group. English syntagmatic knowledge accounted for 11.80% of unique variance (Tables 13 and 14). Among the primary five children, Mandarin lexical breadth (46.22%) accounted for most of the variance in Mandarin syntagmatic knowledge. English lexical breadth

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² All suppressors identified in the different models were retained because they do not change the patterns of predictions and also that researchers (e.g., Zientek & Thompson, 2010) argue that removing suppressor variables could lead to an underestimation of the relationship between variables.
breadth appeared to suppress the relationship between English and Mandarin syntagmatic knowledge, as evidenced in the negative variance (-97%). Removing the suppressor in a follow-up regression analysis showed that the cross-language relationship between syntagmatic knowledge was further diminished. There was also a significant amount of overlapping variance common to English and Mandarin breadth and English syntagmatic knowledge (25.95%).
In this study, the cross-language association of lexical depth between English and Mandarin in Mandarin-English bilingual children was investigated, using tasks that assessed paradigmatic and syntagmatic knowledge. The first objective was to examine cross-language associations of these two types of knowledge in English and Mandarin. It was hypothesized that a greater cross-linguistic link would be observed with paradigmatic knowledge as compared to syntagmatic knowledge. Paradigmatic, but not syntagmatic knowledge, was found to be a reliable predictor of the same type of knowledge in the other language in both groups. The second objective was to compare the cross-language patterns of both types of knowledge in younger children (ages 8 and 9) and older children (ages 10 and 11). It was predicted that the magnitude of cross-language relationships would be larger in the younger children and the results supported this hypothesis. Magnitude of the cross-language relationship of paradigmatic knowledge was larger in the younger children.

**Performance on Paradigmatic and Syntagmatic Tasks**

In the present study, the younger participants showed better performance on the syntagmatic task as compared to the paradigmatic task in the same language. The younger children’s better performance on the syntagmatic knowledge task could be interpreted as that they had a more well-developed sense of syntagmatic relations as compared to paradigmatic knowledge. On the other hand, the older children’s comparable performance on both tasks showed that their paradigmatic knowledge had caught up with their syntagmatic knowledge. The findings show indirect support for the syntagmatic-paradigmatic shift in lexical organization with age (Anglin, 1985; Cronin, 2002; Palermo, 1971; Söderman, 1993; Wolter, 2001), as reviewed in the introduction section. However, these results should be interpreted with caution because of the
cross-sectional design. A longitudinal approach should be used in future studies to examine the syntagmatic-paradigmatic shift.

The Cross-language Relationship of Lexical Depth

Paradigmatic knowledge in English was found to be a significant predictor of Mandarin paradigmatic knowledge and vice-versa in both the younger and older children. These findings were robust, even after suppression effects were removed. These findings are consistent with those of Ordóñez et al. (2002) and extend previous research, showing that receptive paradigmatic knowledge was related between languages without cognates such as English and Mandarin.

Syntagmatic knowledge in English and Mandarin was not related in either age cohort. This departs from results of Ordóñez et al. (2002). A possible reason is that the typological distance between English and Mandarin is greater than in English and Spanish (investigated in Ordóñez et al.’s study), therefore, a cross-language relationship is not observed in syntagmatic knowledge in comparison. Taken together, these results support the hypothesis of a stronger cross-language relationship of paradigmatic knowledge as compared to syntagmatic knowledge between English and Mandarin. This pattern of cross-language relationships is consistent with that observed among the Spanish-English bilingual children in Ordóñez et al. (2002), showing that difference in degrees of relationships across the two types of depth of lexical knowledge is also present in dissimilar languages.

Theoretically, the two sets of findings discussed above can be explained in the context of the two notions presented earlier. First, they lend support to the Revised Hierarchical Model (RHM; Kroll & Stewart, 1994). The RHM posits that a common conceptual store links the lexical knowledge of the two languages of a bilingual child. The finding that paradigmatic knowledge was
a significant predictor of the same type of knowledge in the other language supports the view that a common store exists between languages. In fact, this commonality is not only limited to languages that share the same writing system, but also to those do not represent the same typology.

The cross-language relationship of paradigmatic knowledge but not syntagmatic knowledge also provides insight into the type of lexical knowledge that is shared between languages. Consistent with the hypothesis put forth by Wolter (2006), paradigmatic knowledge is more likely to be related across languages. This is because paradigmatic relations are less subject to conceptual modification and remain fairly similar across languages. Therefore, once a network of conceptual relationships among words have been built up in one language, it can be easily applied to another language without much need to make accommodations. In contrast, syntagmatic relations, as represented by collocational knowledge, are more localized within a language. The rules that govern which words and the resulting meaning of the word combinations across languages would also be different across languages. The high contextual dependency thus makes it difficult to apply syntagmatic knowledge accurately to another language, and therefore knowledge involving this type of relation is less likely to be related across languages.

Language Proficiency and Cross-language Relationships

The hypothesis that cross-language relationships would be more significant in the younger children was also supported to a certain extent. The strength of the cross-language relationship in paradigmatic knowledge was significantly stronger in the younger cohort of children as compared to the older group, in the direction from Mandarin to English, supporting Dufour and Kroll (1995)’s claim.
This finding aligns with that of Chen and Leung (1989) as well as Kroll and Curley (1988), who argue that language proficiency affects cross-language relationships. In studies conducted by these researchers, learners with less exposure to and thus lower proficiency in a language accessed concepts via their other language. This provided support for the Word Association Hypothesis situated within the RHM. On the other hand, more proficient learners appeared to access word concepts directly, without the need to access the corresponding word in the other language, a phenomenon that was congruent with the Concept Mediation Hypothesis of the RHM. In this study, the primary five children had significantly higher performance on the lexical breadth and depth tasks in English and Mandarin as compared to the primary three children. This is indicative of higher L1 and L2 proficiency in the older group. Therefore, based on the theoretical explanation put forth by the RHM, the younger group would be more reliant on word association processes as compared to the older children (Dufour & Kroll, 1995). This is evident in that paradigmatic knowledge in the other language was a stronger predictor in the younger group as compared to the older group.

However, despite a slightly bigger contribution of English paradigmatic to Mandarin paradigmatic knowledge in the younger group as compared to the older group, the difference was not significant. This is surprising because the primary five children also performed significantly higher on the Mandarin lexical tasks as compared to the primary three cohort. Thus, the magnitude of cross-language relationship should be significantly greater for the younger children. However, this finding appears to run counter to the Word Association Hypothesis. A possible explanation is that as compared to English, Mandarin is more semantically transparent (Shu, McBride-Chang, Wu, & Liu, 2006). Mandarin words are formed by compounding in predictable ways which makes it is easier to figure out their meanings from their constituent morphemes (McBride-Chang et al.,
2005). Therefore, it is possible that regardless of proficiency levels, the children in the present study found it easier to access word meanings in Mandarin, making differences between the two groups less pronounced.

**The Relationship between Lexical Breadth and Depth**

Both regression analyses and commonality analyses showed that within-language lexical breadth was the biggest contributor to lexical depth in both English and Mandarin in both age groups. In addition to unique variance, within-language lexical breadth further contributed to lexical depth jointly with other predictors. These findings provide strong empirical evidence for the commonly held view that within languages, an adequate vocabulary size is necessary for developing knowledge of word classes and semantic relations among words (e.g., Nurweni & Read, 1999; Qian, 2002; Schmitt & Meara, 1997).

Notably, whereas the association between English and Mandarin breadth of knowledge was minimal in the younger group, generally, stronger associations between the two variables with lexical depth in the other language were found in the older group, as shown in the commonality analyses. This suggests that there is a greater cross-language relationship between English and Mandarin lexical breadth and depth in the older children as compared to the younger children. This is surprising because previous research had shown that lexical breadth is only related between L1 and L2 that share cognates, such as French and English (Arnaud, 1984). These findings could potentially be explained by the *Concept Mediation Hypothesis*. According to this view, more proficient learners can make connections between words in the L1 and L2 through common concepts. In this study, it is possible that the older children’s stronger depth of knowledge enabled them to make use of the common concept to establish links between words in the two languages. The knowledge across languages was thus more integrated, leading to the greater overlap in
variance. However, this explanation is tentative. Further investigations on how the interrelations among lexical measures change over time would be useful in understanding the role proficiency plays in the cross-language relationships among dimensions of lexical knowledge.

In summary, the findings support the existence of a cross-linguistic link of paradigmatic knowledge between languages do not share the same script. By contrast, cross-linguistic facilitation of syntagmatic knowledge was not observed in the present study, suggesting that it may be a more language-specific construct. Within-language lexical breadth was the main contributor to both paradigmatic and syntagmatic (receptive) knowledge in both languages for both age groups, indicating the importance of breadth of knowledge to developing a deeper knowledge of words.

Overall, the pattern of results shown in this study provides preliminary empirical support for the claim put forth by Wolter (2006). Paradigmatic knowledge is largely decontextualized and therefore related across languages. On the other hand, syntagmatic knowledge is highly reliant on governing grammar rules within a language. There are greater differences in the concept of the same words across language. Therefore, cross-language relationships are absent because knowledge of collocations in one language might not facilitate the understanding of collocations in the other language.
Chapter 7. Study 2

Within- and Cross-language Associations of Syntagmatic and Paradigmatic Knowledge with English and Mandarin Reading Comprehension

Despite the common assumption that lexical knowledge is vital for comprehension of texts (e.g., Braze, Tabor, Shankweiler, & Mencl, 2007; Kieffer & Leasaux, 2007; Muter, Hulme, & Snowling, 2004; Snow, Burns, & Griffins, 1998), there has been little research on how the depth of lexical knowledge relates to reading comprehension. Most studies have focused on the importance of lexical breadth (e.g., Beck & McKeowen, 1991; Laufer & Ravenhorst-Kalovski, 2010; Nation, 2001). Thus the purpose of Study 2 is to explore the within and cross-language relationships between paradigmatic and syntagmatic knowledge and English and Mandarin reading comprehension, among children in primary three and five. English and Mandarin differ in linguistic features, notably in word formation rules and semantic transparency (Shu et al., 2006). However, the reliance of reading on lexical knowledge leads to the expectation that lexical depth would be important to reading comprehension within each language. With respect to cross-language relationships, as demonstrated in Study 1, although English and Mandarin are typologically dissimilar, paradigmatic knowledge is related between the two languages. Therefore, it is possible that paradigmatic knowledge in English would also facilitate reading comprehension in Mandarin and vice-versa.

In the following sections, theoretical explanations for the link between lexical knowledge and reading comprehension will be reviewed. Following that, the literature on how different aspects of lexical knowledge, particularly lexical depth, relate to reading comprehension in both English and Mandarin, will be reviewed. Finally, the cross-language associations of lexical knowledge between English and Mandarin will be discussed.
The Lexical Knowledge-Reading Comprehension Link

Among the four hypotheses Anderson and Freebody (1981) put forth to explain the link between lexical knowledge and reading comprehension, the Instrumentalist and Knowledge hypotheses appear to endorse contributions of breadth and depth of lexical knowledge to reading comprehension, respectively.

The Instrumentalist Hypothesis posits that vocabulary knowledge impacts the level of reading comprehension directly. Anderson and Freebody (1983) estimate that a child would encounter approximately 10000 unfamiliar words a year, even if he or she reads only minimally. Therefore, knowing more words (i.e., lexical breadth) would enhance comprehension of texts because it aids in the decoding of meaning of words within texts. Intervention studies (e.g., McKeown, Beck, Omanson, & Perfetti, 1983) have supported this view, showing that explicit instruction to increase vocabulary size leads to positive gains in reading comprehension. However, researchers have also shown that vocabulary instruction which only provides superficial definitions of words, without helping learners make connections among words, does little to enhance reading comprehension (e.g., Baumann & Kame’enui, 2003; Stahl & Fairbanks, 1986). This suggests that vocabulary size cannot fully account for success in reading comprehension.

Extending from the Instrumentalist Hypothesis, the Knowledge Hypothesis relates lexical knowledge to comprehension through general knowledge. Based on this hypothesis, knowing the meaning of words leads to a greater understanding of the concepts that these words are associated with (i.e., depth of knowledge), which in turn facilitates comprehension of texts (Anderson & Pearson, 1984). According to Nagy and Herman (1987), reading comprehension goes beyond understanding the meaning of individual words within a text. It also involves the ability to effectively integrate words into related concepts and make connections among concepts within a
context. For instance, consider the sentence within a text passage *it is a common sight to see people bathing at the bank of the Ganges*. A reader who does not know that the Ganges refers to a river would still be able to understand the sentence if he or she is able to make connections between *bank* and *bathing* within the sentence and activate its collocate *river*. A variety of studies (Beck, McKeown, and Kucan, 2002; Beck, Perfetti, & McKeown, 1982) have supported the Knowledge Hypothesis, showing that vocabulary instruction which included activities to help students make connections among words led to positive gains in reading comprehension.

In summary, the associations of lexical breadth and depth with reading comprehension appear to be well established in theory. Following criticisms (Nagy, 1988; Wesche & Paribakht, 1996) on the inadequacy of breadth measures to assess lexical knowledge, emerging research has begun examining the role of lexical depth in reading comprehension. Nevertheless, there has not always been a clear distinction between the two dimensions, especially in studies that compare the cross-language contributions of lexical knowledge to reading comprehension.

**Lexical Breadth and Reading Comprehension**

The role of breadth of lexical knowledge in reading comprehension is widely acknowledged in bilingual children (e.g., August et al., 2005; Carlisle & Beeman, 2000; Grabe & Stroller, 2004; Stahl, 2003; Stahl & Nagy, 2006). Nagy (1988), among many others, emphasized the importance of building up the size of vocabulary among readers to aid in the comprehension of texts in English. Li, McBride-Chang, Wong, and Shu (2012), found that lexical breadth at age 8 was a significant predictor of English reading comprehension at age 10 among Hong Kong children. The importance of breadth of word knowledge has also been demonstrated in Mandarin reading comprehension (e.g., Wang, Cheng, & Chen, 2006; Zhang & Koda, 2014). For instance, Wang et al. (2006) found that vocabulary breadth, measured using the PPVT, accounted for a
significant amount of variance in Mandarin reading comprehension among immigrant children in Grades 1 to 4 in the United States, after controlling for word reading skill and non-verbal reasoning. Overall, a robust link between breadth of word knowledge and reading comprehension in both English and Mandarin has been established.

**Lexical Depth and Reading Comprehension**

**Lexical Depth and English Reading Comprehension.** Researchers have acknowledged that depth of lexical knowledge contributes to reading comprehension above and beyond the contribution of breadth of knowledge. In fact, the contribution of the former appears to be stronger than that of the latter (e.g., Laufer, 1997; Nassaji, 2004; Ouellette, 2006; Qian 1998, 1999, 2002; Snow, Tabor, Nicholson, & Kurland, 1995).

Several studies that investigated the lexical depth-reading comprehension link in English have yielded positive results (e.g., Nation & Snowling, 1998; Ouellette, 2006; Proctor et al., 2012; Ricketts et al., 2007; Roth, Speece, & Cooper, 2002; Vellutino & Scanlon, 1987). Among the different measures that were used to assess lexical depth, word definition tasks were most often used. For instance, regression analyses conducted by Roth et al. (2002) found that the ability to provide oral definitions was a significant predictor of English passage comprehension among children of ages 6 to 8. Ouellette (2006) also showed that performance on a word definition task was a significant predictor of oral reading comprehension among English monolingual children (ages 9-10 years).

Studies that employed different tasks have also yielded similar findings. For instance, in the study conducted by Vellutino & Scanlon (1987), children in Grades 2-3 and 6-7 participated in a free word association task which assessed their ability to produce associations that share paradigmatic relations (e.g., dog/cat). Performance on this task was found to be significantly
correlated with a reading comprehension task. In addition, Proctor et al. (2012) found that performance on the *Semantics* subtest of the CELF was significantly related to reading comprehension measured concurrently. Finally, Nation and Snowling (1998), using a lexical priming task, found that good comprehenders showed priming effects when word-pairs belonged to the same category (e.g., *Dog-Cat*), regardless of whether the words within each pair were strongly associated with each other. Poor comprehenders only showed priming effects when there was a strong association between the words (e.g., *King-Queen*). The observed difference between good and poor comprehenders led Nation and Snowling (1998) to conclude that the ability to make semantic associations between words was crucial in reading comprehension.

From the review above, it is clear that many of the research studies examining lexical depth focused on the paradigmatic aspect. Less is known about the contributions of syntagmatic knowledge. Emerging research has begun examining the relationship between syntagmatic knowledge and reading comprehension, although these have been limited to investigations with university-level students (e.g., Ganji, 2012; Hsu, 2010; Keshavarz & Salimi, 2007; Qian, 1999). In the limited number of studies available, findings consistently indicate a significant relationship between the two. For instance, Qian (1999) found a significant correlation between performance on collocational items in a vocabulary depth task and reading comprehension in English among university students in Canada. Keshavarz and Salimi (2007) asked Iranian university students learning English as an L2 to complete a task consisting of both lexical and grammatical collocations. Performance on this task shared a significant correlation with participants’ scores on a cloze passage task. Hsu (2010)’s intervention study conducted with Chinese-English bilingual adolescents in Taiwan also showed that instruction on English collocations was associated with positive gains in English reading comprehension.
In summary, studies that have employed different tasks to assess the different aspects of depth of word knowledge among both bilinguals and monolinguals of different ages have yielded similar findings. However, while these studies convincingly demonstrated that good comprehension skills can be attributed, to a large extent, to the depth of lexical knowledge, the effect of lexical breadth was not controlled in many of them (except for Ouellette, 2006 and Proctor et al., 2012). In addition, the relative contributions of paradigmatic knowledge and syntagmatic knowledge cannot be differentiated because most studies only assessed one of the two types of knowledge.

**Lexical Depth and Mandarin Reading Comprehension.** There is also some empirical work examining the link between lexical knowledge and reading comprehension in Chinese (Mandarin and Cantonese) but this body of work is less extensive (e.g., Chik et al., 2012; Li et al., 2012; Shu et al., 2006). As with research in English, different tasks have been employed to examine this link. However, findings have been inconsistent. Shu et al. (2006) used a Mandarin version of the Similarities subtests of the Revised Wechsler Intelligence Scale for Children (WISC-R) to measure lexical depth. Chinese monolingual children in Grades 5 and 6 were asked to define words and describe the similarities between two things in each item on the task. Their performance on the task was found to predict reading comprehension, after controlling for decoding, rapid naming, and morphological awareness. In another study conducted in Hong Kong, Chik et al., (2012) measured lexical depth with a task that required children in Grades 1 to 5 to construct a sentence using target words. The results also revealed this task to be a significant predictor of reading comprehension for children in Grades 1 to 3. However, no evidence of a link between lexical depth and reading comprehension in Chinese was found in Li et al. (2012). In this study, it was found
that performance on a word definition task in Cantonese at age 8 years was not predictive of reading comprehension among Chinese children in Hong Kong at age 10.

Contrary to research in English, studies that examined the depth of lexical knowledge in Mandarin have made no distinction between paradigmatic and syntagmatic knowledge. Lexical depth was measured holistically. The mixed findings yielded across these studies suggest that there is a need to look more closely at the different aspects of lexical depth, so as to establish if the lexical depth-reading comprehension link exists in Mandarin.

**The Cross-Language Relationship of Lexical Depth**

Similar to the state of research investigating how lexical knowledge is related across languages (as reviewed in Study 1), there is a dearth of research examining the relationship between lexical knowledge and reading comprehension across languages, noticeably so between typologically dissimilar languages. This is in stark contrast to the robust findings with regard to the cross-language relationships reading comprehension share with phonological awareness (e.g., Durğunoğlu et al., 1991), and morphological awareness (e.g., Pasquarella et al., 2011; Wang et al., 2006; Zhang, 2013).

Melby-Lervåg and Lervåg (2011) and Proctor et al. (2006) pointed out that the relationships between higher-order facets of linguistic competence, such as oral language, across languages are not as straightforward as lower-order skills such as decoding. Building on this point, it is expected that the cross-language link between lexical depth and reading comprehension would be even more complicated. Reading comprehension is seen as depending on a bigger set of skills (e.g., *Simple View of Reading*, Hoover & Gough, 1990) than lexical knowledge. Therefore, even though there is empirical evidence for the cross-language relationship of lexical knowledge, specifically, of paradigmatic knowledge, between both typologically similar languages such as
English and Spanish (e.g., Cunningham & Graham, 2000; Nagy et al., 1993; Ordóñez et al., 2002) and distant ones such as English and Mandarin (refer to findings in Study 1 as well as Jiang, 2000, 2004), it would be presumptuous to conclude that cross-language relationships of lexical knowledge would also extend to reading comprehension without empirical verification.

Researchers have begun to investigate the lexical knowledge-reading comprehension link across languages. However, similar to the investigations of the link between L1 and L2 lexical knowledge, research has focused on languages that share cognates such as English, Spanish, and French (e.g., Dressler, 2000; Jiménez, Garcia, & Pearson, 1995; Nagy, García, Durgunoğlu, & Hancin-Bhatt, 1993; Proctor et al., 2006). For instance, Nagy et al. (1993) found that knowledge of cognates between English and Spanish aided comprehension in English among Spanish-speaking children learning English as an L2. In another study with Spanish-English bilingual children, Dressler (2000) found that children who were taught a cognate strategy in Spanish (i.e., children were taught explicitly to identify cognates among words they encountered) were able to apply it successfully in English reading.

The literature on the cross-language associations of lexical knowledge among children with dissimilar first and second languages is limited. Researchers posit that the potential of a cross-language link between lexical knowledge and reading comprehension is less likely between languages such as Mandarin and English in view of the typological differences between them (e.g., Genesee, 1994; Melby-Lervåg & Lervåg, 2011). Consistent with this view, Pasquarella et al. (2011) found that an English lexical breadth measures (PPVT) was not a significant predictor of Mandarin reading comprehension among Mandarin-English bilingual children between the ages of 6 and 10. Mandarin lexical breadth also did not predict English reading comprehension. On the other hand, Li et al. (2012) assessed lexical knowledge in Cantonese using a depth measure of paradigmatic
knowledge (word definitions) among 8-year-old Chinese-English bilingual children in Hong Kong. They found that performance on the task was a reliable predictor of English reading comprehension at age 10, after controlling for word reading, phonological awareness, and lexical knowledge in English. Taken together, the findings of these two studies suggest that cross-language relationships of lexical knowledge to reading comprehension between English and Mandarin can occur at the level of lexical depth (specifically, paradigmatic knowledge) but not breadth. However, the limited literature in this area warrants more empirical work in order to confidently conclude that the lexical depth-reading comprehension link exists between these two languages.

The Present Study

Therefore, in view of the gaps in research concerning lexical depth and reading comprehension, the present study examines the relationships between two types of depth knowledge, paradigmatic and syntagmatic knowledge and reading comprehension in relation to Chinese-English bilingual children of two age groups (children aged 8-9 years and 10-11 years). At the core of this study are two objectives. First, the relative contributions of aspects of lexical depth (specifically paradigmatic and syntagmatic knowledge) to reading comprehension within English and Mandarin are examined. Second, the cross-language relationships between paradigmatic knowledge and reading comprehension in both languages (i.e., the link between English paradigmatic knowledge and Mandarin reading comprehension and that between Mandarin paradigmatic knowledge and English reading comprehension) are investigated. It should be noted that the second question is more exploratory in nature given the limited literature on cross-language links between English and Mandarin.

Two predictions are made in this study. First, it is expected that both paradigmatic and syntagmatic knowledge would make independent contributions to reading comprehension within
both English and Mandarin. This is because majority of past findings point to a significant link between different measures of lexical depth and reading comprehension (e.g., Keshavarz & Salimi; Nation & Snowling, 1998; Ouellette, 2006; Roth et al., 2007; Vellutino & Scanlon, 1987). Second, considering findings of a cross-linguistic link at the paradigmatic level documented in Li et al. (2012), it is hypothesized that a crossover effect of paradigmatic knowledge on reading comprehension would be observed. Considering the difficulty in drawing hypotheses given the extremely limited literature on relationships between Mandarin and English, no definite predictions were made on the directionality of this relationship.

In the examination of these two objectives, a variety of control variables (lexical breadth, working memory, morphological awareness, and word reading) were also included. These variables have been found in previous research to be related to lexical depth and reading comprehension in English and Mandarin (e.g. Carlisle, 1995; Daneman & Carpenter, 1980; Kieffer & Lesaux, 2012; Kirby et al., 2012; Ku & Anderson, 2003; Leong, Tse, Loh, & Hau, 2008). Therefore, it is necessary to partial out the contributions of these variables in the examination of the effect of lexical depth on reading comprehension.
Chapter 8. Method for Study 2

Participants

The participants in the present study were the same as those who participated in Study 1. As with Study 1, the EL1 and ML1 participants in each age group were compared on their performance on the tasks that were included in the present study. The means and standard deviations associated with the tasks for the EL1 and ML1 participants in both age groups are presented in Table 15. Analyses using the Mann-Whitney U test (a non-parametric test was used due to the disparity in sample sizes of the two groups) showed that in the younger participants, only significant differences on the Mandarin compound awareness \( U = 416, p < .01 \) and Mandarin lexical breadth tasks \( U = 615.5, p < .05 \) were found between the EL1 and ML1 participants. No significant differences were found for all other measures \( (ps > .05) \). In the primary five group, no significant differences were found between the EL1 and ML1 children on all tasks. Therefore, given the similarity in performance of both groups within each grade on measures of interest, the data of EL1 and ML1 participants in each age group were analysed in one group.

Measures

Participants in the present study completed measures of word reading, derivational morphological awareness, lexical breadth, paradigmatic and syntagmatic knowledge, and reading comprehension in English. Parallel measures of character reading, compound awareness, lexical breadth, paradigmatic and syntagmatic knowledge, and reading comprehension in Mandarin were also administered. In addition, participants were administered a working memory task. The lexical breadth and depth measures were the same as those used in Study 1. The other tasks used in the present study are described below and their reliabilities are reported in Table 16.
Auditory Working Memory. Auditory working memory was measured using the Auditory Working Memory subtest of the Woodcock-Johnson III Test of Cognitive Abilities (W-J III; Woodcock, Mather, & McGrew, 2001a). For each item, participants were read a list of words and numbers (e.g., 4-orange-1-bear-7) and asked to repeat what they heard. The requirement was that they had to repeat all the names first in the sequence they were read, followed by all the numbers, again in the sequence that they heard (i.e., orange-sweater-4-1-7). The task consisted of two test items and 21 test items that were arranged in sets of three. For each item, a score of 2 was assigned if participants repeated the sequence in the correct order specified. A score of 1 was given if there was a mistake in the sequence of the words or numbers. Mistakes in both the word and number sequence resulted in a score of 0. The total possible score was 42. Testing was discontinued when participants scored 0 on three consecutive items.

Word and Character Reading Accuracy. English word reading was measured using the Word Identification subtest of the Woodcock-Johnson III Test of Achievement (Woodcock, McGrew, & Mather, 2001b). Participants were presented with a total of 76 words, arranged in order of difficulty and morphological complexity and were asked to read them aloud. Testing was discontinued when participants made six consecutive errors on a page. There was no standardized assessment available for Mandarin character reading, therefore, an experimental task adapted from Luo, Chen, Deacon, Zhang, and Yin (2013) was used. The task consisted of 145 items of increasing difficulty and decreasing frequency. Items were selected from the twelve volumes of primary school Mandarin textbooks used in Singapore (Singapore Ministry of Education, 2007). Testing was discontinued when participants made ten consecutive errors. The same set of items was used for both age groups. For both the English and Mandarin tasks, a correct response was scored as 1 and an incorrect one was scored as 0.
Morphological Awareness. Experimental measures of morphological awareness in English and Mandarin were created for the present study (Appendices I and J, respectively). The English test of morphological awareness was adapted from Carlisle (2000) and it assessed participants’ ability to manipulate derivatives. In this task, participants were presented with a target word, followed by a sentence that they had to complete by adding or taking away a derivative in the target word. For instance, participants were given the target word *deep* and asked to complete the sentence (e.g., *The ______ (depth) of the pool was two meters*). Participants were read the words and sentences and were also given a written copy of it to follow along. Participants were asked to give a verbal response. The task consisted of two practice items and 20 test items and participants were required to answer all items. Correct and incorrect items were scored as 1 and 0, respectively.

Considering that more than 75% of Chinese words are combinations of two or more morphemes, the Mandarin morphological task that was created assessed participants’ ability to identify and form compounds. The task was adapted from McBride-Chang et al. (2005). For each item in this task, participants were given a description of a novel object and asked to come up with a name for the object. Participants had to make use of their understanding of compounds within Chinese words to complete the task. An example of an item in the task was *用来插花的瓶子叫花瓶，那用来插花的锅叫什么?* (If bottle that you use to put flowers in is called a vase, then what do you call a pot that you use to put flowers in?). Participants were read the descriptions and given a copy of the items to follow along. Verbal responses were sought. There were a total of two practice items and 15 test items for this task. Participants were required to answer all questions. In both the English and Mandarin tasks, scores of 0 and 1 were assigned for incorrect and correct responses, respectively. The same set of English and Mandarin items was used for both age groups.
**Reading Comprehension.** Parallel measures of reading comprehension were administered in both English and Mandarin. Considering that there were no appropriate measures of Mandarin reading comprehension, and that current standardized measures of English reading comprehension were deemed culturally inappropriate for Singaporean children, experimental measures were created by the research team for the purpose of this study. Two different versions of the measure were developed, one for each of the two age groups in English as well as in Mandarin. The English measure for the primary three children consisted of five passages and 25 multiple-choice questions, whereas that for the primary five children was comprised of five passages and 22 questions (Appendices E and F, respectively). Both age versions of the Mandarin measure were made up of five passages. The primary three version had 22 questions whereas the primary five version consisted of 20 questions (Appendices G and H, respectively). Binary scoring was adopted (0 for incorrect answer and 1 for correct answer). This task was administered in a group setting.

The passages and items were adapted from local textbooks and reference books to ensure cultural appropriateness. Six teachers (three English-language teachers and three Mandarin teachers) in local schools with experience teaching primary three and five students also rated the passages and items to ensure that the versions were age-appropriate. Two English and two Mandarin native speakers proofread the content of the English and Mandarin tasks, respectively, for grammatical accuracy. Both the English and Mandarin versions of the measure were piloted with a total of 20 primary four Singaporean students in three instances before they were finalized.

**Procedure**

Testing was carried out over two or three sessions, each lasting between 40 and 60 minutes. Short breaks of 5 to 10 minutes were given to prevent fatigue effects. Individual testing was conducted in a quiet corner in the centres they were recruited from by trained undergraduate and
graduate research assistants. Group testing was conducted in a classroom provided by centre personnel. There were at least two research assistants present during group testing to ensure that testing proceeded smoothly. The order of the language and tasks was counterbalanced across participants.
Chapter 9. Results of Study 2

The data associated with all the measures relevant to Study 2 were examined for univariate and multivariate outliers. No univariate and multivariate outliers with respect to the three lexical measures and reading comprehension in both languages were found. The data were also examined for normality for all measures used in the present study. Skewness and kurtosis values that fell outside the acceptable range of test statistic/SE < ± 2.0 were transformed following the guidelines by Tabachnick and Fidell (1996). Specifically, English derivational awareness, English lexical breadth and Mandarin paradigmatic knowledge were moderately negatively skewed for the primary three participants whereas English derivational awareness, Mandarin reading comprehension, Mandarin paradigmatic knowledge, and Mandarin morphological awareness were negatively skewed for the primary five participants. A sequence of reflection, square root transformations followed by re-reflection was carried out for each measure to improve normality. Mandarin reading comprehension was moderately positively skewed for the primary three participants and a square root transformation was carried out. The skew for each of these measures fell within acceptable limits after the transformations were performed. The scores reported in the table of descriptives are raw scores. The transformed values were used for subsequent inferential analyses.

Descriptive Statistics and Correlations

Table 16 presents the descriptive statistics and reliability coefficients of each measure. Table 17 shows the bivariate correlations among English and Mandarin measures, respectively. There were significant moderate correlations between the control variables of working memory, English word reading, and English morphological awareness and the outcome variable of English reading comprehension for both groups (\(p\)'s < .01). There were also significant moderate
correlations between Mandarin character reading and Mandarin reading comprehension as well as
between Mandarin compound awareness and Mandarin reading comprehension \((p’s < .01)\). With
regard to the link between lexical knowledge and reading comprehension, there existed significant
moderate to strong correlations between the breadth and depth measures and reading
comprehension within each language \((p’s < .01)\).

Among the primary three children, the strength of relationships between the breadth and
depth measures and reading comprehension was consistent across both languages. Specifically,
the relationship between paradigmatic knowledge and reading comprehension was strongest in
both languages, followed by lexical breadth, and finally syntagmatic knowledge. For the primary
five children, across both languages, paradigmatic knowledge had the strongest correlation with
reading comprehension, followed by syntagmatic knowledge, then lexical breadth. With regard to
cross-language relationships, for the primary three students, the English lexical measures shared
moderate correlations with Mandarin reading comprehension \((.33 - .42)\). However, with the
exception of Mandarin paradigmatic knowledge \((.38)\), the other two Mandarin measures were not
significantly correlated with English reading comprehension. For the primary five children, all
three lexical measures in Mandarin shared moderate correlations with English reading
comprehension \((.36 - .53)\). Only English syntagmatic \((.43)\) and paradigmatic knowledge \((.49)\) were
significantly correlated with Mandarin reading comprehension.

**English Reading Comprehension**

In order to examine how the different dimensions of lexical depth relate to reading
comprehension in English, a series of hierarchical linear regression analyses were carried out. For
each set of analyses, control variables of non-verbal reasoning, word reading, and morphological
awareness were entered in the first three steps, respectively. The three lexical measures (i.e., lexical
breadth, paradigmatic and syntagmatic knowledge) were then individually entered in the subsequent steps. Two subsequent regression analyses were then conducted for each grade to examine the unique and shared variances among the three measures by changing the order of variables. In the first analysis, the order of syntagmatic knowledge and lexical breadth was reversed and in the second set of analyses, paradigmatic knowledge was entered before the other two measures.

**Within-language Contributions of Lexical Depth in Primary Three Participants.** As presented in Table 18, for the primary three participants, the control variables of working memory \(\Delta F(1,74) = 21.23, p < .01\), word reading \(\Delta F(1,73) = 6.53, p < .05\), and morphological awareness \(\Delta F(1,72) = 24.91, p < .01\) accounted for significant variance in reading comprehension, accounting for 22%, 6%, and 18% of additional variance respectively.

With respect to the lexical measures, lexical breadth accounted for an additional 7% of significant unique variance in English reading comprehension among the primary three participants \(\Delta F(1,71) = 10.85, p < .01\) whereas the two depth measures collectively contributed 9% of significant unique variance to English reading comprehension above and beyond that contributed by the breadth measure. Specifically, syntagmatic knowledge contributed 5% of variance \(\Delta F(1,70) = 7.69, p < .01\), whereas paradigmatic knowledge contributed 4% of variance \(\Delta F(1,69) = 7.52, p < .01\). Final beta weights in the first model suggest that other than morphological awareness \([\beta = .26, t(75) = 3.68, p < .01]\), paradigmatic knowledge emerged as a unique significant predictor of reading comprehension in English \([\beta = .39, t(75) = 3.29, p < .01]\). Tolerance values and Variance Inflation Factors of all variables ranged between .29 to 1.00 and 1.00 to 3.50, respectively, suggesting no multicollinearity among the measures. When syntagmatic knowledge was entered in the model before lexical breadth and paradigmatic knowledge (Model
syntagmatic knowledge accounted for 8% of significant variance in English reading comprehension [$\Delta F(1,71) = 12.07, p < .01$], whereas lexical breadth contributed to 4% of significant variance [$\Delta F(1,70) = 6.55, p < .05$]. The results suggest that while there exists a small amount of shared variance between the two variables, each variable still contributed unique variance to reading comprehension. However, when paradigmatic knowledge was entered first after the control variables in Model 3, the variance accounted for by syntagmatic knowledge and vocabulary breadth was subsumed under paradigmatic knowledge, which accounted for 14% of the variance in reading comprehension [$\Delta F(1,71) = 26.24, p < .01$]. The two other lexical measures were relegated to being non-significant factors.

Given that the sample consisted of both EL1 and ML1 participants, follow up analyses using interaction terms were carried out to examine whether language status had an effect on the relationships between the different dimensions of lexical knowledge and reading comprehension. Non-significant beta values of the three interaction terms with respect to lexical breadth, and syntagmatic knowledge (-.22 < $\beta$ < -.27, $p > .05$) suggest that there were no significant differences between the two groups in the predictions of English reading comprehension.

Within-language Contributions of Lexical Depth for Primary Five Participants. Among the control measures, only working memory explained 26% significant variance in reading comprehension [$\Delta F(1,46) = 15.33, p < .01$] for the older participants (Table 18). Lexical breadth and paradigmatic knowledge explained significant variance in reading comprehension but not syntagmatic knowledge. Unlike the primary three participants, lexical breadth accounted for 10% of variance [$\Delta F(1,43) = 7.35, p < .05$], whereas paradigmatic knowledge contributed 9% of variance [$\Delta F(1,41) = 7.04, p < .05$]. Beta weights show that only paradigmatic knowledge emerged as a unique predictor of reading comprehension [$\beta = .41, t(47) = 2.65, p < .01$]. Collinearity
statistics were normal (tolerance values were below 1.0 and VIF values were below 10), suggesting that there was no issue of multicollinearity. Similar to the younger participants, the variance explained by breadth and syntagmatic knowledge became non-significant when paradigmatic knowledge was entered before the two other measures. Paradigmatic knowledge accounted for a significant 16% of the variance in reading comprehension $[\Delta F(1,43) = 12.48, p < .05]$ when it was entered before the other two measures.

Follow up analyses using interaction terms were carried out to examine whether language status (EL1 and ML1) had an effect on the relationships between the different dimensions of lexical knowledge and reading comprehension. Non-significant beta values of the three interaction terms ($-.25 < \beta < .24, ps > .05$) showed that there were no significant differences between the two groups in the prediction of English reading comprehension by these factors.

**Mandarin Reading Comprehension**

Hierarchical linear regression analyses were also conducted to evaluate the contributions of Mandarin vocabulary breadth and depth to Mandarin reading comprehension. Similar to the English models, non-verbal reasoning, Mandarin character reading, and Mandarin morphological awareness were entered in the first three steps as control variables. Lexical breadth, syntagmatic knowledge, and paradigmatic knowledge were then entered in different sequences to evaluate the amount of unique variance explained by the three types of vocabulary knowledge.

**Within-language Contributions of Lexical Depth for Primary Three Participants.** As displayed in Table 19, working memory, $[\Delta F(1,74) = 11.38, p < .01]$, Mandarin character reading $[\Delta F(1,73) = 22.37, p < .01]$ and compound awareness $[\Delta F(1,72) = 11.40, p < .01]$ contributed 13%, 20%, and 9% of significant variance to Mandarin reading comprehension, respectively. Lexical
breadth contributed an additional 3% of variance to reading comprehension, which was significant \( \Delta F(1,71) = 3.98, \ p < .05 \). Depth measures of syntagmatic \( \Delta F(1,70) = 5.41, \ p < .05 \) and paradigmatic knowledge \( \Delta F(1,69) = 7.39, \ p < .01 \) also contributed to 4% and 5% of significant variance to reading comprehension, respectively. Final beta weights indicated that Mandarin syntagmatic \( \beta = .24, \ t(75) = 2.18, \ p < .05 \) and paradigmatic knowledge \( \beta = .30, \ t(75) = 2.68, \ p < .01 \) were unique predictors of Mandarin reading comprehension, suggesting the importance of both types of lexical depth measures in predicting reading comprehension in Mandarin. Collinearity investigations using Tolerance and VIF values indicated no multicollinearity among the measures. Tolerance values of all measures in the model ranged from .49 to .71, well above the multicollinearity cut-off limit of 0.2. Similarly, the VIF values of all predictors ranged between 1.41 and 2.03, also below the cut-off of 10.

Subsequent regression analyses that reversed the order of breadth, syntagmatic knowledge, and paradigmatic knowledge showed that while some overlap existed in terms of variance accounted for by the two depth measures, both variables still contributed unique variance to reading comprehension in Mandarin. Specifically, syntagmatic knowledge contributed 4% of variance \( \Delta F(1,70) = 6.21, \ p < .05 \), whereas paradigmatic knowledge accounted for 7% of variance \( \Delta F(1,71) = 10.83, \ p < .01 \) to reading comprehension (Model 3 in Table 19). Non-significant beta weights of the interaction terms of language status and the three lexical measures \(- .12 < \beta < .48, \ p \ 's > .05\) indicated that language status did not have a significant impact on the predictions of the three lexical measures on Mandarin reading comprehension.

**Within-language Contributions of Lexical Depth for Primary Five Participants.** As shown in Table 19, for the primary five participants, control variables of working memory \( \Delta F(1,46) = 4.81, \ p < .05 \), character reading \( \Delta F(1,45) = 31.01, \ p < .01 \), and compound awareness
[\Delta F(1,44) = 3.53, \ p < .05] contributed 10\%, 37\%, and 4\% of the variance in reading comprehension, respectively, which were all significant. Unlike the primary three participants, breadth did not contribute significant variance [\Delta F(1,43) = .32, \ p > .05]. Syntagmatic [\Delta F(1,42) = 8.31, \ p < .01] and paradigmatic knowledge [\Delta F(1,41) = 8.17, \ p < .01], on the other hand, contributed 8\% and 7\% of significant variance in comprehension. Among the different measures, compound awareness [\beta = .29, \ t(47) = 2.19, \ p < .05], syntagmatic [\beta = .21, \ t(47) = 2.11, \ p < .05] and paradigmatic knowledge [\beta = .42, \ t(47) = 2.86, \ p < .01] emerged as unique predictors. Findings of significant variance accounted for by syntagmatic and paradigmatic knowledge after partialling out the contributions of each other showed that both measures were unique predictors of reading comprehension. Non-significant beta weights of the interaction terms of language status (EL1 vs. ML1) and the three lexical measures (.01 < \beta < .08, \ ps > .05] indicated that language status did not have a significant impact on the link between lexical knowledge and Mandarin reading comprehension.

**Cross-Language Relations between Paradigmatic Knowledge and Reading Comprehension**

Cross-language relationships of paradigmatic knowledge was also examined using a series of linear regressions. In each age group, separate regressions were conducted to examine the independent contribution of paradigmatic knowledge to reading comprehension in the other language. Cross-language relations in the direction from English to Mandarin as well as from Mandarin to English were examined. In each model, working memory was entered in the first step, followed by word reading, morphological awareness, lexical breadth, syntagmatic knowledge, and paradigmatic knowledge. The paradigmatic measure in the other language was entered in the last step to examine whether it was a unique predictor of reading comprehension.
As shown in Table 20, Mandarin paradigmatic knowledge was not a significant predictor of reading comprehension in English for the younger cohort \( \beta = -.09, t(75) = -1.98, p > .05 \). However, the same type of knowledge was a unique significant predictor for English reading comprehension in the older group (Table 20), accounting for an additional 6% of significant variance \( \beta = .32, t(47) = 2.41, p < .05 \), after partialling out the contributions of the within-language factors. Similar regressions were conducted to examine the contributions of English paradigmatic knowledge to reading comprehension in Mandarin. As shown in Table 21, contrary to the pattern of results obtained with the English comprehension models, there was no evidence of a cross-linguistic link in the direction from English to Mandarin reading comprehension with respect to paradigmatic knowledge in both the primary three \( \beta = -.05, t(75) = -.38, p > .05 \) and primary five children \( \beta = -.02, t(47) = -.16, p > .05 \).

**Commonality Analyses**

Given the negative beta weights associated with some of the variables, commonality analyses were conducted to examine the shared and unique variance among the measures of lexical breadth and depth in relation to English and Mandarin reading comprehension within each age group (Tables 22 to 25). The commonality analyses were conducted using the same variables that were used in the regression analyses. However, only the commonality coefficients associated with the lexical breadth and depth measures are presented in the tables because these measures were the focus of the present study.

**Predicting English Reading Comprehension.** The total, shared, and unique variance for the within- and cross-language predictors of English reading comprehension for both age groups are displayed in Tables 22 and 23. Among the four lexical measures (i.e., English lexical breadth,
paradigmatic knowledge, syntagmatic knowledge, and Mandarin paradigmatic knowledge), English paradigmatic knowledge explained the largest amount of unique variance in English reading comprehension among the younger children (9.11%). English syntagmatic knowledge contributed 2.19% of unique variance but the unique variance contributed by English lexical breadth was negligible (.34%). Among the lexical measures, the overlap in variance between English breadth and paradigmatic knowledge and between English syntagmatic and paradigmatic knowledge were comparable (3.28% and 3.95%). The overlap in variance between the breadth measure and syntagmatic knowledge measure was minimal in comparison (1.13%). The shared variance between English and Mandarin paradigmatic knowledge was negative (-1.79%), suggesting that Mandarin paradigmatic knowledge might be a suppressor in the relationship between English paradigmatic knowledge and reading comprehension. A comparison of the within-language prediction model of English reading comprehension (Table 18) to the cross-language model (Table 20) showed that the relationship between English paradigmatic knowledge and English comprehension was diminished without Mandarin paradigmatic knowledge added in the model (β = .40 vs. β = .36). This confirmed that Mandarin paradigmatic knowledge was a suppressor.

The cross-language lexical measure, Mandarin paradigmatic knowledge (the between-language factor) accounted for the largest amount of unique variance in the older participants (9.84%). Interestingly, English paradigmatic knowledge only accounted for 1.48% of unique variance in English reading comprehension for the older group. However, there was an overlap of 6.77% of variance between paradigmatic knowledge in the two languages. Notably, the unique variance contributed by syntagmatic knowledge was virtually zero. There was also minimal variance shared with the other lexical measures. The negative variance syntagmatic knowledge
shared with paradigmatic knowledge (-.03%) also suggested that it was a suppressor of the relationship between English paradigmatic knowledge and reading comprehension, although the suppression effect was very small.

Predicting Mandarin Reading Comprehension. The commonality coefficients associated with the within- and cross-language predictors of Mandarin reading comprehension are shown in Tables 24 and 25. In both groups, the majority of variance accounted for was contributed by that unique to syntagmatic (5.11% and 7.16% in the younger and older groups, respectively) and paradigmatic knowledge (8.88% for the younger group and 9.76% for the older group).

In the younger group, the shared variance between Mandarin breadth and paradigmatic knowledge (2.16%) was comparable to that between the Mandarin syntagmatic and paradigmatic tasks (2.33%). However, there was minimal shared variance between Mandarin breadth and syntagmatic tasks (.72%). For the older group, there was a significant amount of shared variance between the Mandarin syntagmatic and paradigmatic tasks (8.46%). However, the shared variance between Mandarin breadth and syntagmatic measures was very small (.47%). Mandarin lexical breadth also appeared to be a suppressor in the relationship between Mandarin syntagmatic knowledge and reading comprehension, as evidenced by the negative variance (-.85%), although the suppression effect is small. The variance shared between English and Mandarin paradigmatic knowledge was also negative (-.41%), suggesting that English paradigmatic knowledge might have suppressed the relationship between Mandarin paradigmatic knowledge and reading comprehension.
Chapter 10. Discussion for Study 2

In this cross-sectional study, the relative contributions of paradigmatic and syntagmatic knowledge to English and Mandarin reading comprehension in two groups of children (ages 8-9 and 10-12) were investigated. The crossover effect of paradigmatic knowledge on reading comprehension was also examined. Parallel tasks of measures lexical breadth, syntagmatic and paradigmatic knowledge, and reading comprehension in both languages were administered to examine this.

With reference to previous studies, it was hypothesized that both types of knowledge would make significant contributions to reading comprehension in both languages for both age groups, after partiailling out the effects of breadth of knowledge and other control variables. Both paradigmatic and syntagmatic knowledge were found to be reliable predictors of Mandarin reading comprehension in both age groups, which showed support for the hypothesis. However, this hypothesis was only partially supported in the prediction of English reading comprehension, where only paradigmatic knowledge was a significant predictor. It was also hypothesized that there would be a crossover effect of paradigmatic knowledge on reading comprehension in both age groups with no definite predictions made with regard to direction in which cross-language relationships occur. This hypothesis was supported in that a cross-language relationship was observed in the direction from Mandarin to English, but only within the older group. The findings are discussed in more detail.

Within-Language Contributions of Lexical Depth

The Relationship between Paradigmatic Knowledge and Reading Comprehension.

Within both English and Mandarin, the contribution of lexical depth to reading comprehension was demonstrated by a significant relationship between paradigmatic knowledge and reading
comprehension. The paradigmatic knowledge-reading comprehension link remained significant even after known key predictors of word reading and morphological awareness had been controlled for, indicating that lexical depth has a unique role in reading comprehension. In addition, regardless of the order in which the three lexical measures were entered, paradigmatic knowledge always remained a significant unique predictor in the models of English and Mandarin reading comprehension for both age groups. Commonality analyses also showed that paradigmatic knowledge contributed a significant amount of unique variance to reading comprehension in each language, which adds credence to the link between these two variables. The result is consistent with findings from previous studies that have examined the link between lexical knowledge and reading comprehension in both languages (e.g., Chik et al., 2012; Kieffer & Lesaux, 2007; Lervåg & Aukrust, 2010; Muter et al., 2004; Oullette, 2006; Qian, 1999, 2002; Tannenbaum et al., 2006; Shu et al., 2006). This study’s findings also extend those of previous studies by showing that the contribution of specifically paradigmatic knowledge to both English and Mandarin reading comprehension was robust, even after considering effects of lexical breadth.

These findings can be contextualized within the hypothesis put forth by Nation and Snowling (1998) that reading comprehension is contingent upon the ability to meaningfully organize the mental lexicon. The finding that paradigmatic knowledge emerged as a strong significant predictor in both languages, suggests that the hypothesis of Nation and Snowling (1998) is applicable to both English and Mandarin reading. These findings can then be taken to indicate that knowledge of hierarchical relationships among words is important in comprehension of texts in alphabetic languages as well as morpho-syllabic ones. The results are also in line with the Knowledge Hypothesis (Anderson & Freebody, 1981), which suggests that in addition to the breadth of knowledge, a better grasp of the concepts related to words is important to reading
comprehension Beck et al., 2002; Beck et al., 1982). The fact that paradigmatic knowledge made independent contributions to reading comprehension above and beyond lexical breadth in both languages is not surprising because comprehension involves the integration of information and making connections among concepts within the text in addition to decoding meanings of individual words (Nagy and Herman, 1987).

The Relationship between Syntagmatic Knowledge and Reading Comprehension.

Contrary to paradigmatic knowledge, however, the syntagmatic-reading comprehension link was inconsistent between English and Mandarin. In English, syntagmatic knowledge was not a unique predictor of reading comprehension in both age groups. This finding departs from that of previous research (Hsu, 2010; Keshavarz & Salimi, 2007; Qian, 1999). In English, syntagmatic knowledge was not a unique predictor of reading comprehension in both age groups. Findings from commonality analyses showed that the contribution of syntagmatic knowledge to reading comprehension was almost zero in the older children, again indicating the lack of a link between the two variables. A possible reason is that the effects of paradigmatic knowledge was not controlled for in previous studies, and most past studies concluded that the relationship between syntagmatic knowledge and reading comprehension was significant based on correlations.

In addition, the nature of the tasks used could possibly explain the differences in findings between the present study and previous research. Keshavarz and Salimi (2007)’s study used a cloze passage to measure reading comprehension. In comparison to a multiple-choice reading comprehension task used in this study, the format of cloze passages is such that test-takers have to rely heavily on other words in the passage to derive at the correct answers, thus making knowledge of syntagmatic relations more important. A second explanation for the discrepancy between current findings and that of previous studies is with regard to the low internal consistency of the
English syntagmatic task (evident in the low Cronbach’s alpha associated with the task). The low reliability could have rendered the task less effective in measuring syntagmatic knowledge and thus obscured the relationship between syntagmatic knowledge and reading comprehension in English. It is not possible to determine which of the two explanations was more applicable, thus, more research is needed to clarify the relationship between the two variables.

By contrast, Mandarin syntagmatic knowledge was a significant predictor of Mandarin reading comprehension in both age groups. The difference in the relationship between syntagmatic knowledge and reading comprehension in Mandarin and English could possibly be explained by three reasons. First, there is greater flexibility in the use of Chinese words as compared to English (Wong, Li, Xu, & Zhang, 2014). For instance, the word 背 /bei4/ can adhere to different parts of speech (as a verb meaning carry or as a noun meaning back) depending on the context. In order to identify the part of speech that this word corresponds in a text, it is necessary to refer to the word it collocates with. As a result of this flexibility in word use, there is a greater number of words in the Chinese language that have multiple meanings (Duan & Qin, 2012). For example, switch off and close in the collocations switch off the lights and close the door are both represented by 关 in Mandarin. More polysemy among Mandarin words leads to greater ambiguity in the meaning of words within a text. Therefore, collocational knowledge is likely to be more crucial in Mandarin reading to resolve these ambiguities. In addition, because there are no spaces between words in Mandarin texts, word boundaries are not as clearly demarcated as compared to English. Therefore, collocations serve to aid word segmentation (Wong et al., 2014).

**Cross-language Contributions of Paradigmatic Knowledge**

With regard to cross-language relationships, it was found that there was a cross-language contribution of Mandarin paradigmatic knowledge to English reading comprehension among the
older children. Empirically, this finding expands upon that of Li et al. (2012), showing that the cross-language relationship between paradigmatic knowledge and reading comprehension persists even after effects of within-language lexical depth had been controlled. The findings can be situated within the hypothesis put forth by Wolter (2006) which was reviewed in Study 1. Central to this hypothesis is that paradigmatic knowledge is more likely to be related across languages because paradigmatic relations among words remain relatively constant across languages. Therefore, paradigmatic knowledge can be effectively applied across languages. The findings here suggest that paradigmatic knowledge is also potentially useful in reading comprehension across languages, although it is important to note that the patterns of cross-language relationships were not consistent between the two age groups. A cross-linguistic link was only observed in the older participants.

L1-L2 proficiency level could explain why a cross-language relationship was only observed in the primary five children. There might be a threshold proficiency level in the L2 that needs to be attained before cross-language contributions of lexical depth to reading comprehension can occur. According to the Linguistic Threshold Hypothesis (Cummins, 1979), cross-language relationships of reading skills are only observed when a certain proficiency in the L2 is achieved. Although Study 1 findings showed that cross-language associations were observed even among the primary three children, it only occurred between the same type of knowledge in the two languages (i.e., between English and Mandarin paradigmatic knowledge). As discussed earlier in the introduction section, the cross-language relationship between paradigmatic knowledge and reading comprehension is possibly a more complex process as compared to that of paradigmatic knowledge across languages, it is possible that a higher proficiency level is required for cross-language insights to occur between paradigmatic knowledge and reading comprehension.
In addition, a cross-language association was also only observed in the direction of Mandarin to English. English paradigmatic knowledge did not predict Mandarin reading comprehension. A plausible explanation for why Mandarin paradigmatic knowledge was related to English reading comprehension but not vice-versa is the role of morphological characteristics in facilitating cross-language facilitation. Kazzazi (2011) observed a cross-language association in the direction from the language with a more transparent semantic structure to the one with a more complex structure (i.e. more difficult to acquire). As compared to English, Mandarin has a more semantically transparent structure (Shu et al., 2006) where words are formed primarily by compounding rules (Ku & Anderson, 2003; Wang et al., 2006; Zhang et al., 2012). As compared to English, meanings and semantic categories of words can be easily deciphered from its constituent morphemes (McBride-Chang et al., 2005). For instance, it is not easy to see that English words *pork* and *beef* are semantically related unless one knows the meanings of these two words. However, both words in Mandarin contain a common morpheme 肉 (meaning meat) that serves as a marker to indicate that they belong to the same semantic category. Therefore, the cross-language relationship observed in this study could be due to participants using Mandarin equivalents of words to decipher their more complex and semantically opaque English counterparts as well as to effectively organize information in the mental lexicon. The results of the commonality analyses appear to support this notion as a sizeable overlapping variance between English and Mandarin paradigmatic knowledge was observed. However, further investigations are needed to verify this postulation.

**Relationship among Lexical Measures**

Given the differences in the role of the lexical measures in reading comprehension between the two languages, it was important to examine how the measures were related to one another in
predicting reading comprehension. Commonality analyses showed that across English and Mandarin for both age groups, the overlap in variance between lexical breadth and syntagmatic knowledge was very small, suggesting that these two measures may not form a single construct. This lack of overlapping variance supports the view that there is a need to consider lexical breadth and depth (at least for lexical breadth and syntagmatic knowledge) as separate constructs in research (e.g., Greidanus et al., 2004; Wesche & Paribakht, 1996). With regard to the depth measures, among the younger children, both depth measures not only contributed unique variance within both English and Mandarin reading comprehension, there was also an overlap in variance between the two within each language. Similarly, among the older children, both syntagmatic and paradigmatic knowledge in Mandarin contributed unique and shared variance to Mandarin reading comprehension. This pattern of results appear to support the view that lexical depth is multidimensional (Beck & McKeown, 1991; Haastrup & Henriksen, 2000; Laufer & Parbakht, 1998; Nagy & Herman, 1987; Ouellette, 2006; Qian, 1999; Read, 2000; Wesche & Paribakht, 1996), where its subcomponents interact but also make independent contributions to the construct. However, the associations among the depth measures in English for the older children appeared to be inconsistent and there were also suppression effects associated with syntagmatic knowledge in English and Mandarin in this group. Therefore, further investigations are needed to clarify the relationships among the different lexical measures.

In summary, it was established in this study that paradigmatic knowledge contributed significantly to reading comprehension in both English and Mandarin. However, syntagmatic knowledge was a unique predictor only in Mandarin reading comprehension. The difference in the role of syntagmatic knowledge in English and Mandarin reading comprehension could be attributed to the differences in word and text characteristics between the two languages. A cross-
language relationship between Mandarin paradigmatic knowledge and English reading comprehension was also established only among the older children, suggesting that L1-L2 proficiency and language characteristics might affect whether cross-language associations are observed. The cross-language finding in this study expands upon current literature. Research on crossover effects of lexical depth has been skewed towards investigations between languages that share the same alphabet such as Spanish and English or French and English (e.g., Nagy et al., 1993; Proctor et al., 2006; Ramírez, Chen, & Pasquarella, 2013). Among these studies, cognates were believed to be the semantic units that are related between languages. The cross-language link between paradigmatic knowledge and reading comprehension thus provides preliminary evidence that cross-language contributions of knowledge of hierarchical relations among words to aid reading comprehension between non-cognate languages is possible.
Chapter 11. General Conclusions

Despite the importance of lexical knowledge in reading (e.g., August et al., 2005; Carlisle & Beeman, 2000; Grabe & Stroller, 2004; Stahl, 2003; Stahl & Nagy, 2006), our understanding of this construct is still lacking, especially with respect to the depth of lexical knowledge. The present dissertation thus had two objectives. First, how two aspects of depth of word knowledge were related with each other between English and Mandarin, was examined. Specifically, these two aspects referred to the knowledge of paradigmatic and syntagmatic relations among words. The second objective was to investigate how these aspects of lexical depth were related to reading comprehension in the two languages in English and Mandarin among bilingual children. These questions were investigated in two interrelated studies.

Findings from Study 1 demonstrated the bidirectional cross-language contributions of paradigmatic knowledge but not syntagmatic knowledge across English and Mandarin. The pattern of results appeared to be consistent with bilingual models of language processing (e.g., Kroll & De Groot, 1997; Kroll & Stewart, 1994) that postulate a link between the mental lexicons of L1 and L2 of bilinguals. Similar findings in both the younger and older participants in the present study provided more credibility in this relationship. The cross-linguistic link of paradigmatic but not syntagmatic knowledge further supports the hypothesis of Wolter (2006) that decontextualized knowledge that does not change conceptually across languages is related across languages but syntagmatic knowledge which is dependent on the context in which it is used is not. The findings echo that of Ordóñez et al. (2002) and extend, showing that paradigmatic knowledge is related between languages that do not share the same script.

Study 2 examined the link between depth of lexical knowledge in English and Mandarin and whether cross-language relationships of lexical depth existed across languages to contribute
to reading comprehension. Findings demonstrated the importance of lexical depth in reading comprehension within both English and Mandarin in both younger and older participants. Specifically, English paradigmatic knowledge was a unique predictor of English reading comprehension just as Mandarin paradigmatic knowledge significantly predicted reading comprehension in Mandarin. Syntagmatic knowledge, however, was only a unique contributor of reading comprehension in Mandarin. These findings are consistent with the view that lexical depth is significant in predicting reading comprehension (e.g., Nation & Snowling, 1998; Proctor et al., 2012; Roth et al., 2002; Ricketts et al., 2007; Vellutino & Scanlon, 1987) and also showed that the link between depth of knowledge and reading comprehension persisted, even after the effects of lexical breadth had been partialled out. The finding of a significant link between different aspects of lexical depth and reading comprehension in Mandarin also presented as a novel finding.

In addition, findings of cross-language facilitation of Mandarin paradigmatic knowledge on reading comprehension in English is consistent with the results of Study 1, indicating that a cross-language link is limited to this particular type of knowledge. However, the observation of a cross-language relationship in only one direction from Mandarin to English suggests that this relationship could be affected by the degree of semantic transparency. Mandarin words are primarily formed by compounds and thus, meanings of words can largely be derived from their constituent compounds (McBride-Chang et al., 2005). Such is not always the case in English. Therefore, higher semantic transparency in Mandarin words could have facilitated the decoding of meaning of unfamiliar English words encountered in reading, as found by Karazzi (2011). The finding that a cross-linguistic link was only observed among the older participants suggests that a certain proficiency has to be reached before cross-language facilitation of lexical knowledge on
reading comprehension can occur. The younger participants in this study might not have attained the level of proficiency in their L1 and L2 that allowed for cross-language insights to occur.

**Educational Implications**

Overall, these results have a number of practical implications. First, the results indicate that assessment of children’s lexical knowledge should not only involve tasks that assess size of vocabulary. Assessments of children’s awareness of how words relate to other concepts and words are also important. Laufer, Elder, Hill, and Congdon (2004), as well as Wesche and Paribakht (1996), among other researchers, have called for the need to use a combination of tasks that measure breadth and depth of knowledge. This would help us gain a better understanding of the extent of lexical knowledge of both monolingual and bilingual children. In addition, past research has suggested the utility of viewing the lexicon of a bilingual as a whole, rather than as two separate systems that do not interact (e.g., Bedore et al., 2005; Pearson et al., 1993). The findings here support this view. Therefore, wherever possible, assessments of the lexical knowledge of bilingual students, even those with dissimilar L1 and L2, should be done in both L1 and L2, to gain a better understanding of the extent of their knowledge of words.

These findings also provide insight into how vocabulary instruction should be structured. The two studies presented here show the contributions of lexical breadth to lexical depth, which in turn contributes to reading comprehension. Therefore, effective instruction should include activities that help students accumulate a repertoire of words while building up their depth of knowledge of these words (Beck et al., 2002). Specifically, given the central role that paradigmatic knowledge plays in reading comprehension, activities that help students make hierarchical connections among words (e.g., *partonomic links, hyponomy, synonymy*) would be beneficial. The finding that syntagmatic knowledge contributes significantly to reading comprehension in
Mandarin also necessitates incorporating instruction of collocations in the Mandarin language curriculum in schools, at least in the context of Singapore.

The finding of a cross-language link between English and Mandarin paradigmatic knowledge points to the feasibility of incorporating instructional activities that encourage students to make links between their first and second languages, as proposed by August et al. (2005). The RHM of bilingual processing (Kroll & De Groot, 1997) postulates that the development of knowledge of words in the L2 is faster if the concepts of these words are already present in the L1. This is because learners do not have to build up networks associated with these words again in the other language. Therefore, classroom practices that help students make these cross-language connections would prove to be beneficial in the acquisition of vocabulary.

**Limitations and Future Directions**

The findings of the present study should also be considered in the context of its limitations. First, the reliabilities associated with the English syntagmatic knowledge measure was low, especially for the younger group, which could have rendered the task less effective in examining the relationships among variables. The low reliabilities reflect the challenge of designing collocation-type tasks because the use of collocates is not always consistent, especially in regards to medium collocations that were used in this study. Future investigations should consider using multiple tasks to assess the construct which would allow for cross-validation.

The second limitation concerns the small sample sizes. The samples consisted of both English-L1 and Mandarin-L1 children. However, given the small numbers of Mandarin-L1 children in the present study, it was not possible to examine the two groups separately. Previous research has shown differences in the development of reading skills between English-L1 and Mandarin-L1 children in Singapore (e.g., Yeong & Rickard Liow, 2010; 2012). Future studies
should consider these two groups separately to clarify how language background affects cross-language associations of lexical knowledge. Furthermore, the sample size of the primary five sample was relatively small in comparison to the primary three group, which could have obscured the power of the analyses and given rise to difficulties in the interpretation of the results. Future studies should examine whether patterns of cross-language relationships could be replicated across different ages with more equal sample sizes.

In addition, it was not possible to administer the full vocabulary measure of the BLAB due to time constraints. Only 40 of the 100 items for each of the language versions were used in the present study. Although normality checks revealed a normal distribution of the scores on these measures, it would nonetheless be necessary for future studies to assess the feasibility of using a subset of the items as compared to administering the full range of items.

Whether receptive depth of knowledge is as important a predictor as productive depth of knowledge remains an important and interesting question to address in future research. For instance, receptive knowledge might be more predictive of identification-type comprehension tasks whereas productive vocabulary tasks might be more significant in comprehension tasks that require oral or written responses. In addition, it is possible that the relative significance of each type of task in predicting reading comprehension may change with time as the demands of the reading tasks change. Thus, future research should adopt longitudinal methods and include both receptive and productive tasks in prediction models in order to examine the contributions of these two types of knowledge to different types of reading tasks over time. Finally, in view of the overlapping variance among measures demonstrated in the commonality analyses, future studies should consider investigating the mediating relationships that might be present among the variables.
In conclusion, the findings of the current dissertation contribute to our understanding of the dimension of lexical depth. They inform how aspects of this dimension, specifically paradigmatic and syntagmatic knowledge, are related across languages and how they contribute to reading comprehension in English and Mandarin. These findings imply the need to increase the focus on lexical depth in instruction in addition to helping students accumulate a larger number of words in their lexicon. Helping students make connections at the conceptual level across languages would make acquisition of words more efficient. Finally, the findings have implications on assessment. Findings point to the efficacy of depth of knowledge of words in identifying children who have difficulties in reading comprehension in both languages. In addition, it is also necessary to assess both breadth and depth of lexical knowledge in both L1 and L2 to gain a more complete picture of the lexical knowledge of bilingual children.
References


Caramazza, A. (1997). How many levels of processing are there in lexical access? *Cognitive Neuropsychology, 14*(1), 177 - 208. doi: 10.1080/026432997381664


Table 1.

Means and Standard Deviations of Lexical Breadth, Depth, and Non-verbal Reasoning for EL1 and EL2 Children in Both Age Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Primary Three</th>
<th>Primary Five</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EL1 (n=62)</td>
<td>ML1 (n=25)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Lexical Breadth</td>
<td>23.57</td>
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<tr>
<td>Paradigmatic Knowledge</td>
<td>10.85</td>
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<tr>
<td>Syntagmatic Knowledge</td>
<td>26.28</td>
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</tr>
<tr>
<td>Mandarin Measures</td>
<td>23.57</td>
<td>5.58</td>
</tr>
<tr>
<td>Lexical Breadth</td>
<td>18.64</td>
<td>5.58</td>
</tr>
<tr>
<td>Paradigmatic Knowledge</td>
<td>8.08</td>
<td>4.21</td>
</tr>
<tr>
<td>Syntagmatic Knowledge</td>
<td>21.67</td>
<td>5.31</td>
</tr>
</tbody>
</table>

Table 2.

Means, Standard Deviations, and Reliability Coefficients of Lexical Breadth, Depth, and Non-verbal Reasoning for Both Age Groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>Primary Three</th>
<th>Primary Five</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>Range</td>
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<tr>
<td>Non-verbal Reasoning</td>
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<tr>
<td>English Measures</td>
<td>23.02</td>
<td>5.23</td>
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<td>Paradigmatic Knowledge</td>
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<td>2-18</td>
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<td>Syntagmatic Knowledge</td>
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<td>16-35</td>
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<tr>
<td>Mandarin Measures</td>
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<td>6.39</td>
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<td>Lexical Breadth</td>
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<td>8-36</td>
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<td>Paradigmatic Knowledge</td>
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<td>0-19</td>
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<td>Syntagmatic Knowledge</td>
<td>.73</td>
<td>10-32</td>
</tr>
</tbody>
</table>
Table 3.

*Bivariate Correlations among all English and Mandarin Measures for Both Age Groups*

<table>
<thead>
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<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>1. Non-verbal Reasoning</td>
<td></td>
<td>.24</td>
<td>.20</td>
<td>.19</td>
<td>.24</td>
<td>.46**</td>
<td>.50**</td>
</tr>
<tr>
<td>2. English Lexical Breadth</td>
<td>.39**</td>
<td></td>
<td>.55**</td>
<td>.70**</td>
<td>.40**</td>
<td>.63**</td>
<td>.31**</td>
</tr>
<tr>
<td>3. Mandarin Lexical Breadth</td>
<td>.08</td>
<td>.26*</td>
<td></td>
<td>.40**</td>
<td>.60**</td>
<td>.44**</td>
<td>.47**</td>
</tr>
<tr>
<td>4. English Syntagmatic</td>
<td>.35**</td>
<td>.47**</td>
<td>.13</td>
<td></td>
<td>.41**</td>
<td>.67**</td>
<td>.48**</td>
</tr>
<tr>
<td>5. Mandarin Syntagmatic</td>
<td>-.23*</td>
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<td>.51**</td>
<td>.03</td>
<td></td>
<td>.45**</td>
<td>.67**</td>
</tr>
<tr>
<td>6. English Paradigmatic</td>
<td>.41**</td>
<td>.70**</td>
<td>.27*</td>
<td>.61**</td>
<td>.08</td>
<td></td>
<td>.54**</td>
</tr>
<tr>
<td>7. Mandarin Paradigmatic</td>
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<td>.38**</td>
<td>.61**</td>
<td>.49**</td>
<td>.41**</td>
<td>.53**</td>
<td></td>
</tr>
</tbody>
</table>

*Correlations for primary three group are in the lower diagonal and that for the primary five group are in the upper diagonal

*p < .05, **p < .01*
Table 4.

Regression Models Predicting English and Mandarin Paradigmatic Knowledge for Both Age Groups

<table>
<thead>
<tr>
<th>Predictor and Step</th>
<th>Primary Three</th>
<th>Primary Five</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔR²</td>
<td>ΔF</td>
</tr>
<tr>
<td>English Paradigmatic Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-verbal Reasoning</td>
<td>.17</td>
<td>16.85**</td>
</tr>
<tr>
<td>English Breadth</td>
<td>.34</td>
<td>58.02**</td>
</tr>
<tr>
<td>Mandarin Breadth</td>
<td>.01</td>
<td>1.45</td>
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<tr>
<td>Mandarin Paradigmatic</td>
<td>.07</td>
<td>13.52**</td>
</tr>
<tr>
<td>Mandarin Paradigmatic Knowledge</td>
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<td></td>
</tr>
<tr>
<td>Non-verbal Reasoning</td>
<td>.07</td>
<td>6.59*</td>
</tr>
<tr>
<td>Mandarin Breadth</td>
<td>.34</td>
<td>48.79**</td>
</tr>
<tr>
<td>English Breadth</td>
<td>.02</td>
<td>3.58</td>
</tr>
<tr>
<td>English Paradigmatic</td>
<td>.08</td>
<td>13.52**</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01

Table 5.

Models Comparing Regression Coefficients of English and Mandarin Paradigmatic Knowledge between the Two Age Groups

<table>
<thead>
<tr>
<th>Predictor and Step</th>
<th>English</th>
<th>Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔR²</td>
<td>ΔF</td>
</tr>
<tr>
<td>Non-verbal Reasoning</td>
<td>.14</td>
<td>21.99*</td>
</tr>
<tr>
<td>Mandarin Breadth</td>
<td>.26</td>
<td>59.77**</td>
</tr>
<tr>
<td>English Breadth</td>
<td>.02</td>
<td>4.00*</td>
</tr>
<tr>
<td>Age Group</td>
<td>.17</td>
<td>51.54</td>
</tr>
<tr>
<td>Paradigmatic</td>
<td>.03</td>
<td>5.79*</td>
</tr>
<tr>
<td>Paradigmatic × Age group</td>
<td>.02</td>
<td>4.05*</td>
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*p<.05, **p<.01
Table 6.

Regression Models Predicting English and Mandarin Syntagmatic Knowledge for Both Age Groups

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*p < .05, **p < .01
Table 7.  
Commonality Analyses of Proportions of Total, Common and Unique variance for Both Age Groups in Predicting English Paradigmatic Knowledge

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<th>Mandarin Breadth</th>
<th>Mandarin Paradigmatic</th>
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Table 8.  
Summary of Unique and Common Variance for Independent Variables in Predicting English Paradigmatic Knowledge for Both Age Groups

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Table 9.
Commonality Analyses of Proportions of Total, Common and Unique Variance for Both Age Groups in Predicting Mandarin Paradigmatic Knowledge

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<th>English Paradigmatic</th>
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Table 10.
Summary of Unique and Common Variance for Independent Variables in Predicting Mandarin Paradigmatic Knowledge for Both Age Groups

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Table 11.

*Commonality Analyses of Proportions of Total, Common and Unique Variance for Both Age Groups in Predicting English Syntagmatic Knowledge*

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<th>Mandarin Breadth</th>
<th>Mandarin Syntagmatic</th>
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Table 12.

*Summary of Unique and Common Variance for Independent Variables in Predicting English Syntagmatic Knowledge for Both Age Groups*

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Table 13.

*Commonality Analyses of Proportions of Total, Common and Unique Variance for Both Age Groups in Predicting Mandarin Syntagmatic Knowledge*

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<th>English Syntagmatic</th>
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Table 14.

*Summary of Unique and Common Variance for Independent Variables when Predicting Mandarin Syntagmatic Knowledge for Both Age Groups*

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Table 15.

Mean Scores and Standard Deviations of all English and Mandarin Measures for EL1 and ML1 Children in Both Age Groups

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<th>Primary 5 (n=25)</th>
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<th>ML1 (n=16)</th>
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<td>M</td>
<td>SD</td>
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Table 16.

Reliabilities, Mean Scores, Standard Deviations, and Reliability Coefficients of all English and Mandarin Measures for Both Age Groups

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<tr>
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Bivariate Correlations among all English and Mandarin Measures for Both Age Groups

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*p<.05, **p<.01

*Correlations for primary three group are in the lower diagonal and that for the primary five group are in the upper diagonal.
Table 18.

**Linear Regressions Predicting English Reading Comprehension for Both Age Groups**

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*p<.05, **p<.01
Table 19.
**Linear Regressions Predicting Mandarin Reading Comprehension for Both Age Groups**

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**Model 2**

| 4. Syntagmatic Knowledge            | .46   | .05          | 7.69**     | .24*    | 2.18*  | .59   | .08            | 8.43**   | .32*   | 2.11* |
| 5. Lexical Breadth                  | .48   | .01          | 1.85       | .06     | .53    | .59   | .00            | 0.38     | -.08   | -.50  |
| 6. Paradigmatic Knowledge           | .52   | .05          | 7.39**     | .30**   | 2.68** | .66   | .07            | 8.17**   | .42**  | 2.86**|

**Model 3**

| 4. Paradigmatic Knowledge           | .48   | .07          | 10.83**    | .30**   | 2.68** | .62   | .12            | 12.97**  | .42**  | 2.86**|
| 5. Syntagmatic Knowledge            | .52   | .04          | 6.21*      | .24*    | 2.18*  | .66   | .04            | 4.41*    | .32*   | 2.11* |
| 6. Lexical Breadth                  | .52   | .00          | 0.24       | .06     | .53    | .66   | .00            | 0.25     | -.08   | -.50  |

*p < .05, **p < .01
Table 20.

Cross-language Relations between Mandarin Lexical Depth and English Reading Comprehension for Both Age Groups

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<td>2. Character Reading</td>
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*p<.05, **p<.01

Table 21.

Cross-language Relations between English Lexical Depth and Mandarin Reading Comprehension for Both Age Groups

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*p<.05, **p<.01
Table 22.

Commonality Analyses of Proportions of Total, Common and Unique variance for Both Age Groups in Predicting English Reading Comprehension

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Table 23.

Summary of Unique and Common Variance for Independent Variables Predicting English Reading Comprehension for Both Age Groups

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Table 24.
Commonality Analyses of Proportions of Total, Common and Unique variance for Both Age Groups in Predicting Mandarin Reading Comprehension

<table>
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<tr>
<th>Working Memory</th>
<th>Mandarin Character Reading</th>
<th>Mandarin Morphological Awareness</th>
<th>Mandarin Lexical Breadth</th>
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Table 25.

Summary of Unique and Common Variance for Independent Variables Predicting Mandarin Reading Comprehension for Both Age Groups

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<td>-1.03</td>
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Appendix A: English Syntagmatic (Collocations) Task

In each question, you are given a word followed by four options (1,2, 3 and 4). For each question, pick out **TWO (2)** options that you think go best with the word given. An example is given:

E.g. **Healthy** 1. **Meal** 2. **Body** 3. Race 4. Time

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Options</th>
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</thead>
<tbody>
<tr>
<td>Bare</td>
<td>1. Trees 2. Schools 3. <strong>Hands</strong> 4. Plates</td>
</tr>
<tr>
<td>Plain</td>
<td>1. Taste 2. <strong>Clothes</strong> 3. Hair 4. Look</td>
</tr>
</tbody>
</table>
Appendix B: Mandarin Syntagmatic (Collocation) Task

华文配词活动

请你选出两个你认为能与指定词搭配的答案。

例：关心 1. 朋友 2. 晚餐 3. 父母 4. 书包

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<th>目标词</th>
<th>选项</th>
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<tbody>
<tr>
<td>1 保护</td>
<td>1. 心情 2. 大门 3. 地球 4. 身体</td>
</tr>
<tr>
<td>2 打消</td>
<td>1. 计划 2. 想法 3. 坏事 4. 同学</td>
</tr>
<tr>
<td>3 调整</td>
<td>1. 物件 2. 价钱 3. 衣服 4. 时间</td>
</tr>
<tr>
<td>4 安排</td>
<td>1. 旅行 2. 星期 3. 活动 4. 知识</td>
</tr>
<tr>
<td>5 领养</td>
<td>1. 现金 2. 园地 3. 兴趣 4. 孩子</td>
</tr>
<tr>
<td>6 脱离</td>
<td>1. 国家 2. 关系 3. 危险 4. 课室</td>
</tr>
<tr>
<td>7 报答</td>
<td>1. 恩情 2. 家人 3. 要求 4. 东西</td>
</tr>
<tr>
<td>8 宽阔的</td>
<td>1. 房间 2. 身体 3. 衣服 4. 场地</td>
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<tr>
<td>9 丢失</td>
<td>1. 书本 2. 水分 3. 机会 4. 生命</td>
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<tr>
<td>10 打听</td>
<td>1. 声音 2. 消息 3. 情况 4. 朋友</td>
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<td>11 美满的</td>
<td>1. 心情 2. 家庭 3. 歌声 4. 生活</td>
</tr>
<tr>
<td>12 容易的</td>
<td>1. 方法 2. 地方 3. 题目 4. 食物</td>
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<td>13 精巧的</td>
<td>1. 手工 2. 味道 3. 小孩 4. 饰品</td>
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<td>14 生动的</td>
<td>1. 音乐 2. 兴趣 3. 表情 4. 想法</td>
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<td>15 平坦的</td>
<td>1. 鼻子 2. 海洋 3. 草原 4. 道路</td>
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<td>16 提出</td>
<td>1. 双手 2. 问题 3. 力气 4. 要求</td>
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<tr>
<td>17 分配</td>
<td>1. 工作 2. 景色 3. 朋友 4. 食物</td>
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<td>18 尖利的</td>
<td>1. 角落 2. 眼睛 3. 手指 4. 声音</td>
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<td>19 厚重的</td>
<td>1. 味道 2. 大雨 3. 桌子 4. 礼物</td>
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<td>20 安定的</td>
<td>1. 房子 2. 命运 3. 日子 4. 心情</td>
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Appendix C: English Paradigmatic (Semantics) Task

Please pick out **TWO** words that are most related to each other. Let’s try a few examples:

E.g.  Water  **Rice**  Cupboard  **Spoon**
E.g.  **Happy**  Sad  Mask  Letter
E.g.  **Lovely**  **Beautiful**  Naught  Tall
E.g.  **Mouth**  Chair  **Nose**  Cow

<p>| | | | | |</p>
<table>
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<tr>
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<td>Bush</td>
<td><strong>Sand</strong></td>
<td>Sky</td>
<td><strong>Beach</strong></td>
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<td>3)</td>
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<td>Oven</td>
<td>Telescope</td>
<td><strong>Flute</strong></td>
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<td>Belt</td>
<td>Branch</td>
<td><strong>Palm</strong></td>
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<td>5)</td>
<td>Smooth</td>
<td><strong>Tough</strong></td>
<td>Damp</td>
<td>Easy</td>
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<td>6)</td>
<td>Jogging</td>
<td>Listening</td>
<td>Washing</td>
<td><strong>Crawling</strong></td>
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<td>7)</td>
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<td>Develop</td>
<td>Complain</td>
<td>Stammer</td>
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<td>Investigations</td>
<td>Directions</td>
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<td>9)</td>
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<td>Injection</td>
<td>Calculation</td>
<td>Introduction</td>
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<td>10)</td>
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<td>Wide</td>
<td><strong>Empty</strong></td>
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<td>Rare</td>
<td><strong>Spacious</strong></td>
<td>Cramped</td>
<td>Fake</td>
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<td>12)</td>
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<td><strong>Dawn</strong></td>
<td>Flood</td>
<td>Blossom</td>
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<td>Genuine</td>
<td>Modern</td>
<td>Fortunate</td>
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<td>14)</td>
<td>Gather</td>
<td><strong>Persuade</strong></td>
<td>Offend</td>
<td>Discourage</td>
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<td><strong>Loyal</strong></td>
<td>Elegant</td>
<td>Faithful</td>
<td>Swift</td>
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<td><strong>Obstruct</strong></td>
<td>Scatter</td>
<td><strong>Hinder</strong></td>
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<td>Peculiar</td>
<td><strong>Ample</strong></td>
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<td><strong>Purposely</strong></td>
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冯典 D: Mandarin Paradigmatic (Semantics) Task

华文语义活动

在这个活动中，每一个题目都会出现 4 个词。请圈出两个最有关连的词。

例：
1. 上衣 电脑 青菜 裙子
2. 轮胎 汽车 鸭子 头发
3. 惊讶 开心 勇敢 伤心
4. 整齐 安静 干净 友善

| 1 | 风扇 | 白米 | 雨伞 | 洗衣机 |
| 2 | 泥土 | 船只 | 树根 | 白鞋 |
| 3 | 巴士 | 兵器 | 搭客 | 小纸袋 |
| 4 | 客厅 | 滑梯 | 房间 | 机场 |
| 5 | 遍布 | 抢先 | 整洁 | 礼让 |
| 6 | 祝贺 | 放弃 | 分离 | 坚持 |
| 7 | 强壮 | 杂乱 | 懂事 | 健康 |
| 8 | 好处 | 外头 | 优点 | 差别 |
| 9 | 高大 | 遥远 | 迟早 | 矮小 |
| 10 | 足够 | 紧张 | 明亮 | 安心 |
| 11 | 喜欢 | 讨厌 | 退后 | 摆放 |
| 12 | 角落 | 山坡 | 电影 | 平地 |
| 13 | 出现 | 欢迎 | 提醒 | 露面 |
| 14 | 炎热 | 假装 | 靠近 | 凉快 |
| 15 | 古怪 | 可爱 | 奇特 | 专注 |
| 16 | 骄傲 | 专心 | 洁净 | 自大 |
| 17 | 解开 | 收拾 | 商量 | 讨论 |
| 18 | 青年 | 软弱 | 老人 | 努力 |
| 19 | 转变 | 集合 | 分开 | 增加 |
| 20 | 遂起 | 勉强 | 建设 | 选购 |
Appendix E: English Reading Comprehension Task (Primary Three)

Passage 1

David felt a sharp pain in his tooth. He refused to see a dentist because he was afraid of an extraction. David’s mother became very angry and told him that the pain would worsen if he did not visit the dentist. However, it was only when the pain became unbearable that David decided to be brave.

While waiting for the dentist at the clinic, David’s hands were shaking. The told him that his tooth had to be removed and gave him an injection. David cried because he thought it would be very painful. The dentist comforted him, saying that he would feel nothing. To David’s surprise, it turned out to be almost true. Later, the dentist told him not to eat too many sweets and to brush his teeth the proper way.

1. Why did David not want to see a dentist?
   a) He did not want to be brave.
   b) He did not want to get an injection.
   c) He did not want his tooth removed.
   d) His mother was very angry with him. ( 

2. David finally went to the dentist because
   a) The pain in his tooth became worse.
   b) His tooth broke.
   c) He was afraid his mother would be angry.
   d) He was afraid the pain would worsen. ( )

3. When David’s tooth was removed, he
   a) was very surprised
   b) was in a lot of pain
   c) cried out loud
   d) did not feel much pain ( )

4. What do you think caused David’s toothache?
   a) He did not eat sweets.
   b) He did not brush his teeth.
   c) He did not visit the dentist for a long time.
   d) He did not brush his teeth in the correct way. ( )

5. Which word in the passage has the same meaning as ‘too much to endure’?
   a) Shaking
   b) Proper
   c) Unbearable
   d) Painful ( )
Passage 2

It was the start of the holidays. Jack and his friends planned to go to the park for a game of football. They were chatting happily when they saw a tall tree and decided to rest in the shade for a while.

Jack then saw a bird in the tree. He took a stone and aimed it at the bird but his friends stopped him. They told him that it was wrong to harm creatures but Jack ignored their advice and threw the stone at the bird. The stone missed the bird and it flew away in fright. Jack laughed aloud.

Jack stopped laughing when he heard a buzzing sound. He turned and saw a swarm of bees flying towards him. The stone must have hit a beehive! Jack stood motionless for a while before running away as fast as his legs could carry him. Breathless, he came to a pond and jumped into it. The bees then flew away and he escaped with a few stings. His friends helped him out of the pond reluctantly.

6. Why did Jack and his friends go to the park?
   a) They wanted to chat in the park.
   b) They wanted to go there to play.
   c) They wanted to rest in the shade.
   d) It was the start of the holidays. (d)

7. Why did Jack jump into the pond?
   a) He wanted his friends to help him.
   b) He did not want the bees to attack him.
   c) He wanted to escape from his friends.
   d) He ran too fast and fell into the pond. (b)

8. Why do you think Jack stopped laughing?
   a) He did not like the buzzing sound.
   b) The stone missed the bird and it flew away.
   c) He was being chased.
   d) He realized it was wrong to harm birds. (d)

9. The word ‘motionless’ means Jack
   a) had no expression on his face.
   b) was unable to use his hands because he was shocked.
   c) did not want to run away from the danger.
   d) could not move because of fear. (d)

10. Which word below describes Jack?
    a) Careless
    b) Unfriendly
    c) Bold
    d) Cruel (b)
Passage 3

Ten years ago, Redang Island was remote and home to less than one thousand people. Most of them lived in water villages in wooden huts built on sticks and fished for a living. Travel guidebooks cautioned tourists to stay away from the island because camping was the only way to spend the night there.

However, tourists no longer have to worry. Now there are many accommodation options all over the island, including beautiful beach resorts. There are also the cheaper hostels for travellers on a budget. Redang Island is now advertised as a place with lots to do, for both the young and the old, such as diving, sun-bathing, snorkeling and even dancing. No wonder Redang Island is rated as a popular tourist attraction because it is suitable for every type of traveller!

11. How did the villagers of Redang Island earn a living ten years ago?
   a) They lived in huts built on sticks.
   b) They provided camping trips for tourists.
   c) They lived in cheap hostels.
   d) They caught and sold fish.

12. Why are tourists to the island more comfortable nowadays?
   a) They can now camp on the island.
   b) They can now go sun-bathing.
   c) There are many places to stay.
   d) Redang Island is remote.

13. Why is Redang Island popular?
   a) There are many beach resorts.
   b) It is for all kinds of tourists.
   c) The village people are kind.
   d) It is for young people only.

14. What word in the passage has the same meaning as ‘warned’?
   a) Remote
   b) Advertised
   c) Rated
   d) Cautioned

15. Travellers on a budget are people who
   a) like to take part in many activities
   b) like to live in hostels
   c) Spend little money
   d) always travel
Passage 4

Have you ever had flu? If you have, you would know how miserable it can make you. You usually get a fever, a cough, feel very tired and may also have a sore throat. You often feel ill for a few days or even as long as a week. Sometimes, you may be confused about whether you have flu or a cold, but with flu, you usually have a worse fever. Flu is a type of virus, so medicine will only stop the symptoms such as the cough and fever, rather than cure you. For many children, flu just goes away but for others, it can become very serious.

Most children get the flu when the weather is wet and cold because they stay indoors where germs spread more easily. The best way to prevent the flu is to wash your hands often, keep your hands to yourself, and go to the doctor to get a flu injection.

16. How is flu different from a cold?
   a) Flu is not as serious as a cold.
   b) Flu just goes away but a cold does not.
   c) Your fever is not as high with a cold.
   d) Flu spreads more easily than a cold.

17. Why do most children get the flu in cold wet weather?
   a) The flu spreads easily when it is cold.
   b) Children do not wash their hands.
   c) There is no sun to kill the germs.
   d) Children do not go outside as much when it is cold and wet.

18. Which word in the passage has the same meaning as ‘feeling unhappy or uncomfortable’?
   a) Worse
   b) Miserable
   c) Tired
   d) Confused

19. What will taking medicine do when you have flu?
   a) It kills the virus.
   b) It makes your flu more serious.
   c) It makes your cough and fever better.
   d) It prevents the germs from spreading.

20. Which of the following would not help to prevent the flu?
   a) Wash your hands often
   b) Shaking the hands of your friends
   c) Getting a flu injection
   d) Keeping your hands to yourself
Joey held up an umbrella to try to shield herself from the rain but it was useless. She was soaked. Joey tried to tread carefully across the road because the surface was slippery. A car sped past her, splashing dirty water over her new shoes. She saw a black patch on her uniform and started to cry. Just then, she saw a dog charging towards her and it knocked her to the ground. She hurt her knee and could not get up.

Joey looked around for assistance. She could see her best friend, Tina across the street but did not call out to her. Last week, they had a big argument last week, so Joey was sure Tina would not help her.

As Joey was trying to get up, Tina ran over to help her. Joey started to cry again but now she was happy. That’s what friends are for!

21. How do you know it was raining very heavily?
   a) Joey used an umbrella.
   b) The ground was slippery.
   c) A car splashed water on Joe.
   d) Joey was soaked.  

22. Why was there a black patch on Joey’s uniform?
   a) She slipped and fell.
   b) She dirtied it with her tears.
   c) She dirtied it when a dog knocked her down.
   d) Water from a car dirtied it.  

23. Why did Joey not call out to Tina for help?
   a) Tina was too far away.
   b) Joey was too tired to call out to Tina.
   c) Joey was sure Tina would refuse to help her.
   d) Joey wanted assistance from another person.  

24. Which word in the passage has the same meaning as ‘protect against’?
   a) tread  
   b) shield  
   c) charge  
   d) sped  

25. Why did Joey cry a second time?
   a) She was very upset.
   b) Tina helped her even though they had a big argument.
   c) There was a dark patch on her uniform.
   d) Her knee was still hurting.  

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Appendix F: English Reading Comprehension (Primary Five)

Passage 1

The dolphin is a gentle mammal that has a special bond with man. Scientists have long been fascinated with the dolphin’s high intelligence and affinity with humans.

Unfortunately, the lives of dolphins have been threatened by man’s careless activities. Thousands of dolphins die each year because they suffocate while trying to break free from the nets cast by fisherman. For those that do not die in the nets, the fishermen kill them when they lift up the nets.

Despite that, there is no evidence to suggest that the dolphins have lost their faith in man. Every now and then, we hear tales of how loveable dolphins befriend shipwrecked victims.

It is known that dolphins are gregarious mammals. Being in a group is important for their survival. If one member of the school is not able to come to the surface, the others will support it with their bodies to help it come to the surface. Marine biologists believe that it is this same instinct that makes dolphins come to the aid of humans lost at sea.

1. Which of the following is used to describe dolphins in the passage?
   a) Special
   b) Careless
   c) Friendly
   d) Fascinating

2. Which of the following is the cause of deaths of dolphins every year?
   a) Dolphins not being able to swim to the surface
   b) Dolphins getting caught and killed by scientists in nets
   c) Lack of air as dolphins struggle to escape when caught
   d) Suffocation when dolphins try to rescue humans

3. What does the word ‘that’ in paragraph three refer to?
   a) Scientists studying dolphins
   b) Dolphins losing their faith in man
   c) Dolphins coming in contact with man
   d) Dolphins getting killed by man

4. ‘Dolphins are gregarious animals’ means that dolphins are
   a) are intelligent
   b) help one another
   c) like living with others
   d) are in danger of being killed

5. What is another word in the passage that has the same meaning as ‘bond’?
   a) Tales
   b) Faith
   c) Affinity
   d) Instinct
Passage 2

It has been a week since Jenny and her family relocated to England from Singapore. Father has started on his new job. Mother was excited to be here. At first, Jenny and her sister did not share her excitement. However, her sister seemed to have adjusted to her new environment and was enjoying herself in school now. Jenny decided to be brave and take the first step to get to know people.

Jenny sat patiently in her garden, waiting for someone to come along. A girl came walking hurriedly past her house. Jenny recognized her as she had seen the girl go past her house on a few occasions. Because of her petite frame, the girl had to stand on her toes so that Jenny could see her behind the fence. She gave Jenny a friendly wave. Jenny wanted to wave back but she did not feel as fearless as she did earlier. She smiled because the girl resembled Betty, her cheerful neighbour in Singapore.

Just like what she told herself the day before, Jenny said to herself: “I will make new friends tomorrow. I will definitely do it tomorrow!”

6. Why do you think Jenny’s family moved to England from Japan?
   a) Both Jenny and her sister wanted to do so.
   b) Jenny’s mother was excited to move to England.
   c) Jenny’s sister wanted to attend school in England.
   d) Jenny’s father had a job in England. ( )

7. The girl who walked past was petite. This means she was
   a) friendly   b) cheerful
   b) in a hurry   d) short ( )

8. How did Jenny feel when the girl waved to her?
   a) Patient   b) Fearless
   b) Excited   d) Unsure ( )

9. The girl was someone whom Jenny
   a) knew from Japan
   b) liked very much
   c) had seen for the first time
   d) did not know ( )

10. Why did Jenny find it difficult to make new friends?
    a) She did not like to make new friends.
    b) She kept putting it off.
    c) She was busy.
    d) Nobody wanted to be her friend. ( )
Passage 3

Tom went to a jungle deep in the Amazon to learn about spider monkeys. He trailed groups of these exotic animals every day, observing their way of life. **He was not armed** because he did not want the monkeys to think that he wanted to hurt them.

On one occasion, he sat on a branch of a tree about two metres above the ground, observing a group of monkeys take a rest and snack on fruit. After a couple of hours, Tom shifted to find a more comfortable sitting position. At this moment, he dropped his water bottle. He would not have been discovered if he had not let out a loud groan. The monkeys walked over to take a closer look. One of them climbed up the tree and sat down next to him. Both Tom and the monkey stared at each other, perhaps wondering why they looked so different.

11. **“He was not armed”** means that Tom
   a) did not want to hurt the monkeys
   b) did not have weapons with him
   c) was not prepared for any attacks
   d) lost his arms because of the monkeys

12. Tom climbed up onto the tree to
   a) get some rest
   b) escape from the monkeys
   c) get some fruit for the monkeys to munch on
   d) see the monkeys better

13. How did the monkeys discover Tom?
   a) He changed his sitting position.
   b) He dropped his water bottle.
   c) He made a noise.
   d) He moved a branch.

14. The monkeys were ____________ when they saw Tom.
    a) curious                      b) afraid
    b) delighted                   d) furious

15. After the monkey sat down beside Tom, it
    a) attacked him
    b) climbed up the tree
    c) thought Tom looked strange
    d) looked at Tom
Passage 4

Joseph was watching the animals. He watched the animals as they moved around in search for any grass or leaves that are able to survive in this piece of land that sees little rainfall. This was an area that Joseph had been to with the animals so many times that he stopped paying attention to where he was or what he heard. His thoughts wandered as he followed the animals.

It was only when he saw the pile of bones near an abandoned tent that he realized that he was in a new place. He could not believe his eyes. The bones were covered with picture drawings of strange-looking people and animals. Joseph stood very still as he stared at the drawings. He felt his heart racing. Who drew these pictures and what did they mean?

16. Where did the animals usually look for food?
   a) In a forest       b) In the grasslands
   c) On a mountain    d) In a desert

17. What was Joseph doing while he walked with the animals?
   a) Looking after the animals
   b) Wandering around
   c) Examining things
   d) Thinking about things

18. Joseph realized he was in a new place because of the
   a) Abandoned Tent
   b) Land
   c) Animals
   d) Bones

19. Why did Joseph stand very still?
   a) He stopped paying attention to where he was.
   b) His racing heart made him unable to move.
   c) He was lost as he was in a new place.
   d) He was astonished because what he saw.

20. This was an unusual day because of what Joseph
   a) Gave the animals
   b) Drew on the bones
   c) Discovered
   d) Felt
Passage 5

The puffer fish gets its name because it inflates itself when it gets disturbed or is taken out of water. It contains a toxin that can be fatal. However, many Japanese love to eat it. You have to pay a huge sum of money for a single puffer fish, or fugu in Japanese. You must also have a license to prepare this Japanese delicacy. Attending courses and writing exams are some things you have to do to obtain it.

21. Why is the puffer fish given such a name?
   a) It inflates when it is put in water.
   b) It contains a deadly toxin called puffer.
   c) It causes a person to puff up within a short time.
   d) It puffs up when irritated. (   )

22. What does ‘it’ in the last sentence refer to?
   a) A single puffer fish
   b) A huge sum of money
   c) A cooking course
   d) A license to prepare Fugu (   )
华文理解问答活动

篇章（一）
小美最不喜欢打针。小美最近发高烧，妈妈说小美得打针。小美听了，红着眼跟妈妈到医院去。

在医院里，一个小男孩又哭又闹。小孩的妈妈看到小美，说：“那个小妹妹真乖，你打针时也不该哭闹。”

男孩的个子比小美大。小美不服气，认为她的年纪不一定比他小。男孩说出他的生日日期。小美得意地笑了。

在一旁的妈妈说：“你现在知道了，你是小姐姐，打针时就不应该害怕。”小美点点头。

小男孩看到小美不害怕，就不好意思哭闹了。护士在为小男孩打针时，有一个更小的小女孩也来打针，小女孩的妈妈对她说：“你看，小哥哥都不哭……”

1. 妈妈为什么带小美到医院去？
   a) 小美害怕打针。
   b) 她要小男孩不哭闹。
   c) 小美受伤了，得打针。
   d) 小美病倒了，得打针。 ( )

2. 小美红着眼，她应该是
   a) 眼睛受伤了
   b) 生气地哭了
   c) 受伤所以哭了
   d) 害怕所以哭了 ( )
3. 小男孩为什么又哭又闹？
   a) 他不喜欢到医院。
   b) 他喜欢哭闹。
   c) 他不想打针。
   d) 他不是乖小孩。 （ ）

4. 小男孩的妈妈为什么以为小美没有小男孩大？
   a) 小妹不哭闹
   b) 小美说出她的生日。
   c) 小美也害怕打针。
   d) 小美长得比小男孩小。 （ ）

5. 小美为什么得意地笑了？
   a) 她不害怕打针。
   b) 小美很不服气。
   c) 小男孩的妈妈说小美很乖。
   d) 小美比小男孩大。 （ ）

6. 以下哪一个句子可以知道小男孩打针也不哭闹了？
   a) 你要像她，不哭不闹。
   b) 打针时就不应该害怕。
   c) 小美得意地笑了。
   d) 小哥哥都不哭。 （ ）
篇章（二）

明天就要考试了，今天我只好开夜车了。只见窗外一片黑暗。这时，睡神也到我的身上了。

妈妈在唱歌让弟弟妹妹睡觉。不久，他们一点声音也没有了。我一个人在灯下读书。忽然，墙上的钟响了十二声，我的双眼慢慢地合上了。我只好爬上床睡觉，但是却睡不着。

记得老师常常说：“平时要用功，考试时才不用抱佛脚！”现在我才明白这句话的意思，可是太迟了！

7. “我只好开夜车了”，表示作者
   a) 在灯下看书
   b) 读书读得很晚
   c) 在晚上开车
   d) 在晚上抱佛脚

8. “睡神也来到了我的身上。”这句话的意思是
   a) 作者很想睡觉
   b) 作者想睡但睡不着
   c) 作者去找睡神了
   d) 妈妈叫作者去睡觉

9. 从哪里可以看出作者很累？
   a) 钟响了 12 下，表示很晚了。
   b) 他上床后却睡不着。
   c) 他的双眼慢慢地合上。
   d) 他希望快点把书读完。
10. 为什么作者上床却没有睡觉？
   a) 他还没有抱佛脚。
   b) 明天要考试了。
   c) 他还没有准备好功课。
   d) 妈妈和弟妹没有发出声音。

11. “可是太迟了！”说明了什么？
   a) 作者抱不到佛脚。
   b) 作者考试不及格。
   c) 作者很着急。
   d) 作者很后悔。

篇章（三）
医学家李时珍的父亲是个医生，常常给人看病不收钱。李时珍从小受到父亲的影响，决心当医生。父亲一直反对，因为人们都看不起医生。李时珍没有改变决心，还是每天跟着父亲学习医术。

有一次，李时珍的父亲给一个人看病，想不出药方，像热锅上的蚂蚁。这时，李时珍说出了一个药方。病人用了这个药方，很快就好了起来。因为这件事，父亲同意让李时珍完成心愿。

后来，李时珍为人看病。但是，他发现医书里有很多错误，很多药物也没有记上去，所以他用了27年的时间，整理出了《本草纲目》这本医书。

12. 李时珍为什么要当医生？
   a) 当时的人看不起医生。
   b) 他想要出名。
   c) 他要给有钱人看病。
   d) 他的父亲是一名医生。
13. 李时珍的父亲为什么感到着急?
   a) 李时珍说出了一个药方。
   b) 他不想李时珍当医生。
   c) 他不知道应该开什么药方。
   d) 他就像热锅上的蚂蚁。（  ）

14. 李时珍为什么会写《本草纲目》?
   a) 他开始为病人看病。
   b) 他想用 27 年整理医书。
   c) 他发现没有人写医书。
   d) 医书记的不完整，错处也多。（  ）

15. 你觉得李时珍是个怎么样的人？
   a) 什么事都拿不定注意的人
   b) 做什么事都非常不小心的人
   c) 做了决定，就不会改变的人
   d) 看不起没有钱的人的医病（  ）

篇章（四）

英国报纸在 2014 年对 131 国家进行调查，发现全球生活费（fei）最高的城市是新加坡，最低的是印度的孟买。

亚洲国家中，香港排名第 13，中国上海排名 21。去年最高生活费的城市，日本东京，今年排名掉到了第 6 名。

16. 生活费最低的是什么城市？
   a）新加坡  b）上海
   c）东京  d）孟买（  ）
17. 2013年生活费最高的城市是
   a) 新加坡  b) 孟买  c) 香港  d) 东京  

篇章（五）

一个非常喜欢吃水果的商人叫工人去买苹果。他对工人说：“不要到市场买苹果，我只喜欢吃果园的苹果。你要买甜的苹果。如果买回来的苹果都是甜的，我就送你一份大礼物。”

来到果园，园主说：“这里的苹果都是甜的，不信的话你试一个看看。”

工人想说只试一个，怎么知道其他的苹果甜不甜呢？于是，工人每采一个苹果，就咬一口。果然，园主说的都是真的，工人就把试过的苹果的都买回去。他心想：那份大礼物我是拿定了!

商人看到苹果，气得话都说不出来。

18. 商人叫工人
   a) 去买礼物。  b) 到果园吃水果。  c) 买甜的苹果。  d) 到市场买水果。  

19. 文中说到园主说的都是真的。园主说的什么话是真的？
   a) 商人喜欢吃果园的水果。  b) 果园的水果比市场的甜。  c) 工人可以试果园的水果。  d) 果园的水果都是甜的。  

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20. 工人为什么要试每一个水果？
   a) 他不相信园主的话。
   b) 他最喜欢吃苹果了。
   c) 商人叫他这么做。
   d) 园主不喜欢说真话。 ( )

21. 为什么商人气得说不出话来？
   a) 买回来的苹果都不甜。
   b) 他不喜欢果园的苹果。
   c) 苹果都被工人咬了。
   d) 他得给工人一份大礼物。 ( )

22. 工人是一个怎么样的人？
   a) 贪小便宜          b) 自以为聪明
   c) 机灵懂事        d) 乐于助人 ( )
华文理解问答活动

篇章（一）

下午，小明放学回家，看见地上有个钱包。一个青年说是他的，一个女士也说钱包是她的。

两个人争吵起来，小明这下可为难了。他灵机一动，问他们钱包里有多少张信用卡。两人都说不记得。

小明突然大喊了一声：“警察叔叔，快到这里来！”

两人听了，马上溜走了。原来钱包里没有名片。当然，警察叔叔也不会这么巧在这个时候出现。小明到了警察局把钱包交给警察。

1. “小明这下可为难了”意思是
   a) 他担心那两个人会对付他
   b) 他不知道怎么把钱包里的钱分给两人。
   c) 他不知道怎么让他们不吵。
   d) 他不知道应该把钱包给谁。

2. 小明问钱包里有几张名片，是
   a) 要为难他们
   b) 要他们说出钱包里有什么
   c) 要找出谁是钱包的主人
   d) 想让他们不要再争吵

3. 钱包最后______________。
   a) 回到了它的主人手上
   b) 被小明收了起来
   c) 被路过的警察拿走了
   d) 被交到警察局
4. 那两个人是___________
   a) 胆小的人
   b) 态度不好的人
   c) 不诚实的人
   d) 凶恶的人

5. 小明能解决问题主要靠的是
   a) 经验
   b) 胆量
   c) 耐心
   d) 机灵

6. 你会怎么形容小明?
   a) 不怕麻烦
   b) 观察力强
   c) 做事有条理
   d) 聪明诚实

篇章（二）
一天，我和表哥在小贩中心吃午餐时，看到一个女士坐在轮椅上请路人买纸巾。可是，很多人都当她是透明的，匆匆地走开。当那名女士过来时，我从口袋里拿出了几块钱给她，可是她不收。我只好拿了一包纸巾，再给她钱。表哥告诉我，女士家里很穷，所以年纪很小就放弃学业去工作养家。有一天，她为了救一个小女孩，双腿被车撞断了，从此只好靠卖纸巾维持生活。

7. 很多人看到女士的反应是
   a) 害怕
   b) 同情
   c) 不理她
   d) 不好意思
8. 那个女士为什么坐在轮椅上？
   a) 她要别人同情她。
   b) 她从小就有病。
   c) 他故意被车撞。
   d) 她发生了车祸。

9. 那名女士什么值得我们学习？
   a) 赚钱养家
   b) 认真工作
   c) 舍己为人
   d) 不爱钱

篇章（三）

在韩国，老年人可以免费坐地铁。送货公司就想到请这些老年人来送货。请老人的送货公司越来越多，目前已经有300多名老人每天负责配送物品。

76岁的金顺子奶奶就是其中一个员工。她说自己不知道还能活多久，希望孩子能从她的身上学到人生最重要的是把握时间做有意义的事，为社会出力，而不是什么都只是为了赚钱而已。

10. 为什么送货公司会请老年人？
   a) 他们免费送货
   b) 他们免费工作
   c) 他们免费坐地铁
   d) 他们免费开车

11. 金顺子奶奶希望孩子知道人生最重要的是
   a) 好好赚钱
   b) 活得久一点
   c) 活得有意义
   d) 免费坐地铁
12. 老人送货这个想法受欢迎吗？
   a) 不受欢迎，没有老人在送货
   b) 不受欢迎，老年人不想赚钱
   c) 受欢迎，老人想赚钱
   d) 受欢迎，很多老人在送货

篇章（四）

我八岁时，妈妈每天早上都带我到外面跑步。我哭闹着不想去，但她不听。难道妈妈不知道运动对我这种体重过重的小孩来说是一种痛苦吗？我的妈妈真狠心！

十岁时，我和妈妈出去玩。我请她帮我背书包，她不答应。我跌倒了，妈妈只是叫我自己爬起来，说完头也不回地往前走，留我一个人坐在那里。我的妈妈好狠心！

三十岁的我发现母亲当年的狠心，让我练出了健康的身体，让我学会了坚强、不靠别人的道理。

13. 作者八岁时觉得妈妈带他跑步是因为
   a) 妈妈喜欢跑步
   b) 妈妈想让他练出健康的身体
   c) 妈妈要看到他痛苦
   d) 妈妈喜欢到外面去

14. 小时候的作者是一个
   a) 坚强的孩子
   b) 健康的孩子
   c) 爱哭闹的孩子
   d) 过胖的孩子
15. 作者跌倒后，妈妈做了什么？
   a) 她向前走，不理会作者
   b) 她看作者爬起来，再往前走
   c) 她让作者不靠别人爬起来
   d) 她把作者扶起来

16. 三十岁的作者会怎么形容妈妈？
   a) 喜欢伤害别人的人
   b) 狠心的妈妈
   c) 爱孩子的好妈妈
   d) 不理孩子的妈妈

篇章（五）

下雨了。妈妈心想：他今天上班又没带伞。妈妈总认为爸爸记忆力不好。一次，妈妈出门前提醒爸爸好几遍，回到家却发现爸爸还是忘了把院子里的树叶清理干净。

门铃响了。会是谁呢？门开了，先是一张湿淋淋的脸，又出现了一双湿透的鞋子，原来爸爸回来了。

妈妈以为爸爸忘了带雨伞，但爸爸却说：“女儿告诉我你生病了，我赶回来看看。”妈妈听了，没说什么，但是露出了欢喜的神情。

17. 妈妈认为爸爸是一个
   a) 善良的人
   b) 努力的人
   c) 急着的人
   d) 健忘的人
18. 爸爸回家的原因是
   a) 他要带妈妈看医生
   b) 他要回家清理树叶
   c) 妈妈生病了
   d) 他要回来拿雨伞

19. 文中“先是一张湿淋淋的脸，又出现了一双湿透的鞋子”，说明
   a) 爸爸刚冲好凉
   b) 爸爸的没擦干脸和鞋子
   c) 爸爸赶回家弄湿了
   d) 爸爸被大雨淋湿了

20. 这个故事主要说什么道理？
   a) 下雨时要带雨伞
   b) 家人要互相关心
   c) 我们要记得做应该做的事
   d) 家人要回家照顾病人
Appendix I: English Morphological Task (Derivations)

For this activity, please change the word given to fit the sentence and. Two examples are given below.

1. **Teach**
   He was a very good _________. (teacher)

2. **Improvement**
   My mother wants my spelling to ___________________. (improve)

<table>
<thead>
<tr>
<th>Target</th>
<th>Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability</td>
<td>She is ________ to come to the party.</td>
</tr>
<tr>
<td>2. Afford</td>
<td>This is an ________ television.</td>
</tr>
<tr>
<td>3. Wise</td>
<td>He is a man of __________.</td>
</tr>
<tr>
<td>4. Permit</td>
<td>Her father refused to give __________.</td>
</tr>
<tr>
<td>5. Division</td>
<td>The cake is hard to _________.</td>
</tr>
<tr>
<td>6. Respect</td>
<td>My sister is always ________ towards her elders.</td>
</tr>
<tr>
<td>7. Swim</td>
<td>She was a good __________.</td>
</tr>
<tr>
<td>8. Mystery</td>
<td>The dark glasses made the man look __________.</td>
</tr>
<tr>
<td>9. Angry</td>
<td>She showed her ________ when she heard the news</td>
</tr>
<tr>
<td>10. Strange</td>
<td>He is a ________.</td>
</tr>
<tr>
<td>11. Acceptance</td>
<td>Is this an offer that you can ____________?</td>
</tr>
<tr>
<td>12. Deep</td>
<td>The __________ of the water is 1 metre.</td>
</tr>
<tr>
<td>13. Strength</td>
<td>The girl is very ________.</td>
</tr>
<tr>
<td>14. Dangerous</td>
<td>She is in a lot of ________.</td>
</tr>
<tr>
<td>15. Active</td>
<td>My favourite ________ is playing basketball.</td>
</tr>
<tr>
<td>16. Useful</td>
<td>They ________ straws to drink water.</td>
</tr>
<tr>
<td>17. Excessive</td>
<td>He spent the ________ money.</td>
</tr>
<tr>
<td>18. Production</td>
<td>Cows ________ milk.</td>
</tr>
<tr>
<td>19. Perform</td>
<td>This is the last ________.</td>
</tr>
<tr>
<td>20. Criminal</td>
<td>He was arrested for committing a _________.</td>
</tr>
</tbody>
</table>
Appendix J: Mandarin Morphological Task (Morphological Analogy)

华文语素活动

1. 太阳升起叫做日出，那如果月亮升起，我们叫它什么？
2. 住在很深的海里的鱼叫深海鱼，住在很深的河里的鱼叫什么？
3. 头痛时吃的药是头痛药，那手痛的时候吃的药是什么药？
4. 戴在手上的表叫做手表，那戴在头上的表叫什么？
5. 长在树上的叶子叫树叶，那长在树上的瓜叫什么？
6. 放在桌子上的灯叫桌灯，那放在床上的灯叫什么？
7. 用来洗衣服的机器叫洗衣机，那用来洗鞋的机器叫什么？
8. 用动物的皮做的鞋子叫皮鞋，那用动物的毛做的鞋子叫什么？
9. 用来插花的瓶子叫花瓶，那用来插花的锅叫什么？
10. 给车加汽油的地方叫加油站，那给车加水的地方叫什么？
11. 有一种炮往高处射炮弹叫高射炮，那往低处射炮弹的叫什么？
12. 头很胖的鱼叫胖头鱼，那头很胖的鸭子叫什么？
13. 下雨时用的伞叫雨伞，那打雷的时候用的伞叫什么？
14. 用来装饭的盒子叫饭盒，用来装饭的袋子叫什么？
15. 在马路洒水的车叫洒水车，那在马路洒花的车叫什么？
Appendix K: Language Background Questionnaire

Dear Parents: Thank you for allowing your child to participate in our study. Please take a few minutes to fill out this questionnaire, as it will greatly assist our research. All the information provided by you will be kept confidential and will NOT be released without your permission.

敬爱的家长：非常感谢您让您的孩子参与这项研究。请您花几分钟的时间完成以下的问卷。您的回馈将对我们的研究有极大的帮助。您所提供的答案将会绝对保密。

Your child’s name (您的孩子的名字) ____________________________

Your relationship with your child (您与您的孩子的关系):

Father (父亲) Mother (母亲) Others (其他): ______________________

If you are/your spouse is not a Singaporean, what is your nationality (如果您/您的伴侣不是新加坡人，请填入您的国籍)？ ____________________________

If your child is not a Singaporean, what is his/her nationality (如果您的孩子不是新加坡人，请填入他/她的国籍)？ ____________________________

Has your child lived in another country for some time? If yes, where and how long was that for (您的孩子有在新加坡以外的地方生活过一段时间吗？如果有，他在那里生活多久呢?)

________________________________

Housing type (住所):

☐ HDB 1-3 Room (一至三房政府组屋) ☐ HDB 4 Room (四房政府组屋)
☐ HDB 5 Room/Executive Flat/Mansionette (五房政府组屋/公寓) ☐ Private Housing (私人住屋)
☐ Others (其它) ____________________________

Mother’s highest education level (母亲最高学历):

☐ Primary school graduate (小学毕业) ☐ Bachelor’s degree (大学毕业)
☐ Secondary school graduate (中学毕业) ☐ Master’s/Ph.D. (硕士/博士)
☐ Diploma/ITE (理工学院/工艺学院毕业) ☐ Others (其它): ____________________________
Father’s highest education level (父亲最高学历):

- Primary school graduate (小学毕业)
- Secondary school graduate (中学毕业)
- Diploma/ITE (理工学院/工艺学院毕业)
- Bachelor’s degree (大学毕业)
- Master’s/Ph.D. (硕士/博士)
- Others (其它): ______________

How many hours per week does your child spend on watching TV or videos in Mandarin and in English?

您的孩子每个星期大概花多少小时观看中英文电视/影片?

**English (英文):**
- 0-5 hours /小时
- 6-10 hours /小时
- >10 hours /小时

**Mandarin (华文):**
- 0-5 hours /小时
- 6-10 hours /小时
- >10 hours /小时

Approximately how many children’s books do you have around the house in Mandarin and in English?

您家里有多少中英文书籍?

**English (英文):**
- 0 – 20
- 21 – 50
- 51 – 100
- >100

**Mandarin (华文):**
- 0 – 20
- 21 – 50
- 51 – 100
- >100

What languages do you use? (你平常使用什么语言?)

Please tick the language(s) that you use, and tick how much of the time you use this language.

请在说明你平时使用的语言的格子以及说明使用频率的格子里打勾。

---

<table>
<thead>
<tr>
<th>My spouse speaks with my child in</th>
<th>All the time</th>
<th>Most of the time</th>
<th>Half the time</th>
<th>Less than half the time</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>百分百</td>
<td>多数时间</td>
<td>一半时间</td>
<td>很少</td>
<td>从来没有</td>
</tr>
<tr>
<td>English 翻译</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandarin 翻译</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others 其它</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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I speak with my child in
我与我的孩子对话时使用

<table>
<thead>
<tr>
<th></th>
<th>All the time</th>
<th>Most of the time</th>
<th>Half the time</th>
<th>Less than half the time</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandarin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Please rank the languages that your child speaks according to how well he/she speaks that language. 请将您的孩子会说的语言按照他/她的流利度排列出来（排列顺序（1）的语言为您的孩子最流利/擅长使用的语言，（2）为第二流利的语言，以此类推）。

<table>
<thead>
<tr>
<th>Rank</th>
<th>Language</th>
<th>Age of exposure</th>
<th>Poor</th>
<th>Average</th>
<th>Very good</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Thank you! 谢谢!