VOCABULARY SKILL OF BILINGUAL ADOLESCENTS AND YOUNG ADULTS:
THE EFFECTS OF FIRST LANGUAGE BACKGROUND AND LANGUAGE LEARNING
CONTEXT

by

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This thesis investigated the vocabulary skill of bilingual adolescents and young adults with two studies. Study 1 examined the contributions of English phonological awareness and morphological awareness to English vocabulary in 80 Spanish-English and 117 Chinese-English bilingual adolescents educated in Canada. Using Structural Equation Modelling, the study showed that English derivational awareness, word reading and length of residence contributed to English vocabulary for both language groups. In addition, for the Chinese-English bilingual group, English phonological awareness contributed to English vocabulary both directly and indirectly through the mediation of English word reading. Study 2 compared the contributions of Chinese compound awareness and homograph awareness to Chinese vocabulary between Chinese L1 young adults educated in China and in Canada. Participants included 96 and 66 first-year university students in China and Canada, respectively. Using hierarchical regression analyses, Study 2 showed that Chinese homograph awareness and character reading contributed to Chinese vocabulary for both groups of Chinese L1 young adults; however, the contribution of
Chinese compound awareness was not significant. The association of Chinese homograph awareness with Chinese vocabulary was not significantly different between the two groups, whereas the association of Chinese character reading with Chinese vocabulary was stronger for the Chinese L1 young adults in China. Overall, the thesis highlights the importance of morphological awareness to vocabulary across English and Chinese for older students.
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Chapter 1: Introduction

Rapid globalization has led to an increasing demand for fluency in more than one language (Zhao, 2009) so that promoting bilingualism or multilingualism becomes crucial. For bilingual adolescents, having adequate language and literacy skills in both their first language (L1) and second language (L2) not only helps to fulfill educational expectations required in the majority language but also enhances career mobility beyond the local environment. This thesis focuses on language and literacy skills of two bilingual groups: Spanish-English bilingual adolescents and Chinese-English bilingual adolescents. Specifically, the thesis aims to investigate the vocabulary skill of the two groups. The primary goal is to examine English as a L2 vocabulary skill for the two groups of bilingual adolescents. This goal is of research interest because the two bilingual groups have different L1 writing systems---Spanish is alphabetic whereas Chinese is morphosyllabic (Lam, Chen, Geva, Luo & Li, 2012). The secondary goal of the thesis is to examine Chinese L1 vocabulary skill for Chinese L1 young adults. Thus, the thesis is about L2 vocabulary skill for bilingual adolescents and L1 vocabulary skill for young adults.

In spite of the advantages of being bilingual, it is not a simple task for adolescents to maintain the development of both L1 and L2. In particular, August and Shanahan (2006) stated that vocabulary skill is important for comprehending advanced texts in higher grades. Oller, Pearson and Cobo-Lewis (2007) found that bilingual speakers’ “total” vocabulary size (words known in both their L1 and L2 and words known in one language only) exceeds that of monolingual speakers. However, the size of L2 vocabulary in bilingual speakers tends to be lower than that of monolingual speakers. Students with English as L2 have been found to have difficulty in developing the vocabulary required to comprehend advanced texts (August, Carlo,
Dressler, & Snow, 2005; August & Shanahan, 2006; Geva, 2006). Thus, it is critical to support vocabulary development in bilinguals. The existing literature suggests that metalinguistic and reading skills are important for vocabulary development in bilinguals, in L1 (McBride-Chang, Cheung, Chow, Chow, & Choi, 2006; McBride-Chang, Tardif et al., 2008) as well as in L2 (Carlo et al., 2004; Cheung et al., 2010; Cunningham & Stanovich, 1997).

Specifically, scholars have recognized that phonological awareness and morphological awareness are two aspects of metalinguistic awareness that are key elements for developing vocabulary (Anglin, 1993; Fowler, 1991; Metsala & Walley, 1998; Nagy & Anderson, 1984). Phonological awareness refers to one’s ability to access and manipulate the sound structure or any phonological unit in words (Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997). Morphological awareness refers to one’s ability to reflect on and manipulate morphemes, the smallest unit of meaning at word level, and to understand and manipulate word formation rules (Carlisle, 1995). Focusing primarily on monolingual English speakers, previous studies have reported that phonological awareness (e.g., Bowey, 1996, 2001; Metsala, 1999) and morphological awareness (Bowers & Kirby, 2010; Carlisle, 2000; Carlisle & Fleming, 2003; Nagy, Berninger, & Abbott, 2006; Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003) are robust predictors of both receptive and expressive vocabulary across different ages and grade levels.

Two studies are reported in this dissertation. The first study compares the contributions of phonological awareness and morphological awareness to vocabulary skill in English as L2 learners between Spanish-English and Chinese-English bilingual adolescents living in Ontario Canada, an English-language-dominant environment. The second study investigates how phonological awareness and morphological awareness are related to Chinese (L1) vocabulary
skill for young adults in Canada, an English (L2) schooling environment and in China, a Chinese (L1) schooling environment. Together, these two studies examine how phonological awareness and morphological awareness contribute to the L2 vocabulary skill of bilingual adolescents from two different L1 backgrounds, and to the same L1 vocabulary skill of young adults who received schooling in different languages.

This thesis includes ten chapters. Chapter 2 presents the rationale of the first study. It includes an overview of the characteristics of English phonological and morphological structure, a review of relevant theories or models in English phonological awareness, morphological awareness, word reading and vocabulary, and a summary of empirical evidence on the association of phonological awareness and morphological awareness with word reading and vocabulary in English. Chapter 3 provides a detailed description of the method of Study 1, including the characteristics of participants and the specification of measures and testing procedures. The results and discussion of Study 1 are reported in Chapters 4 and Chapter 5, respectively. The rationale of Study 2 is established in Chapter 6. The chapter provides an overview of the characteristics of Chinese morphological structure, a review of relevant theories or models in Chinese word reading and vocabulary, and a summary of empirical evidence on the association of phonological awareness and morphological awareness with word reading and vocabulary in Chinese. Chapter 7 provides a detailed description of the method of Study 2, including the characteristics of participants and the specification of measures and testing procedures. The results and discussion of Study 2 are reported in Chapter 8 and Chapter 9, respectively. Lastly, to conclude this thesis, Chapter 10 is a general discussion of the findings with regard to their theoretical and educational implications.
Chapter 2: Study 1 – English Vocabulary for Spanish-English and Chinese-English Bilingual Adolescents

According to the model of “The Simple View of Reading” (Gough & Tunmer, 1986; Hoover & Gough, 1990), successful reading comprehension depends on two equally important skills: 1) decoding, the ability to read words or pseudowords with implied access to the phonological form, and 2) listening comprehension, the ability to understand oral sentences or discourse with vocabulary knowledge, morphological awareness and syntactic awareness. These two skills are relatively independent for older learners. In this model, vocabulary knowledge is the main component underlying listening comprehension. As children grow older, vocabulary plays an increasingly important role in reading comprehension. Braze, Tabor, Shankweiler and Mencl (2007) found that for English language learners (ELLs) ages 16 to 24 years, after controlling for speech sentence comprehension and decoding skills, vocabulary knowledge significantly predicted reading comprehension. Vellutino, Tunmer, Jaccard and Chen (2007) reported that for native English speakers, vocabulary knowledge was a more important determinant of reading comprehension in Grades 6 and 7 than in Grades 2 and 3. In light of the critical role of vocabulary for older students, the first objective of my thesis was to investigate the contributions of phonological awareness and morphological awareness to vocabulary skill in Spanish-English bilingual adolescents and Chinese-English bilingual adolescents.

What is Phonological Awareness?

Phonological awareness refers to one’s ability to identify or manipulate the sound structure or any phonological unit in words (Torgesen et al., 1997). Phonological awareness consists of three levels (Blachman, 2000; Treiman & Zukowski, 1991). Syllable awareness is
the awareness that spoken words are composed of syllables. Onset and rime awareness is the recognition that a syllable can be divided into an onset and a rime. In a syllable, the onset is the initial consonant(s) that precede the vowel and the rime includes the vowel and remaining consonants. For instance, the word *pumpkin* has two syllables: *pump* and *kin*. For the syllable *pump*, /p/ is the onset and /ump/ is the rime. For the syllable *kin*, /k/ is the onset and /in/ is the rime. That is, the bisyllabic word *pumpkin* has two onsets and two rimes. Phoneme awareness is the ability to segment a syllable into a sequence of phonemes, which are the smallest units of speech. For instance, in the monosyllabic word *blind*, the onset is /bl/ and the rime is /ind/, and the five phonemes are /b/, /l/, /i, /n/ and /d/. Development of phonological awareness naturally follows the sequence from large to small phonological units such that syllable awareness precedes awareness of onset and rime, which in turns precedes phoneme awareness (Anthony & Lonigan, 2004; Ho & Bryant, 1997a; McBride-Chang & Kail, 2002; Shu, Peng, & McBride-Chang, 2008; Ziegler & Goswami, 2005). Across different languages, the developmental onset of phonological awareness is subjected to the phonological complexity of the language (Ho & Bryant, 1997a; McBride-Chang, Bialystok, Chong, & Li, 2004; McBride-Chang et al., 2006; McBride-Chang, Cho et al., 2005; Ziegler & Goswami, 2005). For example, Ho and Bryant (1997c) found that although native-Chinese speaking children and native-English speaking children develop syllable awareness around the same age, native-Chinese speaking children lag behind in developing onset and rime as well as phoneme awareness.

**The Role of Phonological Awareness in Word Reading**

Compelling evidence has shown that phonological awareness is a primary mechanism underlying word reading in alphabetic languages (Adams, 1995; Stanovich, 1986; Wagner & Torgesen, 1987). Research involving monolingual English-speaking students has shown that
phonological awareness is a robust predictor of word reading from senior kindergarten through elementary grades (Carlisle & Normanbhoy, 1993; Cutting & Denckla, 2001; Deacon, 2012; Gottardo, Stanovich, & Siegel, 1996; McBride-Chang, Cho et al., 2005; McBride-Chang & Kail, 2002; Singson, Mahony, & Mann, 2000; Torgesen et al., 1997). In a study conducted by Singson et al. (2000) with monolingual English-speaking students in Grades 3, 4, 5 and 6, phonological awareness measured with phoneme deletion was a significant predictor of word reading after controlling for morphological awareness and vocabulary. Similarly, Cutting and Denckla (2001) found that phonological awareness measured with phoneme deletion had a direct effect on word reading for monolingual English-speaking students in Grades 1, 2 and 3. Based on the longitudinal data collected from monolingual English-speakers, Torgesen et al. (1997) found that phonological awareness measured with phoneme deletion and segmentation and blending at Grades 2 and 3 significantly predicted word reading at Grade 5 for monolingual English speakers. Thus, the findings of research on English as the first language demonstrated that phonemic awareness is closely associated with word reading performance since early school years.

For Spanish-speaking students with English as L2, research has shown that English phonological awareness explains individual differences in English word reading from kindergarten to middle grades (Gottardo, 2002; Gottardo, Collins, Baciu, & Grebotys, 2008; Gottardo & Mueller, 2009; Manis, Lindsey, & Bailey, 2004; Nakamoto, Lindsey, & Manis, 2007; Ramirez, Chen, Geva, & Kiefer, 2010). Nakamoto et al. (2007) found English phonological awareness measured with sound matching and syllable and phoneme deletion at Grade 1 was related to the growth of English word reading of Spanish-speaking students from Grade 1 through Grade 6. Ramirez et al. (2010) reported that after controlling for grade,
nonverbal reasoning, working memory and vocabulary, phonological awareness measured with phoneme deletion was significantly predictive of word reading in Grades 4 and 7 for Spanish speaker. Finally, Gottardo et al. (2008) found that English phonological awareness measured with phoneme deletion and detection at Grade 1 was a significant predictor of English word reading at Grade 2 among Spanish-speaking children.

For Chinese L1 students with English as L2, English phonological awareness is related to the performance on English word reading across kindergarten, elementary grades and middle grades (Cheung et al., 2010; Gottardo, Chiappe, Yan, Siegel, & Gu, 2006; Gottardo, Yan, Siegel, & Wade-Woolley, 2001; Knell et al., 2007; Pasquarella, Chen, Lam, Luo, & Ramirez, 2011; Ramirez, Chen, Geva, & Luo, 2011; Wang, Anderson, Cheng, Park, & Thomson, 2008; Wang, Cheng, & Chen, 2006; Wang, Perfetti, & Liu, 2005). Gottardo et al. (2001) reported that English phonological awareness measured with phoneme deletion significantly predicted English word reading in Chinese ELLs from Grade 1 to Grade 8. Wang, Cheng et al. (2006) found that after controlling for age, grade level and English oral vocabulary, English phonological awareness measured with phoneme deletion was a significant predictor of English word reading for Chinese-speaking ELLs in grades 1, 2, 3, 4 and 5. Ramirez et al. (2011) reported that in spite of the different writing systems between Chinese and Spanish, for Chinese L1 students and Spanish L1 students in Grades 4 and 7, English phonological awareness measured with phoneme deletion was significantly predictive of word reading when nonverbal ability, age and vocabulary were controlled. Taken together, previous research has shown that phonological awareness is related to literacy achievement in English for students with English as L1 or L2; thus English phonological awareness is included as a measure of metalinguistic awareness for bilingual adolescents with English as L2 in my thesis.
The Role of Phonological Awareness in Vocabulary

Vocabulary knowledge plays a fundamental role in literacy development that contributes to success in high school and beyond (National Reading Panel, 2000). According to the Lexical Restructuring Hypothesis (Fowler, 1991; Metsala & Walley, 1998), beginning learners store newly acquired words as holistic phonological units. With time, learners gradually expand their vocabulary size. Increasing vocabulary stimulates phonological segmentation and facilitates the restructuring of their learned words. In other words, increasing vocabulary enhances the quality of phonological representations to a finer level in order to discriminate among words of similar phoneme representations. For instance, if a learner knows the words bag, bug, big, bib, dig, and wig, he or she is required for a fine-grained representation to learn the new word bit. Based on the hypothesis, a very fine level of phonological awareness may be strongly associated with increasing vocabulary knowledge.

On the other hand, the relation between English phonological awareness and English vocabulary knowledge could be reversed (McBride-Chang et al., 2006; Meador, Flege, & Mackay, 2000). Focused on native Chinese-speakers learning English as L2, McBride-Chang et al. (2006) emphasized that sensitivity to English phonology may be helpful for learning English vocabulary. Further, Meador et al. (2000) demonstrated that for Italian-English bilingual adults, L2 English communication experience in an English-speaking social context sensitized the perception of phonetic segments in English and this process directly linked to oral recognition of English words. Hence, for older non-English L1 students, English phonological awareness may be crucial for English vocabulary knowledge.

For monolingual English-speaking students, evidence has supported the role of phonological awareness in vocabulary at a young age (Bowey, 1996; Bowey, 2001; Metsala,
In a study conducted with English-speaking preschool children, Bowey (1996) found that after controlling for age, nonverbal intelligence and rhyme oddity, phoneme identity was significantly predictive of vocabulary skill. Metsala (1999) reported that for English-speaking children ages 4- and 5-years-olds, phoneme deletion and blending significantly predicted vocabulary skill after age and non-word repetition were controlled. Collected from longitudinal data on English-speaking children, Bowey (2001) reported that after controlling for the autoregressive effect vocabulary and nonverbal intelligence at age 5, phoneme identity at age 5 was a significant predictor of vocabulary skill one year later. Thus, research on native English speakers has supported the role of English phonological awareness in English vocabulary skill.

Research involving Spanish- and Chinese-speakers with English as L2 have reported that phonological awareness is strongly linked with vocabulary in kindergarten and early grades for both groups of children (Cheung et al., 2010; Gorman, 2012; Gottardo et al., 2008; McBride-Chang et al., 2006; San Francisco, Carlo, August, & Snow, 2006). For example, San Francisco et al. (2006) observed that for Spanish ELLs in kindergarten and Grade 1, English vocabulary was a significant predictor of English phonological awareness measured with phonemic segmentation. In their study that compared Spanish ELLs who had consistently average performance on English vocabulary with Spanish ELLs who had consistently low performance on English vocabulary in first and second grades, Gottardo et al. (2008) reported that English phonological awareness measured with phoneme deletion and detection at Grade 1 significantly predicted English vocabulary at Grade 2 for both groups. With respect to Chinese-speaking children, McBride-Chang et al. (2006) reported that after controlling for age and English word reading, English phonological awareness measured with syllable and phoneme deletion was a significant predictor of English vocabulary for Chinese kindergarteners. Cheung et al. (2010)
found that for Chinese ELLs in kindergarten and Grades 2 and 4, phonological awareness measured with syllable and phoneme deletion was a significant predictor of vocabulary after age and nonverbal intelligence and morphological awareness were accounted for. Thus, although Spanish and Chinese are represented by different writing systems, research involving Spanish and Chinese L1 students has demonstrated that English phonological awareness significantly predicts individual difference in English vocabulary for both groups.

**What is Morphological Awareness?**

Morphological awareness refers to the ability to reflect on and manipulate morphemes, the smallest phonological unit with meaning, and to construct and comprehend morphologically complex words (Carlisle, 1995; Kuo & Anderson, 2006). Across different languages, morphologically complex words are formed through processes of inflection, derivation, and compounding (Kuo & Anderson, 2006). Thus, the construct of morphological awareness is multifaceted that includes inflection awareness, derivational awareness and compound awareness. Carlisle (2003) maintains that morphologically complex words can be decomposed into morphemes that facilitate not only meaning construction but also pronunciation and spelling. According to Mahony, Singson and Mann (2000), morphemes include semantic, phonological as well as syntactic properties; this multifaceted feature of morphemes echoes Carlisle’s (1995) view that morphological awareness may have more metalinguistic capability in predicting vocabulary and reading outcomes than phonological awareness or syntactic awareness. As children grow older, they develop more advanced morphological awareness, which enables them to become better readers (Carlisle, 1987; Templeton & Scarborough-Franks, 1985).
Morphological Awareness in English

Inflectional morphology refers to a process of attaching an inflectional morpheme in the form of a suffix to a word stem required by the syntax such that the meaning and syntactic property of the word remain the same in this process (Carlisle, 1995, 2000, 2003). In English, inflectional suffixes can be added as markers for tense (e.g., \( \text{jump} \rightarrow \text{jumped} \)), for person (e.g., \( \text{I like} \rightarrow \text{he likes} \)), for number (e.g., \( \text{one pen} \rightarrow \text{two pens} \)), for possessive pronoun (e.g., \( \text{your} \rightarrow \text{yours} \)), and for comparative adjective (e.g., \( \text{slow} \rightarrow \text{slower} \)). With respect to development, Kuo and Anderson (2006) observed that English speakers typically acquire inflectional words prior to the beginning of formal literacy instruction.

Derivation involves a word formation process that changes meaning or syntactic property of a word stem, and in English this process involves adding a prefix to a word stem (e.g., \( \text{play} \rightarrow \text{replay} \)) or a suffix to a word stem (e.g., \( \text{success} \rightarrow \text{successful} \)) (e.g., Carlisle, 1987, 2003; Carlisle & Stone, 2005). Prefixing produces a derived word of different meaning from a word stem without changing its syntactic category (verb-to-verb: \( \text{write} \rightarrow \text{rewrite} \)). On the other hand, suffixing in many cases forms a derived word of different meaning as well as of different syntactic category from a word stem (e.g., adjective-to-noun: \( \text{sick} \rightarrow \text{sickness} \); noun-to-adjective: \( \text{operation} \rightarrow \text{operational} \); verb-to-adjective: \( \text{wash} \rightarrow \text{washable} \); verb-to-noun: \( \text{teach} \rightarrow \text{teacher} \)).

Tyler and Nagy (1989) stated that derivational suffixes are categorized into two classes: neutral suffixes vs. non-neutral suffixes. Neutral suffixes (e.g., -\text{ness}, -\text{er}, -\text{ize}, or -\text{ment}) often attach to word stems which are free morphemes and do not cause any phonological shift of stress or vowel in the word stem to which they are added and generate words of meaning transparently related to the word stems. An example is \text{banker} and \text{bank}. In contrast, non-neutral
suffixes (-ity, -ify, -ous, or -ive) often attach to stems which are bound morphemes. For example, taking off the –ify in qualify fails to produce a word in its own right. Besides, non-neutral suffixes tend to cause phonological shift of stress or vowel in the stem to which they attach. An example is the pronunciation of familiar vs familiarity. Further, the meanings of words formed with non-neutral suffixes are often not transparently related to their stems. An example is audition vs audit. Nagy and Anderson (1984) and White, Sowell and Yanagihara (1989) have argued that a large number of the unfamiliar words in texts are relatively transparent derived words that can be decomposed and understood through morphological analysis. According to Nagy, Anderson, Schommer, Scott and Stallman (1989), in middle school, about 60% of the unfamiliar words are morphologically complex words that are sufficiently transparent in word structure and meaning.

According to Tyler and Nagy (1989), derivational awareness assumes three types of knowledge: relational knowledge, syntactic knowledge, and distributional knowledge. Relational knowledge is the ability to recognize the word stem of morphologically complex words and understand the relationship between the word stem and the suffix. For instance, teach is related to teacher but you is not related to youth. The researchers found that fourth graders developed some relational knowledge which continues to increase up to eighth grade. Syntactic knowledge refers to the insight into the change of word class with attached derivational suffixes. For instance, musician is a noun as the word is suffixed with -ian and criticize is a verb as the word is suffixed with –ize. Awareness of syntactic information is developed from mid-elementary grades until eighth grade (Carlisle, 2000; Mahony, 1994; Nagy, Diakidoy, & Anderson, 1993; Singson et al., 2000; Tyler & Nagy, 1989). Distributional knowledge is about the understanding of how suffixes are constrained by the syntactic category of word stem to
which they attach. For instance, *-ness attaches to adjectives but not to verbs, as a result, cleverness is a word in English while *eatness is not. This type of knowledge may not be acquired until late elementary grades (Ku & Anderson, 2003). Ramirez et al. (2011) reported that with maternal education as a covariate, Spanish-speaking ELLs and monolingual English-speakers in Grades 4 and 7 performed similarly in English derivational awareness, due to the fact that the syntactic and distributional properties of derivation are largely similar across English and Spanish.

Compounding is a word formation process of combining two or more morphemes in forms of root words to produce a new word (e.g., basketball) (e.g., Nagy & Anderson, 1984). In English, the morphemes of a new word could be from the same (e.g., noun + noun: cupcake) or different syntactic categories (e.g., verb + noun: cookbook; adverb + verb: downplay). Compound awareness refers to the ability to understand or construct the meaning of combinations of morphemes in the form of root words based on the morphological structure of a given language (Carlisle, 1995; Clark, 1982; Liu & McBride-Chang, 2009). Very young monolingual English-speaking children understand the modifier-head relation expressed in English compounds in which the noun in the second or head position is modified by the noun in the first position (Clark, 1981; Clark, Gelman, & Lane, 1985). Clark et al. (1985) demonstrated that monolingual English-speaking children by age 3 could understand the modifier-head relation, for example, picking the picture of a knife but not the picture of an apple for the referent apple-knife. Gombert (1992) hypothesized that compound awareness develops in three stages: the first stage involves functional control of a language in rich pragmatic contexts (e.g., crayoner); the second stage is to think about morphemes and compounding rules in somewhat abstract terms; the third stage involves consciously manipulating morphemes to form
compounds. Ku and Anderson (2003) pointed out that prior to the formal literacy instruction, children appear to develop the onset of compound awareness and their compound awareness continues to develop through the elementary years or later.

In English, derivation is more productive than inflection or compounding. The majority of morphologically complex words to be learnt from Grade 3 onward are formed through derivation (Anglin, 1993; Nagy & Anderson, 1984). Given these characteristics, derivational awareness plays a larger role in literacy development for older children (e.g., Carlisle & Stone, 2005; Kieffer, Biancarosa, & Mancilla-Martinez, 2013). Because the participants in this dissertation were adolescent bilingual students, English morphological awareness was assessed with derivational awareness.

**Morphological Awareness in Relation to Word Reading**

There are several reasons why morphological awareness, particularly derivational awareness, is related to word reading in English. First, morphemes, including both stem roots and affixes, serve as efficient word parts that appear in many different words. As a result, awareness of morpheme and morphological structure facilitates the acquisition of pronunciation, spelling and meaning of morphologically complex words (Carlisle, 2000, 2003). Moreover, the English orthography is morphophonemic in that it represents both phonemes and morphemes. As such, morphemes often affect syllable boundaries in morphologically complex words. For instance, the morphologically complex word *familiarity* is pronounced differently from its word stem *familiar*. Finally, according to the orthographic depth hypothesis (Frost, Katz & Bentin, 1987; Katz & Frost, 1992), English is represented by a deep orthography where the correspondences between graphemes and phonemes are complex and often irregular. However, when phonological shift occurs in a derived word, the word reserves the consistent spelling of
the stem morpheme (e.g., nation / national; similar / similarity) and its semantic relationship with the word stem. As a result, the morphological cue is important for word reading.

Research has supported the impact of morphological processing in English reading (e.g., Marslen-Wilson, Tyler, Waksler, & Older, 1994; Taft, 1994). Studies with monolingual English-speaking students showed that morphological awareness explains individual differences in word reading performance beyond the role of phonological awareness (Carlisle & Normanbhoy, 1993; Deacon, 2012; Deacon & Kirby, 2004; Roman, Kirby, Parrila, Wade-Woolley, & Deacon, 2009; Singson et al., 2000). Singson et al. (2000) found that for students from Grades 3 to 6, derivation awareness accounted for variance in word reading above and beyond the variance explained by vocabulary and phonological awareness. In a cross-sectional study involving fourth, sixth and eighth graders, Roman et al. (2009) found that derivational and inflectional awareness significantly predicted word reading when age, phonological awareness and orthographic knowledge were controlled. In their longitudinal study, Deacon and Kirby (2004) reported that after controlling for nonverbal intelligence and phonological awareness, Grade 2 derivational awareness significantly contributed to word reading in Grades 3, 4, and 5. Thus, research on English L1 literacy development has demonstrated that the ability of processing derived words is important for word reading performance since elementary grades.

Several studies focused on the role of derivational awareness in reading phonologically shift derived words. Nagy et al. (2006) found that derivational awareness made a significant contribution to reading of phonological shift derived words in the fourth/fifth-grade and the eighth/ninth grade when nonword repetition and phonological abilities were controlled. Similarly, Kuo and Anderson (2006) reported that for children in Grades 4 and 5, the contribution of derivational awareness to reading of morphologically complex words was
significant; this might be explained by the consistent orthographic representation of a word stem in its derived form (e.g., sign, signature). Interestingly, Carlisle and Stone (2005) observed that reading difference between phonological stable and shift words diminished in high school students; the researchers argued that this could be due to increased experience with printed texts that contain derived words (Nagy & Anderson, 1984). Through this experience, older students become efficient at recognizing the morphemic constituents of morphologically complex words and can use them to read unfamiliar words (Carlisle, 1995; Carlisle & Normanbhy, 1993).

It has been observed that English morphological awareness is uniquely related to word reading for Spanish-speaking students and Chinese-speaking students (Cheung et al., 2010; Ramirez et al., 2010; Ramirez et al., 2011; Wang, Cheng et al., 2006). Ramirez et al. (2011) found that for the two language groups in Grades 4 and 7, after controlling for maternal education, nonverbal ability, age, vocabulary, and phonological awareness, both derivational and compound awareness were predictive of word reading with derivational awareness accounting for more variance than compound awareness. In another study, Ramirez and her colleagues (2010) reported that for Grades 4 and 7 Spanish-speakers, English derivational awareness significantly explained individual difference in English word reading when grade, nonverbal ability, working memory, vocabulary, and phonological awareness were controlled. Similar findings have been reported for Chinese-speaking children. For example, Cheung et al. (2010) found that for Grades 2, 3 and 4 Chinese-speakers, English derivational awareness was a significant predictor of English word reading when age, nonverbal ability and phonological awareness were taken into account. Hence, studies show that derivational awareness is crucial for word reading for non-English L1 students.
On the other hand, the relation between English morphological awareness and word reading could be reversed in older children in that extensive exposure to print may lead to better morphological awareness. In fact, as children grow older, they are more likely to encounter morphologically complex words in reading than in the oral language. Thus, orthographic representation may provide clues to morphological structure (Templeton & Scarborough-Franks, 1985). In their cross-sectional study, Pasquarella et al. (2011) found that for Chinese-English bilingual students from first to fourth grades, English word reading significantly contributed to both English derivational and compound awareness after English phonological awareness was controlled. The findings of Pasquarella et al. (2011) may extend to older students who have more exposure to print in higher grades.

**Relation between Morphological Awareness and Vocabulary**

English has a large number of morphologically complex words (e.g., Anglin, 1993; Carlisle, 2000; Nagy & Anderson, 1984; Tyler & Nagy, 1989). According to Nagy and Anderson (1984), the proportion of affixed words to a word stem is 4 to 1 in the texts children read from Grades 3 to 9. From Grade 1 to Grade 5, students’ knowledge of derived words increases from 1,800 to 16,000 with an average growth of 3,500 derived words per year. Consistent with the statistics reported by Nagy and Anderson (1984), Anglin (1993) observed that children in Grade 3 knew a significantly larger number of derived words than root words or inflected forms; this difference was more pronounced at Grade 5. As such, it is not surprising that having a better insight into the word-formation processes makes learning new morphologically complex words easier (Nagy et al., 2003). Children with morphological awareness are able to decompose an unknown morphologically complex word into component
morphemes and infer the meaning of the complex word from the meanings of the component morphemes (Anglin, 1993, Deacon, 2012).

Morphological awareness fosters vocabulary skill through the organization of morphologically related words in learners’ mental lexicon (Kieffer & Lesaux, 2008). For example, when readers with well-developed derivational awareness encounter the word ‘actuality’, they are more likely to extract the word meaning by recognizing the relationship between ‘actuality’ and the more common word ‘actual’, therefore broadening their vocabularies. Further, as derivational suffixes determine the syntactic property of derived word, knowledge of syntactic and distributional properties of derived words would enable the child to acquire new words more efficiently, especially in a sentence context (Mahony, 1994; Tyler & Nagy, 1989). For instance, a person who knows the suffix ‘able’ that signifies that a derived word is an adjective can figure out the exact meaning of ‘washable’ in the sentence “Sneakers are made of washable materials.” if he or she knows the meaning of the word stem ‘wash’.

Extensive research has demonstrated that morphological awareness facilitates vocabulary skill in native speakers of English (Carlisle & Fleming, 2003; Nagy et al., 2006). Carlisle and Fleming (2003) observed that scores on derivational awareness in Grade 3 significantly predicted vocabulary performance two years later. In a cross-sectional study involving students in Grades four to nine, Nagy et al. (2006) found that measures of derivational awareness were significantly predictive of individual differences in vocabulary when non-word repetition and phonological decoding were controlled. Thus, for English L1 students across different grade levels, derivational awareness was a significant predictor of vocabulary skill.

Research involving Spanish-speaking students supports the role of English morphological awareness in English vocabulary (Kieffer et al., 2013; Kieffer & Box, 2013;
Kieffer & Lesaux, 2012a; Kieffer & Lesaux, 2012b). Kieffer and Lesaux (2012a) reported that for English L2 Spanish-speakers from Grade 4 through Grade 7, the rate of growth in derivational awareness was strongly associated with the rate of growth in vocabulary after partialling out the effects of phonological awareness, word reading, decoding, and word fluency. In another study, Kieffer et al. (2013) demonstrated that for Spanish-speaking ELLs in Grades 6, 7 and 8, derivational awareness made a significant and substantial contribution to vocabulary. Similarly, based on the structural equation modeling analysis, Kieffer and Box (2013) found that derivational awareness had a direct effect on the vocabulary skill of morphologically complex words for Spanish-speaking ELLs in grade 6; this finding suggests that the ability of analyzing morphological structure provides clues to figure out meanings of unknown morphologically complex words (Carlo et al., 2004). Hence, for Spanish-speaking ELLs in elementary and middle grades, the ability of derivational awareness is important for vocabulary skill.

For ELLs with Chinese as L1, research has supported the relation between English morphological awareness and English vocabulary (Cheung et al., 2010; Hu, 2010; Lam et al., 2012; Zhang & Koda, 2014). Focused on Chinese-speaking ELLs in grade six, Zhang and Koda (2014) reported that performance on a derivational awareness task and a compound awareness task was significantly correlated to performance on vocabulary. Cheung et al. (2010) found that for Chinese-speaking ELLs in senior kindergarten and Grades 2 and 4, derivational awareness was associated with vocabulary skill after controlling for phonological awareness. Hu (2010) found that vocabulary skill was a significant predictor of derivational awareness and inflectional awareness when phonological awareness and Chinese vocabulary skill were controlled among Chinese-speaking ELLs in Grade one. This finding reflects that very young Chinese-speaking ELLs need vocabulary skill to support their development of morphological awareness. Taken
together, research findings have suggested that the performance on English morphological awareness is associated with the performance on English vocabulary in Chinese-speaking ELLs.

**The Present Study**

The present study aimed to investigate the contributions of phonological awareness and morphological awareness to English vocabulary among Spanish-English and Chinese-English bilingual adolescents. Although the relationships between phonological awareness, morphological awareness and vocabulary in bilingual children have been examined in a number of studies, most studies focused on children in the early and middle elementary grades. Few studies have looked at adolescents, where vocabulary plays an even larger role in reading comprehension. Moreover, most previous studies included one group only with English as L2. To our knowledge, this was one of the first studies to examine two bilingual groups with English as L2 from contrasting L1 backgrounds simultaneously.

The investigation centered on two research questions: 1) To what extent does English phonological awareness contribute to English vocabulary skill for Spanish-English bilingual adolescents and Chinese-English bilingual adolescents? 2) To what extent does English morphological awareness contribute to English vocabulary skill for the two groups of bilingual adolescents? To answer these two questions, the current study controlled for the effect of English word reading skill for the two groups of bilingual adolescents. Based on previous research that examined the two groups with English as L2 separately, I anticipated that English phonological awareness and morphological awareness would contribute to English vocabulary skill for both groups of bilingual adolescents, regardless of their different L1 backgrounds. However, it remained to be seen whether the degree of association is similar between the two groups in the same English language context. It is possible that the relationships are stronger in
Spanish-English bilingual students because there is more overlap between Spanish, their L1, and English, since English and Spanish are represented with the alphabetic writing system.
Chapter 3: Method of Study 1

Participants

Participants included 117 Chinese-English bilingual adolescents (72% females) with the mean age of 18.42 years old (SD = 2.12 years) and 80 Spanish-English bilingual adolescents (68% females) with the mean age of 19.33 years old (SD = 2.72 years). Participants were comprised of both the high school students from Grades 10 to 12 and undergraduate students from first and second years in a metropolitan city in southern Ontario, Canada. All Chinese-English bilingual adolescents spoke Mandarin as their L1. Among them, the majority were from mainland China (80%), 10% were from Taiwan, and the remaining 10% did not provide a country of origin. On average, the Chinese-English bilingual adolescents had been living in Canada for 6.88 years (SD = 4.34 years). All Spanish-English bilingual adolescents spoke Spanish as their L1. On average, this group of bilingual adolescents had been living in Canada for 11.82 years (SD = 6.74 years). Seventeen percent of the Spanish-English bilingual adolescents were from Colombia, 14% were from Mexico, 8% were from Ecuador, and 27% were from different countries: Argentina, Chile, Cuba, El Salvador, India, Nicaragua, Peru, Philippines, Spain, the United States of America, and Venezuela. Additionally, 20% of the Spanish-English bilingual adolescents were born in Canada and the remaining 13% of these adolescents did not indicate a country of origin.

Data were collected on parental education level and frequency of languages spoken with parents and friends. Approximately 80% of the parents of Chinese-English bilingual adolescents possessed college or university undergraduate degrees or above and the remaining 20% had the qualification of high school level or below. Approximately 70% of the parents of the Spanish-English bilingual adolescents possessed college or university undergraduate degrees or above
and the remaining 30% had the qualification of high school level or below. Table 1 shows the frequency of languages spoken with parents and friends.
**Table 1**

Frequency use of L1 and English L2 to Parents and Friends

<table>
<thead>
<tr>
<th></th>
<th>Always in L1</th>
<th>Always in English L2</th>
<th>Frequently in L1 and rarely in English L2</th>
<th>Frequently in English L2 and rarely in L1</th>
<th>Sometimes in L1 and Sometimes in English L2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To Parents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish-English</td>
<td>25%</td>
<td>25%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>bilingual adolescents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese-English</td>
<td>74%</td>
<td>0%</td>
<td>26%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>bilingual adolescents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>To Friends</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish-English</td>
<td>0%</td>
<td>0%</td>
<td>11%</td>
<td>63%</td>
<td>26%</td>
</tr>
<tr>
<td>bilingual adolescents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese-English</td>
<td>2%</td>
<td>0%</td>
<td>56%</td>
<td>28%</td>
<td>14%</td>
</tr>
<tr>
<td>bilingual adolescents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measures

**Vocabulary.** English vocabulary knowledge was measured with The Second Canadian Edition of the Vocabulary portion of the Gates MacGinitie Reading Tests (MacGinitie & MacGinitie, 1992) using different forms and levels. Form 4 of Levels E and F were used for high school and undergraduate students, respectively, to ensure the participants worked through the test more appropriate for their age and ability. Each level consists of 45 target items with 5 multiple choice responses. Participants were given 25 minutes to complete the assigned level of the task. The vocabulary task was in a written form. The total score of the task was the sum of the correct items. Cronbach’s alpha reliabilities of Form 4 of Levels E and F were .94 and .89 for the Chinese-English bilingual adolescents and reliability for the two levels was .91 for the Spanish-English bilingual adolescents.

**Morphological awareness.**

**Derivational awareness.** English derivational awareness was assessed with a derivational production task (Ramirez et al., 2010) adapted from Carlisle (2000). Participants were presented with a root word (target word) and an incomplete sentence through an audio recording, and were provided with a written copy. Participants were asked to provide a written response by modifying the target word to correctly complete the sentence. An example is “Glory (target word). The view from the hilltop was **glorious** (correct response).” The task contained 3 trials followed by 31 test items and participants were asked to complete all items. The total score of the task was the sum of the correct items. Cronbach’s alpha reliabilities of the task for the Chinese-English bilingual adolescents and Spanish-English bilingual adolescents were .84 and .88, respectively.
**Phonological awareness.** The Elision subtest of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was used to measure phonological awareness. The task consists of 20 items. For the first 3 items, the participant was asked to repeat a two-syllable word and then delete one of its syllables (e.g., say *popcorn* without *corn*). For the remaining items, the participant was asked to say a word and then delete its initial, medial, or final phoneme (e.g., say *bold* without */b*/). Testing was discontinued when the participant missed 3 items in a row. The test was administered according to standardized procedure and the total score represented the number of correct items. Cronbach’s alpha reliabilities of the task for the Chinese-English bilingual adolescents and Spanish-English bilingual adolescents were .91 and .86, respectively.

**Word reading.** The Word Identification subtest of the Woodcock Reading Mastery Test-Revised (WRMT-R; Woodcock, 1987) was used to assess word reading accuracy. The participant was asked to read aloud a list of words of increasing length and difficulty. The task included 106 items and was administered in accordance to standardized procedure. The total score represented the number of correct items. For Chinese-English bilingual adolescents and Spanish-English bilingual adolescents, Cronbach’s alpha reliabilities for the task were .92 and .90, respectively.

**Non-verbal reasoning.** The Matrix Analogies Reasoning Test (MAT; Naglieri, 1985) was administered to assess nonverbal reasoning ability. To reduce testing time, only the subtest 2, Reasoning by Analogy, and the subtest 4, Spatial Visualization, were administered to participants. Each subtest contained 16 items and the possible score of the two subtests together was 32. For each item, the participant was asked to choose one of six patterned segments that completed a matrix. Each subtest was discontinued when the participant made four consecutive
errors. Cronbach’s alpha reliabilities for the task for the Chinese-English bilingual adolescents and Spanish-English bilingual adolescents were .76 and .87, respectively.

**Demographic questionnaire.** Participants were asked to fill out a questionnaire for the information on their age, gender, grade level, country of origin, age of immigration to as well as age of residence in Canada. Participants were also asked to indicate their parents’ education level and to report how often they spoke English with parents and friends, using a 5 point Likert-type scale (never-rarely-sometimes-often-always).

**Procedure**

Participants took approximately 2.5 hours to complete the demographic and language use questionnaire, the measure of nonverbal reasoning and all English measures in one session. Each measure was administered by a trained research assistant. Measures of vocabulary and morphology were administered in group format. Data on demographics and language use were also collected during group testing. Measures of nonverbal reasoning, phonological awareness, and word reading were administered individually.
Chapter 4: Results of Study 1

Table 2 shows the minimum and maximum scores, mean scores and standard deviations for age in months, length of residence in Canada, measure of nonverbal reasoning and all English measures for the Spanish-English and Chinese-English bilingual adolescents. Skewness and kurtosis statistics were examined for all of the variables. If any distribution fell outside the range of two positive or negative standard errors then a transformation was performed to improve normality (as per Tabachnick & Fidell, 2007). For the Chinese-English bilingual adolescents, negative skewness was observed in nonverbal reasoning (-8.64), English word reading (-5.03) and English derivational awareness (-6.06). For the Spanish-English bilingual adolescents, negative skewness was observed in the same variables: nonverbal reasoning (-3.16), English word reading (-4.22) and English derivational awareness (-9.19). Negative skewness was also observed in English phonological awareness (-5.58) for the Spanish-English bilingual adolescents. Positive kurtosis was observed in nonverbal reasoning (10.96) and English derivational awareness (3.68) for the Chinese-English bilingual adolescents. Positive kurtosis was observed in English word reading (3.21) and English derivational awareness (12.18) for the Spanish-English bilingual adolescents. Subsequent analysis revealed that transforming data did not change the patterns of correlations and results of structural equation models; therefore, only raw scores are reported for all the variables.
## Table 2

**Descriptive Statistics and Analysis of Variance for Age, Length of Residence and All Measures**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Spanish-English bilingual adolescents (n = 80)</th>
<th>Chinese-English bilingual adolescents (n = 117)</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>F (1,195)</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in months</td>
<td></td>
<td></td>
<td>177</td>
<td>311</td>
<td>231.94</td>
<td>32.65</td>
<td>174</td>
<td>286</td>
<td>221.0</td>
<td>25.44</td>
<td>6.957**</td>
<td>.034</td>
</tr>
<tr>
<td>Length of residence (months)</td>
<td></td>
<td></td>
<td>6</td>
<td>276</td>
<td>141.79</td>
<td>80.88</td>
<td>6</td>
<td>204</td>
<td>82.51</td>
<td>52.13</td>
<td>39.124***</td>
<td>.167</td>
</tr>
<tr>
<td>Nonverbal reasoning</td>
<td></td>
<td></td>
<td>7</td>
<td>32</td>
<td>24.48</td>
<td>5.82</td>
<td>13</td>
<td>32</td>
<td>28.00</td>
<td>3.27</td>
<td>30.831***</td>
<td>.137</td>
</tr>
<tr>
<td>English measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonological awareness</td>
<td></td>
<td></td>
<td>4</td>
<td>20</td>
<td>15.84</td>
<td>3.64</td>
<td>3</td>
<td>20</td>
<td>14.36</td>
<td>4.67</td>
<td>5.655*</td>
<td>.028</td>
</tr>
<tr>
<td>Standard score</td>
<td></td>
<td></td>
<td>1</td>
<td>12</td>
<td>8.49</td>
<td>2.41</td>
<td>1</td>
<td>12</td>
<td>7.64</td>
<td>2.99</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Word reading</td>
<td></td>
<td></td>
<td>63</td>
<td>105</td>
<td>93.29</td>
<td>8.39</td>
<td>59</td>
<td>103</td>
<td>89.30</td>
<td>9.84</td>
<td>8.775**</td>
<td>.043</td>
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<tr>
<td>Standard score</td>
<td></td>
<td></td>
<td>61</td>
<td>126</td>
<td>100.21</td>
<td>12.46</td>
<td>47</td>
<td>121</td>
<td>94.16</td>
<td>15.57</td>
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<td>-</td>
</tr>
<tr>
<td>Derivational awareness</td>
<td></td>
<td></td>
<td>2</td>
<td>31</td>
<td>25.48</td>
<td>5.56</td>
<td>10</td>
<td>31</td>
<td>25.20</td>
<td>4.57</td>
<td>.148</td>
<td>.001</td>
</tr>
<tr>
<td>Vocabulary</td>
<td></td>
<td></td>
<td>7</td>
<td>44</td>
<td>29.10</td>
<td>8.66</td>
<td>7</td>
<td>45</td>
<td>26.75</td>
<td>9.73</td>
<td>3.023</td>
<td>.015</td>
</tr>
<tr>
<td>Grade equivalent</td>
<td></td>
<td></td>
<td>4</td>
<td>16</td>
<td>9.60</td>
<td>2.52</td>
<td>3</td>
<td>13</td>
<td>9.30</td>
<td>2.68</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Notes.** Min = Minimum, Max = Maximum, SD = Standard Deviation

*p < .05, **p < .01, ***p < .001

Both raw scores and standard scores are reported for the measures administered in accordance to standardized procedures, and only raw scores were used for subsequent analyses. Standard scores on English phonological awareness obtained by the Spanish-English and Chinese-English bilingual adolescents were within the average range. With respect to English word reading, the standard score obtained by the Spanish-English bilingual adolescents was at the mean for the normative sample and the standard score obtained by the Chinese-English bilingual adolescents was close to the mean for the norms. However, grade equivalent scores on
English vocabulary obtained by both language groups were between 9th and 10th grades; on average, both language groups performed approximately two grades behind the norm.

A multivariate analysis of variance (MANOVA) was carried out to examine the effect of language group as a between-subjects factor on age in months, length of residence in Canada, measure of nonverbal reasoning, and all English measures. As displayed in Table 2, the MANOVA revealed a significant effect of language group, Wilks’s $\Lambda = .64$, $F (7, 189) = 15.178$, $p < .001$, partial $\eta^2 = .360$. Follow-up one-way univariate analysis of variance (ANOVA) shows that the language groups were significantly different in age in months, length of residence in Canada, measure of nonverbal reasoning, English phonological awareness, and English word reading. On average, the Spanish-English bilingual adolescents were 11 months older than the Chinese-English bilingual adolescents. The former group of adolescents had been living in Canada significantly longer than the latter group of adolescents. For both English phonological awareness and word reading, the Spanish-English bilingual adolescents significantly outperformed the Chinese-English bilingual adolescents. In contrast, the Spanish-English bilingual adolescents scored significantly lower than the Chinese-English bilingual adolescents in nonverbal reasoning. The two language groups performed comparably in English derivational awareness and vocabulary.

Additional group comparisons were conducted on the cognitive measures with age and length of residence in Canada as covariates. The difference in either English phonological awareness or word reading was no longer significant between the two groups of bilingual adolescents after accounting for the covariates. Results on non-verbal reasoning, English derivational awareness and vocabulary remained the same.
Correlations

Table 3 shows the correlations among age in months, length of residence in Canada, measure of nonverbal reasoning, and all English measures for the Chinese-English bilingual adolescents upper-right of the diagonal and for the Spanish-English bilingual adolescents lower-left of the diagonal. For both language groups, English vocabulary was positively correlated with English word reading and derivational awareness. English vocabulary was positively correlated with English phonological awareness for the Chinese-English bilingual adolescents only. For both language groups, English vocabulary and length of residence in Canada were positively correlated. Age in months was negatively correlated with English vocabulary for the Chinese-English bilingual adolescents only. Nonverbal reasoning was positively correlated with English vocabulary for the Spanish-English bilingual adolescents only. For both language groups, measures of English phonological awareness, word reading, and derivational awareness were positively correlated. Length of residence in Canada was positively correlated with English phonological awareness, word reading, and derivational awareness for the Chinese-English bilingual adolescents but only with English word reading for the Spanish-English bilingual adolescents. Age was positively correlated with English word reading for the Spanish-English bilingual adolescents but was negatively correlated with English phonological awareness for the Chinese-English bilingual adolescents. Nonverbal reasoning was positively correlated with English phonological awareness, word reading, and derivational awareness for the Spanish-English bilingual adolescents but only with English phonological awareness for the Chinese-English bilingual adolescents.
Table 3

*Intercorrelations among Age, Length of Residence and All Measures for Chinese-English Bilingual Adolescents and Spanish-English Bilingual Adolescents for Study 1*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age in months</td>
<td>-</td>
<td>-.49***</td>
<td>.10</td>
<td>-.20†</td>
<td>-.08</td>
<td>-.17</td>
<td>-.40***</td>
</tr>
<tr>
<td>2. Length of residence</td>
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<td>-</td>
<td>-.17</td>
<td>.20†</td>
<td>.40***</td>
<td>.34***</td>
<td>.56***</td>
</tr>
<tr>
<td>3. Nonverbal reasoning</td>
<td>.33**</td>
<td>.00</td>
<td>-</td>
<td>.25**</td>
<td>.08</td>
<td>.11</td>
<td>.12</td>
</tr>
<tr>
<td>4. English phonological awareness</td>
<td>.16</td>
<td>.09</td>
<td>.23*</td>
<td>-</td>
<td>.45***</td>
<td>.39**</td>
<td>.47***</td>
</tr>
<tr>
<td>5. English word reading</td>
<td>.40***</td>
<td>.24†</td>
<td>.42***</td>
<td>.39***</td>
<td>-</td>
<td>.64***</td>
<td>.64***</td>
</tr>
<tr>
<td>6. English derivational awareness</td>
<td>.20</td>
<td>.13</td>
<td>.35***</td>
<td>.33**</td>
<td>.48***</td>
<td>-</td>
<td>.65***</td>
</tr>
<tr>
<td>7. English vocabulary</td>
<td>.20</td>
<td>.39***</td>
<td>.55***</td>
<td>.19</td>
<td>.59***</td>
<td>.50***</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes: The upper-right of the diagonal is for Chinese-English bilingual adolescents and the lower-left of the diagonal is for Spanish-English bilingual adolescents.

*p < .05, **p < .01, ***p < .001;

**Specification of Structural Model of English Vocabulary**

For the Spanish-English bilingual and Chinese-English bilingual adolescents, the relationship between English vocabulary and the constituent variables were examined with equivalent statistical models. Using Structural equation modeling (SEM), the model of English vocabulary for Spanish-English group and the model for Chinese-English group were compared to identify similarities and differences among the contribution of variables to English vocabulary. For each of the models, SEM allowed the examination of not only the direct contributions but also the indirect contributions to English vocabulary. Previous research has shown that the growth in English derivational awareness was strongly associated with the growth in English vocabulary after the effect of English word reading was controlled (Kieffer & Lesaux, 2012a) for Spanish ELLs. Furthermore, the mediation of English phonological awareness on English vocabulary via English word reading was evident in L1 Chinese students (Pasquarella et al., 2011). For each of the models, nonverbal reasoning was incorporated as a control variable for the direct and indirect contributions of the reading and linguistic skills. As
length of English schooling is an important factor for English language proficiency in non-English L1 students (Jia, 1998), students’ length of residence in Canada was statistically controlled in each of the models.

Figure 1 displays a theoretical SEM model that examines the direct and indirect relationships between English vocabulary and different English reading and linguistic skills for the Spanish-English and Chinese-English bilingual adolescents. Direct paths were added from English phonological awareness, word reading, and morphological awareness to English vocabulary. Since researchers have postulated that extensive exposure to print may lead to better understanding of English morphology in older learners (Templeton & Scarborough-Franks, 1985), a path was added from English word reading to derivational awareness to examine the effect of English word reading on vocabulary mediated through derivational awareness. Finally, a path was added from English phonological awareness to word reading to test the impact of English phonological awareness on vocabulary mediated through word reading.

A number of control variables were included in the model. Paths were added from length of residence in Canada and nonverbal reasoning to English vocabulary to control for the effects of these variables on vocabulary development. Additionally, paths were added from these variables to English phonological awareness as well as to word reading. However, no paths were added from length of residence in Canada and nonverbal reasoning to derivational awareness because preliminary analyses showed that neither variable was a significant predictor of English derivational awareness once the path was added from English word reading to derivational awareness in the model. Age was not included in the model as preliminary analyses showed that age was a non-significant predictor once length of residence in Canada was entered in the model.
To compare the models of English vocabulary for the Spanish-English and Chinese-English bilingual adolescents, a series of constraints was placed on the parameters to evaluate whether the relationships among variables were significantly different across the two language groups. The constraints required that in each step a parameter estimate to be fixed as equal across groups. The model fit with the constrained path was then compared to the model fit with the original unconstrained model. The extent to which constrained parameters influenced the model fit based on the statistics of both the Akaike information criterion (AIC) and Browne-Cudeck criterion (BCC). Deviance statistics were calculated based on the difference of the AIC, BCC, and degrees of freedom (df) between the original unconstrained model and the constrained models. If the deviance statistic was significant, the model with the lower values was the preferred model (Browne & Cudeck, 1993; Kenny, Kashy, & Cook, 2006). If constraining a parameter significantly reduced the model fit, the parameter estimates were significantly

Figure 1. Theoretical structural equation model of English vocabulary for Chinese-English bilingual adolescents and Spanish-English bilingual adolescents
different across groups, and these parameters should be free to vary for each group. In contrast, if constraining a parameter improved or did not change the model fit, then the parameter estimates were not significantly different across groups. For the two models of English vocabulary for the Spanish-English and Chinese-English groups, constraints were placed one at a time on each predictor of English vocabulary, derivational awareness, word reading, and phonological awareness.

The SEM models were designed and assessed with AMOS 22.0. Parameters were estimated using the maximum likelihood fitting function and bootstrapping with 200 samples and 95% Bias-corrected confidence interval to examine both direct and indirect effects. Model fit for the data was assessed with multiple fit indices including the chi-square test, root-mean-square error of approximation (RMSEA), and the comparative fit index (CFI). According to Kline (1998), a good model fit is suggested if the $X^2$ to $df$ ratio is less than 3. That is, the value is less than 3 when the $X^2$ statistics is divided by the number of degrees of freedom. RMSEA values can range from 0 to 1 with smaller numbers suggesting better model fits; according to Hu and Bentler (1999), a RMSEA value of .08 or less indicates an acceptable model fit. CFI values can range from 0 to 1 with large numbers indicating better model fits, and a CFI value of .90 or larger indicates an acceptable model fit. Thus, the mentioned multiple indices were used to determine if the joint analysis of the two models of English vocabulary for the Spanish-English and Chinese-English bilingual adolescents provides a good fit for the data.

**Structural Equation Models of English Vocabulary**

Table 4 shows the results for the model of English vocabulary for the Spanish-English bilingual adolescents and for the model of English vocabulary for the Chinese-English bilingual adolescents. Coefficients of unstandardized estimate, standard error and standardized beta are
presented for each language group. Model fit statistics for the joint analysis of the two models of English vocabulary for the Spanish-English and Chinese-English bilingual adolescents were $X^2(8) = 13.27, p = .103, X^2/df = 1.66, \text{RMSEA} = 0.06, \text{CFI} = 0.98$. Model fit was satisfactory for the $X^2$ to $df$ ratio, RMSEA statistics and CFI statistics indicated a good model fit for the data.

Table 4

*Coefficients for the Structural Equation Model of English Vocabulary*

<table>
<thead>
<tr>
<th></th>
<th>Spanish-English bilingual adolescents</th>
<th>Chinese-English bilingual adolescents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unstandardized estimate</td>
<td>Standard error</td>
</tr>
<tr>
<td>Length of residence</td>
<td>0.032</td>
<td>0.008</td>
</tr>
<tr>
<td>Nonverbal Reasoning</td>
<td>0.569</td>
<td>0.123</td>
</tr>
<tr>
<td>English phonological awareness</td>
<td>-0.266</td>
<td>0.186</td>
</tr>
<tr>
<td>English word reading</td>
<td>0.307</td>
<td>0.098</td>
</tr>
<tr>
<td>English derivational awareness</td>
<td>0.360</td>
<td>0.128</td>
</tr>
<tr>
<td>English word reading</td>
<td>0.317</td>
<td>0.065</td>
</tr>
<tr>
<td>Nonverbal reasoning</td>
<td>0.522</td>
<td>0.144</td>
</tr>
<tr>
<td>English phonological awareness</td>
<td>0.658</td>
<td>0.223</td>
</tr>
</tbody>
</table>

For the Spanish-English bilingual adolescents, the model explained 58% of the variance in English vocabulary. For the Chinese-English bilingual adolescents, the model explained 63%
of the variance in English vocabulary. For both language groups, length of residence in Canada, English word reading, and derivational awareness directly contributed to English vocabulary. English phonological awareness directly contributed to English vocabulary for the Chinese-English bilingual adolescents only. Nonverbal reasoning directly contributed to English vocabulary for the Spanish-English bilingual adolescents only. Direct effects were also observed in predictor variables. For both language groups, while English word reading directly contributed to English derivational awareness, both length of residence in Canada and English phonological awareness directly contributed to English word reading. Length of residence in Canada directly contributed to English phonological awareness for the Chinese-English bilingual adolescents only. Nonverbal reasoning directly contributed to English phonological awareness for both language groups and to English word reading for the Spanish-English bilingual adolescents only.

Table 5 shows the bootstrapping for the indirect effects for English vocabulary that coefficients of unstandardized estimate and standard error, the 95% Bias-corrected confidence intervals (lower bound and upper bound) and the associated significance levels are reported. For both Spanish-English and Chinese-English bilingual adolescents, English word reading indirectly contributed to English vocabulary via English derivational awareness. The indirect effect of English phonological awareness on English vocabulary was mediated through English word reading for the Chinese-English group only. Both English phonological awareness and word reading mediated the indirect effect of length of residence in Canada on English vocabulary for the Chinese-English group only. The indirect effect of nonverbal reasoning on English vocabulary was mediated through English word reading for the Spanish-English group
only. For both language groups, no indirect contribution was observed from English derivational awareness to vocabulary.

Table 5

*Coefficients of Bootstrapping for Indirect Effects on English Vocabulary*

<table>
<thead>
<tr>
<th></th>
<th>Spanish-English bilingual adolescents</th>
<th>95% Bootstrapping CI</th>
<th>Chinese-English bilingual adolescents</th>
<th>95% Bootstrapping CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unstandardized estimate</td>
<td>Standard error</td>
<td>Lower bound</td>
<td>Upper bound</td>
</tr>
<tr>
<td>Length of residence</td>
<td>0.009</td>
<td>0.047</td>
<td>-0.002</td>
<td>0.200</td>
</tr>
</tbody>
</table>
| Nonverbal reasoning            | 0.221 | 0.046 | 0.053 | 0.236 | * | 0.317 | 0.058 | -0.010 | 0.213 | *
| English phonological awareness | 0.277 | 0.081 | -0.009 | 0.328 | 0.330 | 0.051 | 0.085 | 0.288 | ** |
| English word reading           | 0.114 | 0.064 | 0.023 | 0.286 | * | 0.204 | 0.050 | 0.102 | 0.311 | ** |

*Notes. CI = Confidence Interval
* p < .05, ** p < .01

Table 6 shows the comparison of fit statistics for models with constrained parameters against the original unconstrained model. Only constraining the parameter estimate from English phonological awareness to vocabulary significantly reduced model fit, suggesting the parameter should be free to vary across the Spanish-English and Chinese-English bilingual adolescents. Specifically, English phonological awareness was a significant predictor of English vocabulary for the Chinese-English group only. For three parameters from nonverbal reasoning to English vocabulary, from nonverbal reasoning to English word reading and from length of residence in Canada to English phonological awareness, the original unconstrained model was preferred to the models with a constrained parameter. Nonverbal reasoning was a significant predictor of English vocabulary as well as English word reading for the Spanish-English group only. Length of residence in Canada was a significant predictor of English phonological awareness.
awareness for the Chinese-English group only. Placing constraints on parameter estimates from length of residence in Canada, English word reading, and English derivational awareness to English vocabulary did not significantly change model fit, suggesting these relationships were functionally equivalent between the two groups. All other constraints placed on parameter estimates of predictor variables did not significantly change model fit, suggested that these relationships were not significantly different between the two groups. Figure 2 summarizes the direct and indirect effects on English vocabulary for the Spanish-English and Chinese-English groups, and identifies the parameter estimate that differed across the two groups.

![Figure 2](image.png)

**Figure 2.** Structural equation models of English vocabulary with direct and indirect effects. **Note.** Bold paths refer to parameter estimates that are significantly different between groups; dotted paths denote significant indirect effects on English vocabulary.
Table 6

Comparison of Fit Statistics by Constraining Parameter Estimates to be Equal across Groups

<table>
<thead>
<tr>
<th></th>
<th>$X^2$</th>
<th>df</th>
<th>$X^2/df$</th>
<th>p</th>
<th>CFI</th>
<th>RMSEA</th>
<th>AIC</th>
<th>BCC</th>
<th>$\Delta$AIC</th>
<th>$\Delta$BCC</th>
<th>$\Delta$df</th>
<th>$\Delta p$</th>
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<td>0.06</td>
<td>81.27</td>
<td>86.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constraints Placed on Parameters Predicting English Vocabulary</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of Residence</td>
<td>18.64</td>
<td>9</td>
<td>2.07</td>
<td>*</td>
<td>0.97</td>
<td>0.07</td>
<td>84.64</td>
<td>90.00</td>
<td>-3.37</td>
<td>-3.21</td>
<td>1</td>
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<td>1.69</td>
<td>0.98</td>
<td>0.06</td>
<td>81.20</td>
<td>86.56</td>
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<td>0.08</td>
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<td>-4.20</td>
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<td>-2.38</td>
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<td>0.14</td>
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<tr>
<td>Length of Residence</td>
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<td>1.87</td>
<td>0.98</td>
<td>0.07</td>
<td>82.84</td>
<td>88.19</td>
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<td>-1.19</td>
<td>-1.03</td>
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</table>

Notes. df = degrees of freedom, CFI = Comparative Fit Index, RMSEA = Root-Mean-Square Error of Approximation, AIC = Akaike Information Criterion, BCC = Brown-Cudeck Criterion
*p < .05
Chapter 5: Discussion of Study 1

Focusing on Spanish-English and Chinese-English bilingual adolescents, Study 1 of this dissertation examines the direct and indirect contributions of English phonological awareness, morphological awareness and word reading to English vocabulary. Models of English vocabulary were compared between the two groups of bilingual adolescents. In each model, the contributions of linguistic and reading skills to English vocabulary were evaluated while controlling for the influences of the students’ length of residence in Canada and nonverbal-reasoning. Through comparing the SEM models, the current study found both similarities and differences in the predictors of English vocabulary for the two groups of bilingual adolescents.

For the Spanish-English and Chinese-English bilingual adolescents, English morphological awareness and English word reading directly contributed to English vocabulary. Each group of bilingual adolescents’ length of residence in Canada also made a direct contribution to their English vocabulary. Additionally, English word reading made an indirect contribution to English vocabulary via English morphological awareness. These similarities point to the crucial roles of educational context, morphological awareness and word reading in vocabulary skill in English regardless of the learners’ L1 backgrounds.

Differences were also revealed among predictors of English vocabulary for the Spanish-English and Chinese-English bilingual adolescents. For the Chinese-English bilingual adolescents, English phonological awareness had a direct effect on English vocabulary as well as an indirect effect mediated through English word reading. Length of residence in Canada had an indirect impact on English vocabulary via both English phonological awareness and English word reading. On the other hand, for the Spanish-English bilingual adolescents, non-verbal...
reasoning had a direct effect on English vocabulary and an indirect effect mediated through English word reading.

**Similar Predictor across Groups: Morphological Awareness**

The present study showed that the Spanish-English and the Chinese-English bilingual adolescents achieved similar performance on English morphological awareness. In a previous study, Chen, Ramirez, Luo, Geva, & Ku (2012) reported that the same two groups of bilinguals in middle grades performed similarly on English morphological awareness. The current study extends the result to older students. The two groups of bilingual adolescents scored 25 correct items out of a total of 31 in the English morphological awareness task. This result suggests that older bilingual adolescents are still developing their English L2 morphological awareness by age and reading exposure regardless of the L1.

For both the Spanish-English and Chinese-English bilingual adolescents, the performance on English morphological awareness directly contributed to English vocabulary. This result suggests that the sensitivity to morpheme meaning and morphological structure is important for facilitating vocabulary skill. From middle grades onward, 60% of the unfamiliar words that learners encounter are morphologically complex words which are sufficiently transparent in both the word structure and meaning (Nagy et al., 1989). In English, root words tend to have consistent spellings in derived forms, making it easier to identify the morphological structure. Thus both Spanish-English and Chinese-English bilingual adolescents have encountered a large number of morphologically complex words and had ample opportunities to become insightful about the relation between root words and their derived forms.

Interestingly, the Spanish-English and Chinese-English bilingual adolescents demonstrated a similar relationship between derivational awareness and vocabulary in English
despite the fact that their L1 is represented by different writing systems. Thus, it seems that for bilingual adolescents, exposure to English morphologically complex words plays a larger role in vocabulary skill than L1 influences. Ramirez et al. (2011) found that for both the Spanish-speaking and Chinese-speaking ELLs in Grades 4 and 7, English derivation awareness significantly explained individual differences in English word reading after nonverbal skills, maternal education, age, English vocabulary and phonological awareness were controlled. The researchers explained that this result was due to the nature of major word formation process of English derivation. Thus, both the Spanish-English and Chinese-English bilingual adolescents’ comparable performance on English derivational awareness suggests that having extensive exposure to English morphologically complex words in advanced texts was a key factor regardless of their different L1 writing systems.

**Similar Predictor across Groups: Word Reading**

Both groups of bilingual adolescents performed well on English word reading. The Spanish-English bilingual adolescents’ standard score was the mean of the EL1 students and the Chinese-English bilingual adolescents’ standard score was close to the mean of EL1 students. Compared to the Chinese-English bilingual adolescents, the Spanish-English bilingual adolescents had lived in Canada for a longer period of time and consequently have received more English exposure and instruction. The Spanish-English bilingual adolescents’ longer period of residence in Canada may explain why they developed better English word reading skills. Moreover, because Spanish writing system is alphabetic in nature, there may be more transfer from L1 to English word reading skills for the Spanish-English group. However, after controlling for age and length of residence in Canada, the two groups had comparable word
reading scores. This finding again suggests that exposure to English, rather than L1 influences, plays a key role in bilingual adolescents' English literacy development.

Notably, English word reading directly contributed to English vocabulary for both groups of bilingual adolescents. This result suggests that rich exposure to English words in print is important for English vocabulary learning for older non-English L1 students, regardless of their L1 writing system. Previous studies have found that English word reading ability significantly predicted receptive vocabulary in Spanish L1 students (Kieffer & Lesaux, 2012a) and Chinese L1 students in lower grades (Pasquarella et al., 2011), the current study extends this finding to older bilingual adolescents with Spanish or Chinese as L1. Since vocabulary skill is important for comprehending advanced texts, the current study suggests that the role of word reading in vocabulary is even more important for older bilingual students with English as L2. Cunningham and Stanovich (1997) argued that strong word reading ability may promote better reading practice, which then leads to increased vocabulary. Similarly, the current study suggests that English word reading skill is crucial for English vocabulary skill for bilingual adolescents regardless of their L1 backgrounds.

For both the Spanish-English and Chinese-English bilingual adolescents, English word reading also made an indirect contribution to English vocabulary via English morphological awareness. As mentioned earlier, students in higher graders are exposed to texts that contain a large number of derived words with the same roots and learn to attend to the morphemic constituents within these words (Nagy & Anderson, 1984). Rich exposure to English derived words and attention to morphemic constituents within English derived words may explain why English word reading directly contributed to English morphological awareness for the Spanish-English and Chinese-English bilingual adolescents in the current study. In other words, frequent
encounters with derived words during reading may help to develop derivational awareness, which in turn contributes to vocabulary skill.

**Different Predictor across Groups: Phonological Awareness**

Group comparison on English phonological awareness revealed a pattern similar to that on English word reading. Standard scores on English phonological awareness were within the average range for both the Spanish-English and Chinese-English bilingual adolescents with the Spanish-English group having better performance than the Chinese-English group. The superior performance of the Spanish-English group may be due to the fact that they had lived in Canada, an English-speaking environment, for a significant longer period than the Chinese-English bilingual adolescents. Although the Spanish-English group’s advantage may also be attributed to their alphabetic L1, it cannot be a determining factor as the group difference disappeared when age and length of stay in Canada were controlled.

The two groups of bilingual adolescents demonstrated different patterns with respect to the relationship between phonological awareness and vocabulary. For the Chinese-English bilingual adolescents, English phonological awareness made a direct contribution to English vocabulary as well as an indirect contribution mediated through English word reading. Compared with the Spanish-English bilingual adolescents, the Chinese-English bilingual adolescents were still in the process of developing English phonological awareness due to a lack of grapheme-phoneme correspondences in their L1 as well as reduced exposure to English determined by their shorter length of residence in Canada. In a study conducted with young Chinese-speaking children, McBride-Chang et al. (2006) noted that sensitivity to English phonology may be helpful for learning new words. Similarly, Meador et al. (2000) found that Italian-English bilingual adults whose sensitivity to perceive English phonetic segments
explained the role of English phonemic awareness in recognizing English words. Thus, for the Chinese-English bilingual adolescents, the need to develop the sensitivity to perceive English phonemic segments may explain why English phonological awareness directly contributed to English vocabulary skill. The current study has demonstrated that English phonological awareness is crucial for English language development for English L2 older bilingual students whose L1 writing system is non-alphabetic.

On the other hand, the Spanish-English bilingual adolescents had developed a relatively high level of English phonological awareness which may explain why this metalinguistic skill had no impact on English vocabulary skill. The same reason may also explain the inconsistent results between the present study and Gottardo et al. (2008) which reported English phonological awareness in Grade 1 predicted English vocabulary in Grade 2 for Spanish ELLs. Since the participants in Gottardo et al. (2008) were in the early grades, they were still developing English phonological awareness. Notably, although English phonological awareness made no contribution to English vocabulary skill for the Spanish-English bilingual adolescents, it was still related to English word reading ability.

**Theoretical and Educational Implications**

The results of the current study provide several theoretical implications on the relations between metalinguistic skills and language/literacy outcomes for bilingual adolescents. First, English derivational awareness is a prominent metalinguistic skill for developing English literacy for bilingual adolescents from diverse L1 backgrounds. This is due to the fact that English has a deep orthography (Katz & Frost, 1992). Second, reading provides ample opportunities for developing morphological insights as well as vocabulary skill in English for bilingual adolescents. Notably, given that Chinese is represented by a morpho-syllabic writing
system, bilingual adolescents with Chinese as L1 may still be in the process of developing English phonological awareness, which significantly impacts English vocabulary skill. Taken together, the results of the present study suggest more similarities than differences for Spanish-English and Chinese-English bilingual adolescents.

As vocabulary skill plays a crucial role in literacy development in high school and beyond (National Reading Panel, 2000), the results of the present study lead to educational implications on developing English vocabulary for older bilingual students. In the current study, the Spanish-English and Chinese-English bilingual adolescents obtained lower standard scores on English vocabulary when compared with EL1 students. Since English derivational awareness was a robust predictor of English vocabulary for both groups of bilingual adolescents, they may require instruction to learn root words and the relations between root words and suffixes; as learning root words and morphological principles significantly improve vocabulary and therefore enhance reading comprehension. Given that English derivation is similar to Spanish derivation in many ways (Ramirez et al., 2011), morphological awareness likely transfers from Spanish to English to facilitate their vocabulary learning (Chen et al., 2012; Kieffer & Lesaux, 2012a; Ramirez et al., 2010; Ramirez et al., 2011). On the other hand, instruction may be particularly important for Chinese-English bilingual adolescents considering that Chinese and English have very different derivational systems.

Specifically for Chinese-English bilingual adolescents, the result of the present study offers educational implications for improving English vocabulary through phonological awareness. In the study conducted by Meador et al. (2000), English phonological awareness was assessed with the identification of the initial and final consonants of bisyllabic non-words and the discrimination of vowels in monosyllabic words; McBride-Chang et al. (2006) suggests that
such explicit attention to phonological features may facilitate word recognition in English. As phonology-based methods are deemed to be useful for training vocabulary skill in English (Cheung et al., 2010), Chinese-English bilingual adolescents may require added instruction that focuses on fostering English phonological processing of both consonants and vowels through which to facilitate vocabulary skill.

**Limitations and Future Research**

While the present study provides an understanding of similarities and differences in factors that affect English vocabulary for bilingual adolescents with Spanish or Chinese as L1, there are limitations of the present study. First, and most important, as the data presented were not longitudinal, the study was unable to demonstrate the contribution of English morphological awareness and word reading to English vocabulary skill for Spanish-English and Chinese-English bilingual adolescents as well as the contribution of English phonological awareness to English vocabulary skill for Chinese-English bilingual adolescents with development. Further research should investigate how English phonological awareness, morphological awareness and word reading will contribute to subsequent English vocabulary skill in bilingual adolescents with Spanish and Chinese as L1.

Second, the conclusions are limited to Spanish-English and Chinese-English bilingual adolescents living in an English-speaking social context. Further research might examine the contribution of English phonological awareness, morphological and word reading to English vocabulary skill for bilingual adolescents with Spanish and Chinese as L1 who live in the L1 social context. Also, high percentages of the Spanish-English and Chinese-English bilingual adolescents reported frequently speaking English to friends. As a result, the study demonstrated more similarities than differences between the two groups. Future studies should examine
adolescents who are recent immigrants. Furthermore, the present study included only English measures for predicting English vocabulary for the Spanish-English and Chinese-English bilingual adolescents. To understand the cross-language transfer for the prediction of English vocabulary, further research should replicate the present study by including also L1 measures in Spanish and Chinese.

Third, English vocabulary was assessed using a written format. Notwithstanding, given the large amount of words encountered in printed texts in high school or beyond, it offered a theoretical ground for using the written-based Gates-MacGinitie vocabulary task so as to closely replicate the conditions in which readers are exposed to unfamiliar words in the process of independent reading. As Gates-MacGinitie vocabulary task mainly taps into the breadth aspect of vocabulary, future research on English L2 acquisition in bilingual adolescents may consider assessing both the breadth and depth of vocabulary.

Despite these limitations, the present study increases our understanding of the factors that affect English vocabulary for Spanish-English and Chinese-English bilingual adolescents living in an English-speaking context. For both language groups, English morphological awareness and English word reading are crucial for the development of English vocabulary skill. For the Chinese-English bilingual adolescents, English phonological awareness is a significant predictor of English vocabulary skill. Overall, there are more similarities than differences among older students from diverse L1 backgrounds.
Chapter 6: Study 2 – Chinese Vocabulary for Young Adults in a Chinese L1 Speaking Context and an English-Speaking Context

In the second study of this thesis, I examine how phonological awareness and morphological awareness are related to Chinese vocabulary skill in two groups of young adults who speak Chinese as their L1. One group consisted of university students who were recent immigrants to Canada and educated in an English-speaking environment and the other group was made up of university students who were educated in Mainland China. Comparing the Chinese vocabulary skill of the two groups is of research interest because it provides an understanding of the extent to which phonological awareness and morphological awareness interact with the language learning context to contribute to L1 language skill in young adults.

Because research investigating Chinese vocabulary skill in students beyond the upper middle grades is scarce, this chapter provides a review of the research literature on the contributions of phonological awareness and morphological awareness to Chinese reading and vocabulary outcomes from kindergarten to the upper middle grades. First, this chapter reviews the role of phonological awareness in Chinese reading and vocabulary. Next, this chapter reviews the role of morphological awareness in Chinese reading and vocabulary. The last section of the chapter discusses Chinese reading instruction in Mainland China and Canada as school instruction impacts the development of literacy and language skills.

While previous studies have examined Chinese vocabulary skill in younger students (e.g., Liu & McBride-Chang, 2009; Liu, McBride-Chang, Wong, Shu, & Wong, 2013; Pasquarella, Chen, Lam, Luo, & Ramirez, 2011), this study focused on older learners, as the underlying processes may be different in this population. Previous studies have shown that awareness of compound structure is a robust predictor of Chinese vocabulary skill in younger
Chinese L1 students; whereas little is known whether the same relation is still maintained for older learners with Chinese as L1. Moreover, although Chinese has an abundance of homographs (Packard, 2000), the role of homograph awareness, as an aspect of morphological awareness, in Chinese vocabulary skill has not been systematically examined in older students. Thus, the current study examined how phonological awareness and various aspects of morphological awareness contribute to Chinese vocabulary in young adults educated in Chinese-speaking and English-speaking learning contexts. Because the participants in the study had different amounts of exposure to Chinese in their learning contexts, this variable was controlled in the analysis. In addition, the length of residence in Canada was used as a control variable when predicting Chinese vocabulary for the young adults in Canada.

**Phonological Awareness and Character Reading**

Chinese has a relatively simple phonological structure; the basic unit of phonological structure is the syllable (Ho & Bryant, 1997a). A syllable can be further divided into two units. The initial unit is the onset and the final unit is the rime. For example, the onset /f/ is combined with the rime /áng2/ in forming the syllable /fáng2/ (house). As onsets in Chinese do not contain consonant clusters, the onset is also the initial phoneme in a Chinese syllable. The rime unit, however, is not further deconstructed into phonemes by Chinese speakers. Development of phonological awareness naturally follows the sequence from large to small phonological units such that Chinese syllable awareness precedes awareness of onset and rime. It should be noted that Chinese is a tonal language: a change of tones represents a change of meanings of a syllable (Ho & Bryant, 1997a).

In Chinese, the basic unit of visual form is the character and each character represents a syllable in the oral language. Approximately, 80-90% of characters are composed of two types
of components: semantic radical and phonetic radical (Kang, 1993). For example, in the character 枫 /fēng1/ (maple), 木 /mù/ (wood) is the semantic radical which provides a hint of the meaning of the character, and 風 /fēng1/ (wind) is the phonetic radical which provides a hint of the pronunciation of the character (Li & McBride-Chang, 2014). Based on the Chinese word corpus of the Academia Sinica Taiwan (1998), among 54,393 words there are 65.6% two-character words. That is, there are more two-character words than single-or multi-character words are encountered in spoken and written Chinese.

Studies have widely observed that phonological awareness is associated with character reading in Chinese L1 students in the L1 educational context (Chen, Hao, Geva, Zhu, & Shu, 2009; Hu, 2013; Liu et al., 2013; McBride-Chang, Bialystok, Chong, & Li, 2004; McBride-Chang, Cho et al., 2005; McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003; Pan et al., 2011; Shu, McBride-Chang, Wu, & Liu, 2006; Tong & McBride-Chang, 2010a). Shu et al. (2006) reported that among Grades 5 and 6 students in China, phoneme onset deletion directly contributed to single-character reading. For Taiwanese children in Grade 3, Hu (2013) found that phonological awareness measured by phoneme onset and rime discrimination and phoneme onset deletion significantly predicted single-character reading concurrently and in Grade 5 longitudinally, when age, digit span, oral proficiency in Taiwanese, vocabulary and morphological awareness were controlled. For Hong Kong Chinese students in the second grade and fifth grade, Tong and McBride-Chang (2010a) found that syllable and phoneme onset deletion significantly predicted two-character word reading when age and nonverbal ability were controlled, despite the fact that rote memorization is emphasized in character instruction in Hong Kong. Thus, previous findings show that phonological awareness is important for reading Chinese despite the fact that Chinese is represented by a morphosyllabic writing system.
According to Li & McBride-Chang (2014), reading related ability that associates with reading of a single character also associates with reading of a word composed of two or more characters. This is because characters not only are components of words but also sometimes are words as well. Therefore, phonological awareness is important for single-character reading as well as word reading (of one or more characters).

These findings support the universal phonological principle. According to Perfetti, Zhang and Berent (1992), the universal phonological principle applies across writing systems and holds that the encounter of printed words automatically leads to phonological activation as soon as it is allowed by a given writing system. In Chinese, because a character that corresponds to a morpheme (Packard, 2000), phonological activation automatically and immediately accompanies the recognition of a character. That is, the Chinese writing system allows the activation of phonology at the lexical level.

For Chinese L1 students in an English educational context, the association of Chinese phonological awareness with their performance on character reading is also evident (Wang, Cheng, & Chen, 2006; Wang et al., 2009). Wang et al. (2009) found that among Grade 1 Chinese L1 students, Chinese phoneme onset discrimination was a significant predictor of two-character word reading when age and Chinese vocabulary skill were controlled. The researcher and her colleagues (Wang et al., 2006) also reported that for Chinese students in second and fourth grades, phoneme onset and rime detection significantly predicted single-character reading when age, grade level and Chinese vocabulary skill were controlled. Thus, the results of previous studies suggest that Chinese phoneme onset awareness is associated with character reading among early elementary age Chinese L1 students schooled in English.
According to the Linguistic Interdependence Hypothesis proposed by Cummins (1981), proficiency in a language can transfer to another language, given that exposure to another language is sufficient. In studies that have focused on Chinese L1 students, some have supported that English phonological awareness is associated with Chinese character reading in the Chinese L1 educational context (Cheung et al., 2010) and in an English educational context (McBride-Chang et al., 2006; Pasquarella et al., 2011; Wang, Cheng et al., 2006). In a study conducted with kindergarteners, second graders and fourth graders in a Chinese educational context, Cheung et al. (2010) found that English phonological awareness measured by syllable and phoneme deletion was correlated with Chinese two-character word reading. Pasquarella et al. (2011) found that English phonological awareness measured with phoneme deletion made a direct contribution to Chinese single-character reading for a group of Chinese students in Grades 1-4 who were schooled in English in Canada. Similarly, for Grades 2 and 4 Chinese L1 students educated in an English-speaking context, Wang, Cheng et al. (2006) reported that English phoneme deletion significantly predicted Chinese single-character reading when age, grade level, English vocabulary skill and Chinese phonological awareness were controlled. Thus, previous studies have supported the association of English phonological awareness with Chinese character reading in the Chinese-speaking context and in the English-speaking context.

**Phonological Awareness and Vocabulary**

Based on the lexical restructuring model (Metsala & Walley, 1998), phonological awareness is associated with the growth of vocabulary knowledge in young children. Initially, young learners store newly acquired words as holistic units. Over time, increasing vocabulary in learners’ memory stimulates the restructuring of learned words through the process of phonological segmentation. In other words, increasing vocabulary promotes a finer level of
phonological representation; this process enables learners to discriminate words of similar phoneme representations, such as bag, bug, big, bib, dig, and wig. On the other hand, the relation between phonological awareness and vocabulary could be reversed, as sensitivity to English phonology may facilitate the acquisition of new vocabulary (McBride-Chang et al., 2006). For example, McBride-Chang and her colleagues (2006) found that for Chinese-speaking kindergarteners with English as their L2, English phonological awareness measured by syllable and phoneme onset deletion significantly predicted English vocabulary after age, nonverbal intelligence, English and Chinese word reading and Chinese phonological awareness were controlled. McBride-Chang and her colleagues (2006) further suggested that although the syllable is the basic phonological unit in Chinese speech, learning new Chinese words would enable children to become sensitive to phoneme onset for discriminating different words. As their vocabularies develop, having phoneme onset sensitivity might be useful for children who are learning new Chinese words.

Studies have thoroughly demonstrated the relation between Chinese phonological awareness and Chinese vocabulary skill among students in a Chinese L1 context (Chen et al., 2009; Cheung, Chung, Wong, McBride-Chang, Penny et al., 2010; Hu, 2013; Liu et al., 2013; Liu & McBride-Chang, 2009; McBride-Chang et al., 2003; McBride-Chang, Cho et al., 2005; McBride-Chang, Tardif et al., 2008; Pan et al., 2011; Shu et al., 2006; Zhou, McBride-Chang, Fong, Wong & Cheung, 2012). For Grade 3 Chinese students in Taiwan, Hu (2013) reported that Chinese phonological awareness (measured by phoneme onset and rhyme discrimination and phoneme onset deletion) was correlated with the performance on Chinese vocabulary. Liu and McBride-Chang (2009) found that for third grade students in China, Chinese phonological awareness (measured by phoneme onset and rhyme production and phoneme onset deletion) was
a significant predictor of Chinese vocabulary when nonverbal intelligence and age were controlled. Liu et al. (2013) reported that for eight-year-old Hong Kong Chinese students, after controlling for age, nonverbal intelligence and mother’s education, Chinese syllable and phoneme onset deletion significantly predicted Chinese vocabulary concurrently and a year later. Thus, previous findings have supported the association of phoneme onset and rime awareness with vocabulary among students in different social contexts with Chinese as L1.

As mentioned earlier on, phonological awareness is a cognitive ability which can transfer from one language to another language. For students with Chinese as L1, evidence for the association of English phonological awareness with Chinese vocabulary has been observed (Cheung et al., 2010; Pasquarella et al., 2011). Pasquarella et al. (2011) reported that English phonological awareness measured by phoneme deletion made an indirect contribution, mediated through English word reading, to Chinese vocabulary in a sample of Chinese L1 students from Grade 1 to Grade 4 in an English educational context. Cheung et al. (2010) found that for kindergarteners, second graders and fourth graders in a Chinese L1 educational context, English phonological awareness measured by syllable and phoneme deletion was significantly correlated with Chinese vocabulary. On the other hand, some studies have reported that English phonological awareness was not associated with Chinese vocabulary (Dixon, Chuang, & Quiroz, 2010; McBride-Chang et al., 2006; Wang, Cheng et al., 2006; Wang et al., 2009). For instance, Wang and colleagues (2006, 2009) failed to observe a relationship between English phonological awareness and Chinese vocabulary in their studies. Thus, previous studies have produced inconsistent findings with respect to the association between English phonological awareness and Chinese vocabulary. This thesis investigated whether English phonological

**Chinese Morphological Awareness**

Morphological awareness refers to the ability to manipulate morphemes, the smallest phonological unit with meaning, for forming and understanding morphologically complex words (Carlisle, 1995; Kuo & Anderson, 2006). Chinese is a language where complicated concepts can be formed through the systematic use of morphemes (McBride-Chang et al., 2003). For example, while in English the terms *man* and *adult* are not morphologically related words, in Chinese the corresponding terms 男人 /nán2rén2/ and 成人 /chéng2rén2/ share the base morpheme 人 /rén2/ (person). In Chinese, compounding is the predominant word formation rule as the majority of Chinese words are compounds comprised of two or more morphemes (Packard, 2000). Although there are not as many derived words as compound words in Chinese, some derived words are commonly used, e.g., 学员 /xué2yuán2/ (student). However, awareness of derived words has not been consistently investigated among Chinese children.

**Compound structure awareness.** As mentioned above, compounding is the most important word formation process in Chinese. Among 6000 commonly used Chinese words, one-third are single-morpheme words whereas roughly two-thirds are two-morpheme words; there is also a small number of Chinese words composed of three or more morphemes (Suen, 1986). Generally speaking, a compound is semantically related to its constituent morphemes (Yuan & Huang, 1998). Transparency of compounds helps learners learn new concepts and to understand association among words (McBride-Chang et al., 2003). For example, both compounds 公牛 /gōng1niú2/ (bull) and 公鸡 /gōng1jū1/ (rooster) have the character 公 /gōng1/ /
(male) while the second character in each of the two compounds refers to the kind of animal. In addition, Chinese has a large portion of high frequency morphemes as a single morpheme occurs, on average, in 17 compounds (Yin, 1984; Yuan & Huang, 1998). Due to the existence of a large number of high frequency Chinese morphemes, Chinese-speakers will likely recognize some of the constituent morphemes in an unfamiliar compound (Chen et al., 2009).

According to Huang (1998), there are four major types of compound structures: noun + noun (e.g., 书桌 /shū1zhuō1/ (book table: desk)); verb + noun (e.g., 拖鞋 /tuō1xié2/ (pull shoes: slippers)); verb + verb (e.g., 行动 /xíng2dòng4/ (walk move: action)); and adjective + noun (e.g., 黑板 /hēi1băn3/ (black board: blackboard)). Compound structure awareness refers to the ability to manipulate or reflect on base morphemes for the purpose of understanding and producing compounds (Nagy & Anderson, 1984). Packard (2000) proposed the Headedness Principle which states that two-morphemic (non-recursive) compound nouns and multi-morphemic (recursive) compound nouns tend to have a noun on the right, and this morpheme is modified by one or more morphemes on the left. For instance, 房 /fáng2/ (house) is the head morpheme in compounds, 楼房 /lóu2fáng2/ (building) and 书房 /shū1fáng2/ (study room). The ability to identify the head of a compound noun is crucial for the understanding of compound meanings (Liu et al., 2103). For example, 牙刷 /yá2shuā1/ (toothbrush) and 刷牙 /shuā1yá2/ (to brush one’s teeth) are two compound nouns formed by the same morphemes. Therefore, knowing the head of the compound noun facilitates the learner’s understanding of the different meanings of the two compound nouns.

Compounding structure awareness is typically measured with compound construction (or analogy) and compound production tasks. In a compound construction task, the participant is first given the definition of a familiar animal or object and then asked to create a name for an
imaginary animal or object that has some resemblance to the given definition (e.g., Chen et al., 2009; McBride-Chang et al., 2003; Wang et al., 2009). For example, 斑马是身上有斑纹的一种马，那么身上有斑纹的牛我们叫什么？[Striped horse (zebra) is a kind of horse with stripes on the body. What should we call a cow with stripes on the body? (斑牛: striped cow).] A compound production task takes the form of an orally presented question that requires the production of a novel compound based on the knowledge of morphological structure (e.g., Liu & McBride-Chang, 2009). For example, 我们把形状像眼睛一样的果子叫做什么呢？[What should we call a kind of fruit which looks like an eye? (眼果: eye fruit).] In comparison to the compound construction task, the compound production task reduces the effect of analogy and may be more suitable for older students (Liu & McBride-Chang, 2009).

As Chinese compounds are highly transparent and highly productive, awareness of compound structure can help Chinese speakers learn the meanings of new words (Chen et al., 2009; McBride-Chang, Lam et al., 2008; Liu et al., 2013; Liu & McBride-Chang, 2009). Having knowledge about compounding structures also allows Chinese speakers to produce a large number of compounds with a limited number of familiar morphemes (Chen et al., 2009). Moreover, the ability to combine base morphemes in accordance with the morphological structure may facilitate Chinese speakers’ reading of new words (Liu & McBride-Chang, 2009). When only one character in a two-character word is known, Chinese speakers’ might use their knowledge of how the known character can be combined with other morphemes in oral language to read the whole word (Liu et al., 2013). The current study included compound structure awareness for assessing Chinese morphological awareness.
Awareness of homophones and homographs. Another main feature of the Chinese morphology is the abundance of homophones; homophones are morphemes that share the same sound but have different meanings, e.g., 蓝 /lán2/ (blue) vs. 篮 /lán2/ (basket) (Li, Anderson, Nagy, & Zhang, 2002). On average one syllable represents five homophones in Chinese (Packard, 2000; Shu & Anderson, 1997). Prior to print exposure, Chinese children initially develop the ability to process homophones via oral language only (McBride-Chang et al., 2003). Especially, given that Chinese has an abundance of homophones, homophone awareness requires sufficiently developed oral language to distinguish between morphemes that share the same meaning or those that are homophones with different meanings (Liu et al., 2013). With the awareness that the same sound can have different meanings, Chinese children may pay more attention to the morphological or contextual clues for homophone discrimination (Li et al., 2002; Wang et al., 2006). For instance, having good homophone awareness, the child may note that the morpheme 蓝 /lán2/ (blue) in the word 蓝色 /lán2sè4/ (blue color) is not the same as the morpheme 篮 /lán2/ (basket) in the word 篮球 /lán2qiú2/ (basketball) in the oral language. Thus, it is important for Chinese children to develop the ability to process homophones through oral language.

Chinese children’s ability to discriminate homophones in the oral language in turn enables them to discriminate homophones in print (Yeung, Ho, Wong, Chan, Chung et al., 2013). In written Chinese, homophones are differentiated with different characters (Packard, 2000). When children learn to read, the one-to-one correspondence between homophone and character enables children to rely on different characters to discriminate homophones that have different meanings (Li et al., 2002). Thus, during the process of reading, children come to
realize that homophones are represented by different characters; such a process in turn facilitates children’s homophone awareness (Shu et al., 2006).

Homophone awareness can be assessed using several tasks. The morpheme identification task requires the identification of a morpheme whose meaning is the same as the target morpheme in a word (McBride-Chang et al., 2003). For example, the participant needs to select the picture whose label contains a morpheme which is the same as the target morpheme in the word 口袋 /koʊ3 dài4/ (mouth pocket: pocket) from three pictures, 带鱼 /dài4yú2/ (belt fish: hairtail), 袋鼠 /dài4shū3/ (pocket mouse: kangaroo) and 大夫 /dài4fū/ (doctor). The correct answer is the label 袋鼠 in which the morpheme 袋 is the same as the target morpheme 袋 in the word 口袋. The homophone discrimination task requires the discrimination of a morpheme with the same pronunciation but a different meaning among three orally presented disyllable words (Li et al., 2002). For example, among the words 红茶 /hóng2chá2/ (black tea), 绿茶 /lǜ4chá2/ (green tea) and 检查 /jiǎn3chá/ (to examine), the participant needs to select the word in which the morpheme /chá2/ has a different meaning. The correct answer is 检查, in which the morpheme 查 /chá2/ means check in the word 检查. The meaning of this morpheme is different from the morpheme 茶 /chá2/ (tea) in both 红茶 and 绿茶. A homophone production task requires the production of words that contain a homophone of a given morpheme (Liu et al., 2013). For example, the experimenter identifies a specific morpheme, e.g., 书 /shū1/ (book) in 书桌 /shū1zhuō1/ (book-table: desk) and asks the participant to produce words that include this morpheme such as 书包 /shū1bāo1/ (book-bag: school bag). The participant is asked to produce words that contain a homophone of this morpheme such as 输赢 /shū1yín2/ (lose-win) as 输 is a homophone of the morpheme 书.
The Chinese writing system is considered morphosyllabic as each character represents both a morpheme and syllable (Goswami, 1999; Packard, 2000). That is, each Chinese morpheme corresponds to a syllable in the spoken language and a character in the written language (Packard, 2000). In Chinese, commonly used morphemes are represented with about 7,000 characters in the written language (Li et al., 2002), but there are only about 1,300 spoken syllables (Chao, 1976). As there are far more characters than spoken syllables in Chinese, being able to distinguish homophonic morphemes with different characters is important for learning to read Chinese characters (Hao, Chen, Dronjic, Shu, & Anderson, 2013; McBride-Chang et al., 2003; Shu et al., 2006; Tong & McBride-Chang, 2010b). Chinese speakers who have good homophone awareness are not easily confused by the fact that a homophonic morpheme occurring in a word might not be appropriate in another word (Liu et al., 2013). Thus, the ability to discriminate different meanings across homophones may be important for vocabulary development.

Chinese also has an abundance of homographs (Packard, 2000). In Chinese, a homograph is similar to a homophone in some ways but is different from a homophone in other ways. Like homophones, homographs refer to morphemes that have the same pronunciation but have different meanings (Packard, 2000). On the other hand, unlike homophones which are different morphemes, represented with different characters, homographs are different morphemes that correspond to the same character which has different meanings in different words. For example, the Chinese character 商 /shāng1/ has different meanings in different words: 商 /shāng1/ means trade in 商业 /shāng1yè4/ (business); 商 /shāng1/ is the name of a Chinese dynasty in 商代 /shāng1dài4/ (the Shāng dynasty of ancient China), and 商 /shāng1/ means quotient in 智商 /zhì4 shāng1/ (intelligence quotient).
Chinese homograph awareness refers to the ability to understand that different morphemes are represented with the same character (Packard, 2000). Chinese homograph awareness is generally assessed with a morpheme discrimination task that requires the understanding that a character has different meanings when it occurs in different words (e.g., Ku & Anderson, 2003; Li et al., 2002). For example, among the three words 商品 /shāng1pīn3/ (merchandise), 商店 /shāng1diàn4/ (shop) and 商量/shāng1liáng2/ (to discuss), participants are asked to select the odd word in which the morpheme “商” has a different meaning. The correct answer is 商量/shāng1liáng2/, in which the character 商 /shāng1/ means discuss, whereas the same character means trade in the other two words. Tong and McBride-Chang (2010b) found that the ability to discriminate a homographic morpheme was correlated to performance on a compound construction task, a homophone production task and a derived word production and decomposition task\(^1\) for Hong Kong Chinese students in early and middle grades. Since Chinese has an abundance of homographs (Wang et al., 2009), after being exposed to more written words, Chinese speakers start to realize that the same character can have different meanings in different words (Li et al., 2002). As a Chinese compound is a semantically transparent combination of constituent morphemes, the meaning of a homograph can be accessed through its neighbouring morphemes that form the meaning of a Chinese compound. Thus, the semantically transparent nature of Chinese compounds facilitates access to homographs. In Chinese, given the abundance of homographs that must be distinguished in print, the ability to distinguish homographs is essential for reading development (Li, Shu, McBride-Chang, Liu & Peng, 2012).

\(^1\) A derived word production and decomposition task is described in the section Derivational awareness in Chinese.
**Derivational awareness in Chinese.** Compared to compound morphology, derivational morphology is less salient for word formation in Chinese as there are only a small number of derivational affixes (Packard, 2000). According to Li and Thompson (1981), Chinese derivational affixes contain more suffixes (e.g., 者 means *one who does/is X* in 老者 means *senior*) than prefixes (e.g., 无 means *without* in 无视 means *disregard*). Packard (2000) maintained that compounds contain root stems which appear as lexical units but derivatives contain word-forming affixes which have more general meanings than the root stems. For example, in the case of the root stem 员 (person whose job/position is X) and the word forming derivational suffix 者 (one who does/is X), the former tends to be used to describe a particular occupation or position such as 教员 (instructor) whereas the latter is more productive and can be used in words such as 老者 (senior) or 读者 (reader). Despite the differences, Zhang and Koda (2014) have argued that like Chinese compounds, most Chinese-derived words are formed by combining two or three morphemes (e.g., the derived word 毒性 means *toxicity* and the compound 毒品 means *drugs*); as a result, it would be difficult to differentiate derived and compound words as the two types of words have similar structure.

Previous studies have measured Chinese derivational awareness with an affix choice task (Zhang & Koda, 2014), a derivational-morphology task (Wang et al., 2006) and a derived word production (adopted from Carlisle, 2006) and decomposition task (Tong & McBride-Chang, 2010b). The affix choice task focuses on the understanding of the functions of derivational affixes (Zhang & Koda, 2014). For example, participants are asked to select one option among 化, 可 and 家 to fill in the blank in the sentence 他长大后想当一位____ (He
wants to be a ___ after he grows up). They are told that ↓ is the same pseudo-character in all
the three options. To choose ↓家 as the correct answer, participants need to know the suffix 家
(denoting a person as an expert in a field) and differentiate it from 化 (denoting change) and 可
(-able). A derivational-morphology task evaluates the ability to produce derived words (Wang et
al., 2006). An example is that given the root word (写作: write), participants are asked to
produce a derived word to complete the sentence 他长大后想当一位_____ (作家: writer). A
derived word production (adopted from Carlisle, 2006) and decomposition task (Tong &
McBride-Chang, 2010b) contains two sections. In the first section, the participant is required to
generate a new word based on a word and a syntactic context orally given by the experimenter.
For example, the experimenter orally presents a target word, adventure (探險), the participant is
asked to complete an orally presented sentence “Uncle Wang once wandered through forest in
Africa because he was an ________” (correct answer: adventurer). In the second section, the
participant is required to identify the word stem based on a derived word and a syntactic context
orally given by the experimenter. For example, the experimenter orally presents a target derived
word, swimmer (泳客), the participant is asked to complete an orally presented sentence “A
group of young adults are ________ in the sea in the summer” (correct answer: swimming).
Thus, these derivational awareness tasks emphasize the awareness of word-forming derivational
affixes.

**Relation between Compound Awareness and Character Reading**

Research has widely documented the influence of compound awareness on character
reading in a Chinese-speaking context for students from lower to higher grades (e.g., Chung,
Ho, Chan, Tsang, & Lee, 2013; Hu, 2013; Li et al., 2012; Liu & McBride-Chang, 2009; Shu et
al., 2006; Yeung et al., 2013). Liu and McBride-Chang (2009) found that for third graders in China, compound awareness measured by compound construction and production and homophone production significantly predicted character reading ability when nonverbal intelligence, age and phonological awareness were controlled. Li et al. (2012) found that among kindergarteners and students from Grades 1 to 3 in China, compound awareness measured by homophone and homograph discrimination was a significant predictor of character reading after measures of visual, orthographic and phonological processing were controlled. Yeung et al. (2013) reported that after controlling for age, nonverbal ability, vocabulary, phonological and orthographic skills in Grade 1, the ability to identify morphemes across homophones significantly predicted two-character word reading in Grade 1 concurrently and in Grades 2 and 3 longitudinally for Hong Kong Chinese students. Hu (2013) observed that among native Taiwanese students, after controlling for age, verbal short-term memory, oral proficiency in Taiwanese and the autoregressive effect of character reading in Grade 3, compound construction was a significant predictor of character reading in Grade 5. Shu et al. (2006) found that for students with and without reading disabilities in Grades 5 and 6 in China, homophone production and discrimination directly contributed to character reading. Chung et al. (2013) reported that for Hong Kong Chinese students from Grades 7 to 9 with and without dyslexia, homograph discrimination significantly correlated with two-character word reading when age and nonverbal intelligence were controlled. Thus, understanding compound structure and morpheme meaning is important for character reading for students schooled in Chinese L1 from a young age.

The robust effect of compound awareness on character reading is also evident in Chinese L1 students in an English-speaking context (Wang et al., 2009). Wang et al. (2009) reported that
the ability to identify the head morpheme in compound nouns was a significant predictor of character reading for Chinese L1 first graders after controlling for age, vocabulary, phonological awareness and orthographic processing. Adopted from Wang, Park and Lee (2006), Wang et al.’s (2009) head identification task contained three subgroups of items. In the first two subgroups, the nouns being modified were exchanged and the participants were asked to choose the better two-morpheme compound from two choices. For instance, in “长在树上的花叫什么更好呢？树花还是花树？” (Which is a better name for a flower that grows in a tree: A tree flower? Or a flower tree?), the answer is 树花, a tree flower, or in “只长花的树叫什么更好呢？树花或着花树？” (Which is a better name for a tree that grows a flower: A tree flower? Or a flower tree?), the answer is 花树, a flower tree. In the third subgroup, the participants needed to choose the best three-morpheme compound among four choices. For instance, “这里有一棵树，上面有一只会吃虫子的鸟，应该叫它什么呢？鸟虫树？虫鸟树？树鸟虫？还是虫树鸟？” (There is a tree with a bird that can eat bugs, what would it be called: Bird bug tree? Bug bird tree? Tree bird bug? Or bug tree bird?), the answer is 虫鸟树 Bug bird tree.

Similarly, Chen et al. (2009) found that the performance on a task similar to the head identification task described above and on a compound construction measure significantly predicted character reading for first and second grade Chinese L1 children educated in an English-speaking context after controlling for age, vocabulary, rapid naming and phonological awareness. Based on their findings, the researchers suggested that the ability to identify the head morpheme in compound nouns is a deep morphological processing skill because it requires conscious access to every morpheme and this sensitivity to morphemes in oral language would lead to better performance in character reading. Thus, findings from Wang et al. (2009) and
Chen et al. (2009) highlight the “morphosyllabic” nature of Chinese as morphemes carry meaning information which is crucial for character identification. Taken together, previous studies have shown that compound awareness is important for Chinese reading across different learning contexts.

**Role of Compound Awareness in Vocabulary**

Research on the acquisition of Chinese as L1 in a Chinese-speaking context has shown that compound awareness plays a key role in vocabulary skill (e.g., Chen et al., 2009; Ku & Anderson, 2003; Liu et al., 2013; Liu & McBride-Chang, 2009; Zhang & Koda, 2014; Zhou et al., 2012). Liu and McBride-Chang (2009) found that performance on a compound construction and production task and a homophone production task significantly predicted vocabulary performance when age, nonverbal reasoning and phonological awareness were controlled in third-graders in China. Also, Liu et al. (2013) reported that after controlling for age, nonverbal ability, mother’s education level, phonological awareness and the autoregressive effect of vocabulary skill at age 8, compound construction and homophone production were significantly predictive of vocabulary skill concurrently at age 9 for Hong Kong Chinese students. Zhou et al. (2012) reported that after receiving homophone training on morpheme identification and homophone discrimination, Hong Kong Chinese L1 kindergarteners improved vocabulary performance. Ku and Anderson (2003) observed that among students in Grades 2, 4 and 6 in Taiwan, homograph discrimination was highly correlated with vocabulary skill; Zhang and Koda (2014) also reported the same relationship between the two variables for sixth graders in China. A similar relationship between compound awareness and vocabulary has been reported among Chinese L1 children living in English-speaking countries. For example, Chen et al. (2009) reported that after controlling for age and phonological processing, the performance on
compound construction and the ability to identify the head morpheme in compound nouns significantly explained individual difference in vocabulary skill for Grades 1 and 2 Chinese L1 children schooled in Canada. Thus, studies have shown that awareness of compound structure and morpheme meaning is crucial for vocabulary skill for Chinese L1 students.

**Derivational Awareness and Character Reading and Vocabulary**

Since Chinese has limited derivational morphology, very few studies that have focused on Chinese literacy have measured derivational awareness (Wang et al., 2006; Zhang & Koda, 2014). Zhang and Koda (2014) found that derivational awareness (measured by an affix choice task) was strongly correlated with vocabulary for sixth graders in China. On the other hand, Wang et al. (2006) reported that performance on a derivational-morphology task was strongly correlated with performance on character reading but was not correlated with performance on vocabulary for the third and fourth graders who were Chinese L1 students educated in an English-speaking context. As previous studies have reported inconsistent findings of how important derivational awareness was in relation to Chinese literacy and language development, more research in this area is needed.

**Chinese Reading Instruction in Mainland China and Canada**

Mandarin Chinese, or *Putonghua*, is the official oral language in Mainland China. Mainland China offers a predominantly monolingual Chinese learning environment in which students are immersed in both oral language and print in Chinese. In Mainland China, the curriculum for teaching Chinese is based on the *Guide to the National Curriculum* (Government of the People’s Republic of China, Ministry of Education, 2001). Although Chinese is a non-alphabetic writing system with no grapheme-phoneme correspondence rules involved in reading
the script (Ho & Bryant, 1997a), pinyin, a phonetic coding system, is initially taught to children to help them learn to pronounce simplified Chinese characters (McBride-Chang et al., 2004; Knell, Qiang, Pei, Chi, Siegel, Zhao, & Zhao, 2007). Pinyin instruction typically takes place in the first half of Grade 1. Children also learn the meanings of simplified Chinese characters and the order of strokes for writing simplified Chinese characters. For older students, reading instruction focuses on comprehension skills and reading strategies (Xu, 2015; Zhang, 2009). In high schools, textbooks written in different genres (e.g., expository, narrative, scientific, poems, and even ancient Chinese) are used to enhance students’ vocabulary knowledge and comprehension skills. Students are taught to comprehend texts with different reading strategies such as summarization, questioning and inference drawing. Students are also taught to write texts in different genres. By receiving reading instruction throughout the school years, students develop their reading and writing skills and understanding of character meaning.

Since English and French are the two official languages in Canada, Chinese-speaking students educated in Canada have much less exposure to both oral language and print in Chinese than their peers in Mainland China. In addition to the mainstream English and French educational programs, heritage language programs are educational programs that are provided for all children in the public school system. The participation in any heritage language program is voluntary. In Ontario, Mandarin Chinese language educational classes are offered from

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2 Similar to Pinyin in Mainland China, Zhuyin Fuhao is a phonetic transliteration system for learning character pronunciation in Taiwan. Zhuyin Fuhao consists of 37 symbols taken from the constituents of Chinese characters; the symbols are printed alongside characters in textbooks from Grades 1 to 4 (Hu, 2013). In contrast to Mainland China and Taiwan, Hong Kong gives no instruction in phonetic symbols to aid character pronunciation; instead, a holistic look-and-say approach is taught to children for character reading (Zhang & McBride-Chang, 2011).

3 Simplified Chinese characters are standard Chinese characters used in Mainland China. They were derived from traditional Chinese characters by reducing the number of strokes and simplifying the forms of traditional characters. Instead, traditional Chinese characters are officially used in Taiwan and Hong Kong.
kindergarten to Grade 12. Learners attend a two-and-a-half-hour lesson or a three-hour lesson once a week during weekends or after school on a weekday. For kindergarteners, the program mainly covers informal literacy activities including popular Chinese rhythms and songs and culturally-enriched stories. For children in the early elementary grades, the programs gradually introduce formal literacy instruction. Children are taught pinyin and they learn to read and write simplified Chinese characters. For older learners, reading instruction focuses on four areas: listening, speaking, reading and writing. Learners are taught to understand and communicate in Mandarin with appropriate vocabularies and language structures. With respect to reading, learners are taught to read a variety of level-appropriate texts in Chinese (e.g., short stories, magazine and newspaper articles) to develop comprehension skills and vocabulary knowledge. Regarding writing, learners are taught to construct level-appropriate sentences and passages in Chinese for different purposes.

**The Present Study**

The second study of this thesis compares the Chinese vocabulary skill of Chinese L1 young adults who were recent immigrants to Canada and schooled in an English-speaking context with young adults schooled in a Chinese L1 speaking context. The studies reviewed above have demonstrated that phonological awareness and morphological awareness are two important metalinguistic skills for Chinese vocabulary from kindergarten to the upper middle grades. However, research literature investigating vocabulary skill in Chinese L1 students beyond the upper middle grades is scarce. It is important to study vocabulary skill in this age group, given that vocabulary skill is crucial for comprehending advanced texts that older students are expected to use in academic and other settings (Hoover & Gough, 1990). Due to limited exposure to Chinese, Chinese L1 students schooled in an English-speaking context may
have lower Chinese vocabulary skill when compared with their counterparts who are in a Chinese L1 educational context. There is a need to compare the extent to which the same metalinguistic skills would contribute to the Chinese L1 vocabulary skill between older students educated in an English-speaking context and older students educated in a Chinese L1 speaking context. In particular, the current study aims to investigate whether the same metalinguistic skills are universally important for Chinese vocabulary for older students, regardless of the language learning contexts. As exposure to Chinese was different between the participants educated in an English-speaking context and those educated in a Chinese L1 speaking context, this variable was controlled in the analysis.

Specifically, this study examined the extent to which phonological awareness and morphological awareness predict Chinese L1 vocabulary skill. Chinese morphological awareness was measured using a compound awareness task and a homograph awareness task. To target older Chinese L1 students, the current study used a compound awareness task that emphasizes the creation of pseudoword compounds with two morphemes and three or more morphemes based on the knowledge of morphological structure. At the morpheme level, Chinese has an abundance of homophones and homographs (Packard, 2000; Li et al., 2002); nevertheless, homographs have received much less attention in the research literature compared to homophones. Thus, the current study included a homograph task which was comprised of compounds and derived words, given that derivation is evident in forming Chinese words (Packard, 2000) along with compounding, which is the predominant word formation method of Chinese.
Chapter 7: Method of Study 2

Participants

Participants included 66 Chinese L1 young adults (83% female) from Study 1 who were undergraduates in Toronto, Canada and 96 Chinese L1 young adults (92% female) who were undergraduates in Beijing, Mainland China. The Chinese L1 young adults in Canada were first- and second-year undergraduate students with a mean age of 19.86 years (SD = 1.44 years). Among them, the majority were from Mainland China (70%), 11% were from Taiwan, and the remaining 19% did not provide a country of origin. On average, this group of Chinese L1 young adults had been living in Canada for 4.90 years (SD = 3.02 years). The Chinese L1 young adults in Mainland China were also first- and second-year undergraduate students with a mean age of 19.78 years (SD = 1.12 years). All of them spoke Chinese as their first language and had been living and receiving education in Mainland China since birth.

Data were collected on parental education level and frequency of Chinese L1 spoken with parents and friends. For the Chinese L1 young adults in Canada, approximately 74% of parents possessed a college or university undergraduate degrees or above and the remaining 26% of parents had an incomplete or no college education; the mean level of parental education was a university degree. Eighty-three percent of the Chinese L1 young adults in Canada reported using Chinese only when speaking to their parents and the other 17% reported using Chinese mostly when speaking to their parents. Among the Chinese L1 young adults in Canada, the frequency distribution of using Chinese to converse with their friends at school was as follows: 15% always, 27% often, 26% sometimes, 29% rarely and 3% never. Four percent of these young adults reported using Chinese only when conversing with their friends in community and the
rest, 96%, reported using Chinese mostly when conversing with their friends in community. For the Chinese L1 young adults in Mainland China, approximately 27% parents possessed college or university undergraduate degrees or above and the remaining 73% parents had an incomplete or no college education. The mean level of parental education was high school. All the Chinese L1 young adults in Mainland China reported using Chinese only when speaking to their parents. Among the Chinese L1 young adults in Mainland China, eighty-five percent of them reported using Chinese only when conversing with friends at school and the rest, 15%, reported using Chinese mostly when conversing with friends at school. Eighty-eight percent of these young adults reported using Chinese only when conversing with their friends in community and the rest, 12%, reported using Chinese mostly when conversing with their friends in community.

Measures

Vocabulary. Chinese vocabulary was assessed with a task adapted from Ku and Anderson (2003). For the Chinese L1 young adults in Canada, the Chinese vocabulary task included 55 items. For the Chinese L1 young adults in Mainland China, the Chinese vocabulary task included 37 out of the 55 items administered to the Chinese L1 young adults in Canada and 43 new items to make the task more challenging, for a total of 80 items. The format of the Chinese vocabulary test was the same for both groups. For each item, participants were provided with a target word and asked to choose one of five options that explains the meaning of the target word. For example, for the target word 下人, participants were asked to choose the best answer from five options: a) 下一个人 b) 小孩子 c) 年老的工人 d) 喜欢吓人的人 e) 地位低下的人. (The target word was servant; the five options were a) the next person b) child c) old worker d) a person who likes to frighten others e) a person with low status).
The correct answer is e) 地位低下的人 a person with low status. The vocabulary test was given in written form. Participants from each group were given 25 minutes to complete the assigned measure. The total score was the sum of the correct items. Cronbach’s alpha reliabilities for the Chinese vocabulary measure were .96 for the Chinese L1 young adults in Canada and .78 for the Chinese L1 young adults in Mainland China.

**Morphological awareness.**

**Compound awareness.** Chinese compound awareness was assessed with an experimental compound production task adapted from Liu and McBride-Chang (2010). Participants were asked to generate a novel noun based on a short sentence description. A sample item is “我们把形状像眼睛一样的果子叫做什么呢? (眼果)” “What do we call a fruit which looks like an eye? (correct response: eye fruit)”. The task contained non-recursive compounds (compounds formed with two morphemes) and recursive compounds (compounds formed with more than two morphemes) with increasing levels of difficulty. A sample non-recursive compound item is “我们把闻起来味道酸的冰叫做什么呢? (酸冰)” “What do we call the ice which smells sour? (correct response: sour ice).” A sample recursive compound item is “我们把专门吃铁的怪物叫做什么呢? (吃铁怪)” “What do we call the monster which eats iron? (correct response: iron-eating monster)”. The non-recursive compound section included six trial items followed by 15 test items and the recursive compound section included six trial items followed by 10 test items. The task had a total of 25 test items and the total score was the sum of the correct items. The task was recorded by a native speaker of Mandarin and administered in a group format. Participants were asked to follow along with a written copy of the task and provide a written response for each item. Cronbach’s alpha reliabilities for the
Chinese compound awareness task were .86 for the Chinese L1 young adults in Canada and .77 for the Chinese L1 young adults in Mainland China.

**Homograph awareness.** An experimental Chinese homograph awareness measure was created that included derived words and compounds. In this measure, participants were given a two-character word with a target morpheme [e.g., 商量 (discuss measure: discuss), with 商 (discuss) as the target morpheme] followed by three two-character words. Among the options, one word contained the target morpheme [e.g., 商定 (discuss decide: decide), whereas the other two options each contained a morpheme that was a homonym of the target morpheme [e.g., 商人 (business person: businessman) and 商店 (business store: shop)]. Participants were asked to choose the option that contained the target morpheme. The measure contained one trial item of derived words and one trial item of compounds, followed by 40 test items with 20 compounds and 20 derived words presented in a random order. Based on the SUBTLex database for Chinese (Cai & Brysbaert, 2010), one item is not included among the 20 compounds and one item is not included among the 20 derived words, thus word frequency of the 19 compounds and 19 derived words were calculated. The mean frequency of the 19 compounds was 2.51 (SD = .99) and the mean frequency of the 19 derived words was 2.20 (SD = .79). The difference in mean frequency between the compounds and derived words was not significant, \(t(36) = 1.05, p = .30\). The practice and test items were recorded and played to participants as they worked through the written test. The total score of the measure was the sum of the correct items. Cronbach’s alpha reliabilities for the Chinese homograph awareness task were .86 for the Chinese L1 young adults in Canada and .91 for the Chinese L1 young adults in Mainland China.

**Character reading.** An experimental Chinese character reading task was adapted from Luo, Chen, Deacon, Zhang, and Yin (2013) to assess character reading ability. The task included
240 items comprised of 180 single character items and 60 two-character items. All items were presented in order of decreasing word frequency based on the corpus study conducted by Shu et al. (2003). The majority of items were selected from the 12 volumes of the Elementary School Textbooks (Elementary Education Teaching and Research Center, 1996) used for Grades 1 to 6 in Mainland China. The remaining items were of low frequency and were selected from the Chinese SUBTLex database (Cai & Brysbaert, 2010) to increase the task difficulty level. The task was discontinued when the participant incorrectly read 10 items in a row. The total score was the sum of the correct items. Cronbach’s alpha reliabilities for the Chinese character reading task were .99 for the Chinese L1 young adults in Canada and .93 for the Chinese L1 young adults in Mainland China.

**Phonological awareness.** The Elision subtest of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was used to measure phonological awareness. As in Study 1, the task was administered using to the standardized procedure. Cronbach’s alpha reliabilities for the task were .90 for the Chinese L1 young adults in Canada and .69 for the Chinese L1 young adults in Mainland China.

**Nonverbal reasoning.** The Matrix Analogies Reasoning Test (MAT; Naglieri, 1985) was used to measure nonverbal reasoning ability. To reduce testing time, only Subtest 2, Reasoning by Analogy, and Subtest 4, Spatial Visualization, were administered to the participants. Each subtest contained 16 items and the possible score of the two subtests together was 32. For each item, the participant was asked to choose one of six patterned segments that completed a matrix. Each subtest was discontinued when the participant made four consecutive errors. Cronbach’s alpha reliability for the task was .69 for the Chinese L1 young adults in Canada and .83 for the Chinese L1 young adults in Mainland China.
**Demographic questionnaire.** Both Chinese L1 young adults in Canada and Chinese L1 young adults in Mainland China filled out a questionnaire that provided information on age, gender, grade level and country of origin. In the questionnaire, the adolescents were also asked to indicate their parents’ education level and to report how often they spoke Chinese with parents and friends at school and in the community, using a 5 point Likert-type scale (never-rarely-sometimes-often-always).

**Procedures**

The battery of measures was administered by trained research assistants in two separate sessions. Measures of vocabulary and morphological awareness were administered in the group session. Data on demographics and use of Chinese language were also collected during group testing. Measures of nonverbal reasoning, phonological awareness, and character reading were administered individually. The testing took approximately 1.5 to 2.5 hours for both groups of young adults.
Chapter 8: Results of Study 2

Table 7 shows the minimum and maximum scores, mean scores and standard derivations for age (in months) and all the measures for the Chinese L1 young adults in Canada and Chinese L1 young adults in Mainland China. Additionally, length of residence in Canada was shown for the former group of Chinese L1 young adults. For the Chinese L1 young adults in Canada, negative skewness was observed in nonverbal reasoning (-5.63), Chinese character reading (-5.32), Chinese compound awareness (-4.05), Chinese homograph awareness (-4.73) and Chinese vocabulary (-7.57). For the Chinese L1 young adults in Mainland China, negative skewness was observed in the same variables: nonverbal reasoning (-8.35), Chinese character reading (-24.60), Chinese compound awareness (-3.15), Chinese homograph awareness (-13.89) and Chinese vocabulary (-5.40). Positive kurtosis was observed in nonverbal reasoning (6.21), Chinese character reading (3.24) and Chinese vocabulary (7.59) for the Chinese L1 young adults in Canada. Positive kurtosis was observed in nonverbal reasoning (9.86), Chinese character reading (101.43), Chinese homograph awareness and Chinese vocabulary (5.11) for the Chinese L1 young adults in Mainland China. Transformations were performed to improve normality for any variables that fell outside the range of two standard errors, positive or negative, for both language groups (as per Tabachnick & Fidell, 2007). Subsequent analysis revealed that transforming the data did not change the patterns of correlations among the variables; therefore only raw scores are reported. Standard scores were also reported for English phonological awareness since it was administered with a standardized measure. The standard scores were within the average range for both groups of participants based on a normative sample.
Table 7

Descriptive Statistics and Analysis of Variance for Age, Length of Residence and All Measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Chinese L1 young adults in Canada (n = 66)</th>
<th>Chinese L1 young adults in Mainland China (n = 96)</th>
<th>F (1,160)</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in months</td>
<td>214-286</td>
<td>199-281</td>
<td>1.398</td>
<td>.009</td>
</tr>
<tr>
<td>Length in Canada (months)</td>
<td>6-168</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Nonverbal reasoning</td>
<td>18-32</td>
<td>10-32</td>
<td>1.774</td>
<td>.011</td>
</tr>
<tr>
<td>English phonological awareness</td>
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<td>6-20</td>
<td>3.687</td>
<td>.023</td>
</tr>
<tr>
<td>Standard score</td>
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<td>3-12</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Character reading</td>
<td>0-232</td>
<td>116-238</td>
<td>50.171***</td>
<td>.239</td>
</tr>
<tr>
<td>Compound awareness</td>
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<td>6-24</td>
<td>8.470**</td>
<td>.050</td>
</tr>
<tr>
<td>Homograph awareness</td>
<td>20-40</td>
<td>14-40</td>
<td>6.490*</td>
<td>.039</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>11-55</td>
<td>46-77</td>
<td>261.302***</td>
<td>.620</td>
</tr>
</tbody>
</table>

Notes. Min = Minimum, Max = Maximum, SD = Standard Deviation

*p < .05  **p < .01 ***p < .001

A multivariate analysis of variance (MANOVA) was carried out to examine the effect of language group as a between-subjects factor on age in months, measures of nonverbal reasoning and English phonological awareness, and all Chinese measures. The MANOVA revealed that the language group effect was significant, Wilks’s $\Lambda = .217$, $F (7, 154) = 79.458$, $p < .001$, partial $\eta^2 = .783$ (see Table 7). Follow-up one-way univariate analysis of variance (ANOVA) showed that the Chinese L1 young adults in Mainland China significantly outperformed the Chinese L1 young adults in Canada on Chinese character reading, homograph awareness, and vocabulary, whereas the Chinese L1 young adults in Canada scored significantly higher than the Chinese L1 young adults in Mainland China on Chinese compound awareness. With respect to Chinese homograph awareness, for the Chinese L1 young adults in Canada the mean score of
compounds was 17.50 (SD = 2.42) and the mean score of derived words was 17.12 (SD = 2.63). For the Chinese L1 young adults in Mainland China, the mean score of compounds was 18.43 (SD = 2.50) and the mean score of derived words was 18.02 (SD = 2.02). Paired-samples t-tests showed that the performance on the compound words was significantly better than the performance on the derived words for the Chinese L1 young adults in Canada, $t(65) = 2.18, p = .03$ as well as for the Chinese L1 young adults in Mainland China, $t(95) = 2.36, p = .02$.

**Correlations**

Table 8 shows the correlations among variables for the Chinese L1 young adults in Canada and for the Chinese L1 young adults in Mainland China. For both groups of Chinese L1 young adults, Chinese vocabulary was positively correlated with Chinese character reading and homograph awareness. Chinese vocabulary was positively correlated with Chinese compound awareness for the Chinese L1 young adults in Canada only. For both groups of Chinese L1 young adults in Canada and in Mainland China, Chinese compound awareness and homograph awareness were positively correlated. Chinese character reading was positively correlated with Chinese homograph awareness for both groups of Chinese L1 young adults but with Chinese compound awareness for the Chinese L1 young adults in Canada only. English phonological awareness was positively correlated with Chinese compound awareness and homograph awareness for the Chinese L1 young adults in Mainland China only. The length of residence in Canada was negatively correlated with Chinese character reading, compound awareness, homograph awareness and vocabulary for the Chinese L1 young adults in Canada.
Table 8

*Intercorrelations among Variables for Chinese L1 Young Adults in Canada and Chinese L1 Young Adults in Mainland China*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age in months</td>
<td>-</td>
<td>-.24</td>
<td>-.08</td>
<td>-.16</td>
<td>.37**</td>
<td>.17</td>
<td>.28*</td>
<td>.23</td>
</tr>
<tr>
<td>2. Length in Canada (months)</td>
<td></td>
<td></td>
<td>-</td>
<td>-.26*</td>
<td>-.05</td>
<td>-.47***</td>
<td>-.52***</td>
<td>-.53***</td>
</tr>
<tr>
<td>3. Nonverbal reasoning</td>
<td>-.19</td>
<td>-</td>
<td></td>
<td>.32**</td>
<td>.28*</td>
<td>.22</td>
<td>.39**</td>
<td>.29*</td>
</tr>
<tr>
<td>4. English phonological awareness</td>
<td>-.23*</td>
<td>-</td>
<td>.21*</td>
<td>-</td>
<td>-.05</td>
<td>.14</td>
<td>.06</td>
<td>-.01</td>
</tr>
<tr>
<td>5. Chinese character reading</td>
<td>-</td>
<td>.18</td>
<td>-.01</td>
<td>-</td>
<td>.63***</td>
<td>.86***</td>
<td>.90***</td>
<td></td>
</tr>
<tr>
<td>6. Chinese compound awareness</td>
<td>-.09</td>
<td>-</td>
<td>.20*</td>
<td>.35***</td>
<td>.11</td>
<td>-</td>
<td>.66***</td>
<td>.63***</td>
</tr>
<tr>
<td>7. Chinese homograph awareness</td>
<td>-.04</td>
<td>-</td>
<td>.09</td>
<td>.30**</td>
<td>.25**</td>
<td>.27**</td>
<td>-</td>
<td>.89***</td>
</tr>
<tr>
<td>8. Chinese vocabulary</td>
<td>.04</td>
<td>-</td>
<td>.17</td>
<td>.08</td>
<td>.56***</td>
<td>.18</td>
<td>.45***</td>
<td>-</td>
</tr>
</tbody>
</table>

*Notes.* The upper-right of the diagonal is for Chinese L1 young adults in Canada and the lower-left of the diagonal is for Chinese L1 young adults in Mainland China.

*p < .05, **p < .01, ***p < .001

Hierarchical Regression Analyses

To examine the contributions of English phonological awareness and Chinese morphological awareness to Chinese vocabulary for the Chinese L1 young adults in Canada and the Chinese L1 young adults in Mainland China, a number of hierarchical regression analyses were conducted.

Table 9 shows the results of an analysis for predicting Chinese vocabulary and both groups of Chinese L1 adults were included in the analysis to compare the relations between
Chinese linguistic and literacy skills and Chinese vocabulary in the two groups. Mother’s education was entered into the first step and significantly explained 10% of the variance. Composite scores of students’ use of Chinese L1 with others (at home, at school and in the community) were entered into the second step and significantly explained 39% of the variance. Age and nonverbal reasoning were not significant predictors when entered into the third step. Chinese character reading was entered into the fourth step and significantly explained 30% of the variance. English phonological awareness was not a significant predictor when entered into the fifth step. Entered into the sixth step, Chinese compound awareness was not a significant predictor. Chinese homograph awareness significantly explained 1% of the variance when entered into the seventh step. With the group in Canada coded as 0 and the group in China coded as 1, the four interaction terms between group and each of the four literacy and metalinguistic skills listed from the fourth step to the seventh step were entered in the same block and significantly explained 9% of the variance when entered into the last step. Altogether, the variables examined in this model accounted for 90% of the overall variance in Chinese vocabulary, \( F(12, 149) = 107.97, p < .001 \). While the final standardized beta weights revealed that Chinese character reading and Chinese homograph awareness were unique predictors of Chinese vocabulary for both groups of Chinese L1 young adults, the effect of Chinese character reading on Chinese vocabulary was stronger for the Chinese L1 young adults in Mainland China. The effect of Chinese homograph awareness on Chinese vocabulary was not significantly different between the two groups.
Table 9

Hierarchical Regression Equation Predicting Chinese Vocabulary for the Full Sample of Chinese L1 Young Adults in Canada and Chinese L1 Young Adults in Mainland China

<table>
<thead>
<tr>
<th>Step and predictor</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\beta$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mother’s education</td>
<td>.11</td>
<td>.11***</td>
<td>.04</td>
<td>1.20</td>
</tr>
<tr>
<td>2. Composite scores of students’ use of Chinese L1 with others (at home, at school and in the community)</td>
<td>.49</td>
<td>.39***</td>
<td>-.02</td>
<td>-.43</td>
</tr>
<tr>
<td>3. Age</td>
<td>.50</td>
<td>.01</td>
<td>-.00</td>
<td>-.03</td>
</tr>
<tr>
<td>Nonverbal reasoning</td>
<td></td>
<td></td>
<td>.01</td>
<td>.18</td>
</tr>
<tr>
<td>4. Chinese character reading</td>
<td>.79</td>
<td>.30***</td>
<td>.34</td>
<td>5.26***</td>
</tr>
<tr>
<td>5. English phonological awareness</td>
<td>.80</td>
<td>.00</td>
<td>-.02</td>
<td>-.59</td>
</tr>
<tr>
<td>6. Chinese compound awareness</td>
<td>.80</td>
<td>.00</td>
<td>.01</td>
<td>.23</td>
</tr>
<tr>
<td>7. Chinese homograph awareness</td>
<td>.81</td>
<td>.01**</td>
<td>.29</td>
<td>3.93***</td>
</tr>
<tr>
<td>8. Interaction terms (Group in Canada = 0, Group in Mainland China = 1)</td>
<td>.90</td>
<td>.09***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group x Chinese character reading</td>
<td></td>
<td></td>
<td>1.07</td>
<td>3.45***</td>
</tr>
<tr>
<td>Group x English phonological awareness</td>
<td></td>
<td></td>
<td>.02</td>
<td>.20</td>
</tr>
<tr>
<td>Group x Chinese compound awareness</td>
<td></td>
<td></td>
<td>.01</td>
<td>.10</td>
</tr>
<tr>
<td>Group x Chinese homograph awareness</td>
<td></td>
<td></td>
<td>-.50</td>
<td>-1.52</td>
</tr>
</tbody>
</table>

** $p < .01$ *** $p < .001$

To examine the extent to which compounds and derived words from the Chinese homograph awareness measure would predict Chinese vocabulary when all the other variables were controlled, two additional hierarchical regression analyses were conducted for each group of Chinese L1 young adults separately, as shown in Table 10 and Table 11. In the first regression model, the items of derived words from the Chinese homograph awareness measure were entered into the second last step and the items of compounds from the Chinese homograph awareness measure were entered into the last step. In the next regression model, the sequence was reversed, with the items of derived words from the Chinese homograph awareness measure entered into the last step.

Predicting Chinese vocabulary for the Chinese L1 young adults in Canada, Table 10 shows the variance explained by compounds and the variance explained by derived words from the Chinese homograph awareness measure when mother’s education, composite scores of
students’ use of Chinese L1 with others (at home, at school and in the community), age, nonverbal reasoning, length of residence in Canada, Chinese character reading, English phonological awareness and Chinese compound awareness were controlled. The items of derived words from the Chinese homograph awareness measure significantly explained 3% of the variance when entered into the second last step in the first regression model. The items of compounds of the Chinese homograph awareness measure significantly accounted for an additional 1% when entered into the last step in the model. In the next regression model, the items of compounds significantly explained 3% of the variance when entered into the second last step and the items of derived words significantly accounted for an additional 1% when entered into the last step. The final standardized beta weights revealed that both the items of compounds and derived words from the Chinese homograph awareness measure were unique predictors of Chinese vocabulary.
Table 10

**Hierarchical Regression Equation Predicting Chinese Vocabulary for Chinese L1 Young Adults in Canada**

<table>
<thead>
<tr>
<th>Step and predictor</th>
<th>$R^2$</th>
<th>$ΔR^2$</th>
<th>$β$</th>
<th>$t$</th>
<th>$β$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mother’s education</td>
<td>.00</td>
<td>.00</td>
<td>-.02</td>
<td>-.39</td>
<td>-.02</td>
<td>-.37</td>
</tr>
<tr>
<td>2. Composite scores of students’ use of Chinese L1 with others (at home, at school and in the community)</td>
<td>.04</td>
<td>.04</td>
<td>-.05</td>
<td>-.90</td>
<td>-.05</td>
<td>-.90</td>
</tr>
<tr>
<td>3. Age</td>
<td>.16</td>
<td>.12*</td>
<td>-.10</td>
<td>-1.71</td>
<td>-.10</td>
<td>-1.70</td>
</tr>
<tr>
<td>Nonverbal reasoning</td>
<td></td>
<td></td>
<td>-.05</td>
<td>-.76</td>
<td>-.05</td>
<td>-.76</td>
</tr>
<tr>
<td>4. Length in Canada (months)</td>
<td>.29</td>
<td>.13***</td>
<td>-.02</td>
<td>-.24</td>
<td>-.02</td>
<td>-.26</td>
</tr>
<tr>
<td>5. Chinese character reading</td>
<td>.82</td>
<td>.53***</td>
<td>.56</td>
<td>5.31***</td>
<td>.56</td>
<td>5.25***</td>
</tr>
<tr>
<td>6. English phonological awareness</td>
<td>.82</td>
<td>.00</td>
<td>-.01</td>
<td>-.26</td>
<td>-.02</td>
<td>-.28</td>
</tr>
<tr>
<td>7. Chinese compound awareness</td>
<td>.82</td>
<td>.00</td>
<td>-.01</td>
<td>-.17</td>
<td>-.01</td>
<td>-.17</td>
</tr>
<tr>
<td>8. Chinese homograph awareness both compound and derived words</td>
<td>.87</td>
<td>.04***</td>
<td>.47</td>
<td>4.26***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Chinese homograph awareness derived words</td>
<td>.85</td>
<td>.03***</td>
<td></td>
<td></td>
<td>.24</td>
<td>2.14*</td>
</tr>
<tr>
<td>9. Chinese homograph awareness compound words</td>
<td>.87</td>
<td>.01*</td>
<td></td>
<td></td>
<td>.25</td>
<td>2.14*</td>
</tr>
<tr>
<td>8. Chinese homograph awareness compound words</td>
<td>.85</td>
<td>.03***</td>
<td></td>
<td></td>
<td>.25</td>
<td>2.14*</td>
</tr>
<tr>
<td>9. Chinese homograph awareness derived words</td>
<td>.87</td>
<td>.01*</td>
<td></td>
<td></td>
<td>.24</td>
<td>2.14*</td>
</tr>
</tbody>
</table>

*p < .05 ** p < .01 ***p < .001

Predicting Chinese vocabulary for the Chinese L1 young adults in Mainland China,

Table 11 shows the variance explained by compounds and the variance explained by derived words from the Chinese homograph awareness measure when mother’s education, composite
scores of students’ use of Chinese L1 with others (at home, at school and in the community), age, nonverbal reasoning, Chinese character reading, English phonological awareness and Chinese compound awareness were controlled. The items of derived words from the Chinese homograph awareness measure significantly explained 4% of the variance when entered into the second last step in the first regression model. The items of compounds from the Chinese homograph awareness measure significantly accounted for an additional 9% of the variance when entered into the last step in the model. In the next regression model, the items of compounds significantly explained 12% of the variance when entered into the second last step but the items of derived words were not a significant predictor of Chinese vocabulary when entered into the last step. The final standardized beta weights revealed that only the items of compounds from the Chinese homograph awareness measure were a unique predictor of Chinese vocabulary.
Table 11

*Hierarchical Regression Equation Predicting Chinese Vocabulary for Chinese L1 Young Adults in Mainland China*

<table>
<thead>
<tr>
<th>Step and predictor</th>
<th>(R^2)</th>
<th>(\Delta R^2)</th>
<th>(\beta)</th>
<th>(t)</th>
<th>(\beta)</th>
<th>(t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mother education</td>
<td>.01</td>
<td>.01</td>
<td>.12</td>
<td>1.42</td>
<td>.12</td>
<td>1.44</td>
</tr>
<tr>
<td>2. Composite scores of students’ use of Chinese L1 with others (at home, at school and in the community)</td>
<td>.01</td>
<td>.00</td>
<td>.03</td>
<td>.40</td>
<td>.01</td>
<td>.10</td>
</tr>
<tr>
<td>3. Age</td>
<td>.04</td>
<td>.03</td>
<td>.09</td>
<td>1.08</td>
<td>.09</td>
<td>1.08</td>
</tr>
<tr>
<td>Nonverbal reasoning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Chinese character reading</td>
<td>.33</td>
<td>.29***</td>
<td>.47</td>
<td>5.43***</td>
<td>.45</td>
<td>5.39***</td>
</tr>
<tr>
<td>5. English phonological awareness</td>
<td>.34</td>
<td>.01</td>
<td>-.02</td>
<td>-.24</td>
<td>-.02</td>
<td>-.17</td>
</tr>
<tr>
<td>6. Chinese compound awareness</td>
<td>.35</td>
<td>.01</td>
<td>.03</td>
<td>.29</td>
<td>.03</td>
<td>.36</td>
</tr>
<tr>
<td>7. Chinese homograph awareness both compound and derived words</td>
<td>.44</td>
<td>.09***</td>
<td>.35</td>
<td>3.85***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Chinese homograph awareness derived words</td>
<td>.39</td>
<td>.04*</td>
<td></td>
<td>-.10</td>
<td>-.79</td>
<td></td>
</tr>
<tr>
<td>7. Chinese homograph awareness compound words</td>
<td>.48</td>
<td>.09***</td>
<td></td>
<td>.46</td>
<td>3.75***</td>
<td></td>
</tr>
<tr>
<td>8. Chinese homograph awareness derived words</td>
<td>.47</td>
<td>.12***</td>
<td></td>
<td>.46</td>
<td>3.75***</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05 *** p < .001*
Chapter 9: Discussion of Study 2

Focusing on Chinese L1 young adults in Canada and in Mainland China, Study 2 of this thesis examined the contributions of phonological awareness and morphological awareness to Chinese vocabulary skill. Previous studies have suggested that these metalinguistic skills are important for Chinese vocabulary skill in elementary and middle grades (e.g., Chen et al., 2009; Ku & Anderson, 2003; Liu et al., 2013; Liu & McBride-Chang, 2009). The present study targeted older learners who are entry-level university students. Moreover, it explored the impact of language environment on vocabulary skill by comparing the relations between students schooled in Canada and those schooled in China.

Before examining predictors of Chinese vocabulary, the current study compared the performance of the Chinese L1 young adults in Canada and the Chinese L1 young adults and in Mainland China on the predictor and dependent measures. Results showed that the two groups performed comparably on English phonological awareness. It seems that by the time they reach university, Chinese-speaking students have developed a relatively high level of phonological awareness in their second/foreign language regardless of the language learning environment. This finding confirms the language-universal nature of phonological awareness (e.g., Genesee & Geva, 2006; McBride-Chang et al., 2006; Wang et al., 2006). With respect to the Chinese measures, the Chinese L1 young adults in Mainland China outperformed the Chinese L1 young adults in Canada on character reading, homograph awareness and vocabulary. Although most students in the latter group had completed at least part of high school in Chinese, they had less exposure to both oral and written Chinese after they immigrated to Canada. Thus, reduced exposure may explain why the Chinese L1 young adults in Canada scored lower on these Chinese measures than their counterparts in Mainland China.
Interestingly, the Chinese L1 young adults in Canada outperformed the Chinese L1 young adults in Mainland China on the Chinese compound awareness measure. This finding may be attributed to the design of the measure. Only pseudowords were used in the measure to ensure that it would assess awareness of compound structure rather than Chinese vocabulary. To further reduce the effect of vocabulary, the measure did not follow the analogy format adopted by some of the other compound awareness measures (e.g., Chen et al., 2009; McBride-Chang et al., 2003; Wang et al., 2009) and included recursive items to increase the level of difficulty in manipulating compound structure. The higher performance of the Chinese L1 young adults in Canada seems to suggest that the task was indeed a measure of compound awareness. According to the structural sensitivity hypothesis (Kuo & Anderson, 2010), bilinguals may develop an overall heightened sensitivity to linguistic structures because they are provided with many opportunities to compare and contrast the structural features of their two languages. Accordingly, this bilingual advantage may explain the better performance of the Chinese L1 young adults in Canada on the Chinese compound awareness measure.

**Predictors of Chinese Vocabulary**

Similarities and differences were observed in predicting Chinese vocabulary for the Chinese L1 young adults in Canada and Chinese L1 young adults in Mainland China. Despite the differences in language learning contexts, Chinese character reading and Chinese homograph awareness were significant predictors for the Chinese L1 young adults in Mainland China after controlling for mother education’s, composite scores of students’ use of Chinese L1 with others (at home, at school and in the community), age, nonverbal reasoning, English phonological awareness and Chinese compound awareness, and for the Chinese L1 young adults in Canada after controlling for the same variables and also for length of residence in Canada.
However, the relationship between Chinese character reading and Chinese vocabulary was stronger for the Chinese L1 young adults in Mainland China, whereas the relationship between Chinese homograph awareness and Chinese vocabulary was similar for the two groups of young adults. Within the Chinese homograph awareness measure, both the compounding and derivational aspects were significant predictors for the Chinese L1 young adults in Canada. For the Chinese L1 young adults in Mainland China, the compounding aspect was a significant predictor but the derivational aspect was not. On the other hand, English phonological awareness and Chinese compound awareness did not predict Chinese vocabulary for either group.

**Metalinguistic Awareness and Chinese Vocabulary**

An important finding of the present study is that homograph awareness was a significant predictor of Chinese vocabulary regardless of language learning context. While previous research has examined the contribution of homophone awareness to Chinese literacy outcomes (e.g., Liu et al., 2013; Liu & McBride-Chang, 2009; Shu et al., 2006; Yeung et al., 2013; Zhou et al., 2012), few studies have focused on homograph awareness. Both homographic and homophonic morphemes are homophones in the oral language. Homophone awareness is critical for vocabulary development due to the large number of homophones in Chinese; children without this awareness are constantly confused in vocabulary learning. According to McBride-Chang et al. (2003), Chinese children process homophones through oral language before learning to distinguish them through print. Chinese words tend to be semantically transparent. This transparency allows children to infer the morpheme meaning from the word meaning. For example, if a child knows that the word 书包 /shūbāo/ means “book-bag (school bag)”, it is relatively easy to infer that the morpheme 书 /shū/ means book. Consequently, children may
be able to differentiate homophonic morphemes from words that contain these morphemes, as these words have different meanings. For example, the morpheme 书 /shū/ means book in the word 书包 /shūbāo/ (book-bag: school bag), whereas the morpheme 输 /shū/ means lose in the word 输赢 /shūyíng/ (lose-win), even though both 书 and 输 are homophones. Since homographic morphemes are also homophones in the oral language, Chinese children may process homographs first in oral language the same way they process homophones.

On the other hand, homographs are different from homophones in relation to print. Because homophones are represented by different characters, learning to read facilitates the mapping of homophonic morphemes to their respective meanings (Packard, 2000). Unlike homophones, homographs are represented by the same character which has different meanings in different words. As a result, learning to read the character that represents a homographic morpheme may not facilitate the acquisition of the morpheme to the same extent. For example, the homographic morpheme represented with the character 商 has different meanings such as business, discuss, Shāng (the name of a dynasty in ancient China) and quotient. However, as mentioned earlier, Chinese words tend to be semantically transparent. In a word that contains a homographic morpheme, knowing the word meaning as well as the meaning(s) of other morpheme(s) in the word help children infer the meaning of the homographic morpheme. For example, the homographic morpheme represented by the character 商 has different meanings in the word 商人 and in the word 商代. Knowing that the word 商人 (business person) means businessman, as well as that the morpheme 人 means person in the word, the reader may be able to infer the character 商 means business in the word 商人 (business person: businessman). For the same reader, knowing that the word 商代 means Shāng dynasty, as well as that the
morpheme 代 means dynasty in the word enables the reader to infer that the character 商 means Shāng, the name of a dynasty, in the word 商代, Shāng dynasty. During the process of learning to read, children acquire more word meanings and morpheme meanings in general, which in turn facilitates the acquisition of homographic morphemes. Compared to young children who primarily process homographic morphemes in the oral language, older learners develop more advanced homograph awareness with increased exposure to print, and this awareness enhances vocabulary skill.

Previous research examining the role of morphological awareness in Chinese literacy development has focused primarily on compound awareness; only a handful of studies have examined derivational awareness (Ku & Anderson, 2003; Tong & McBride-Chang, 2010b; Wang et al., 2006; Zhang & Koda, 2014). Using a homograph awareness task, the current study showed that awareness of homographs in derived words was a significant predictor of Chinese vocabulary for the Chinese L1 young adults in Canada. This finding was consistent with those reported by Ku and Anderson (2003) and Zhang and Koda (2014), suggesting that derivational awareness also plays a role in Chinese literacy development. Zhang and Koda (2014) argued that like Chinese compounds, most Chinese-derived words are formed by combining two or three morphemes (e.g., the derived word 毒性 means toxicity and the compound 毒品 means drugs). Since the two types of words have similar structures, it may be hard for even well-educated Chinese speakers to distinguish them from each other (Chen & Pasquarella, in press). However, awareness of homographs in derived words was not a significant predictor of Chinese vocabulary for the Chinese L1 young adults in Mainland China. Since the vast majority of Chinese words are compounds, awareness of homographs in compounds may be more important for advanced learners who have reached a certain level of vocabulary knowledge. Taken
together, the findings of the current study suggest that awareness of homographs in derived words may also contribute to vocabulary skill in Chinese, especially for intermediate level learners. However, a limitation of the current study is that awareness of homographs in both compounds and derived words were assessed with parallel items within the same measure. Future research should build on the findings of the current study by using separate measures for homographs in compounds and derived words.

Unlike previous research (Cheung et al. 2010; Liu et al. 2013; Liu & McBride-Chang, 2009; McBride-Chang et al., 2006; McBride-Chang, Tardif et al., 2008), the current study found that Chinese compound awareness measured by a compound production task was not a significant predictor of Chinese vocabulary for either the Chinese L1 young adults in Canada or their counterparts in Mainland China. One possible explanation for the inconsistency is that homograph awareness was not controlled in the previous studies. Notably, the compound awareness and homograph awareness measures were strongly correlated for both groups of participants. As such, shared variance between the two measures may have reduced the power the compound awareness measure to predict Chinese vocabulary. Another reason for the lack of contribution of compound awareness lies in the fact that the compound awareness and homograph awareness measures used in the present study assessed different aspects of morphological awareness. While the compound awareness measure tapped into the ability to manipulate compound structure, the homograph awareness measure assessed the ability to identify morpheme meanings. Liu et al. (2013) showed that although both compound awareness (measured by a compounding structure awareness task) and homophone awareness (measured by a homophone production task) significantly contributed to vocabulary development for Chinese L1 students at age 9, homophone awareness was a much stronger predictor than
compound awareness. Thus, understanding morpheme meaning may be more important to vocabulary skill, especially for older Chinese learners.

In the present study, phonological awareness, measured in English, was not associated with Chinese vocabulary for either the Chinese L1 young adults in Canada or their counterparts in Mainland China. While previous research has shown that phonological awareness is a significant predictor of vocabulary development in Chinese children in early primary grades (e.g., Liu et al., 2013; Liu & McBride-Chang, 2009; Pasquarella et al., 2011), the nature of the relationship may be different among older students. First, older students tend to have well-developed phonological awareness and the lack of variation in the performance restricts the power of phonological awareness as a predictor of literacy outcomes. Second, the focus of school instruction is text comprehension rather than word reading for older students. As a result, word-level skills, such as phonological awareness, play a smaller role in literacy outcomes (Vellutino, Tunmer, Jaccard, & Chen, 2007; Xu, 2015; Zhang, 2009). This may be particularly true for Chinese due to the logographic nature of the writing system. Finally, because the current study was part of a larger project, phonological awareness was measured in English only to save testing time. Measuring phonological awareness in students’ second/foreign language may lead to a larger measurement error and reduce explanatory power. For these reasons, future research examining the role of phonological awareness in vocabulary skill should adopt a measure of phonological awareness in participants’ L1.

**Character Reading and Vocabulary in Chinese**

It was observed that Chinese character reading was a significant predictor of Chinese vocabulary for both groups of Chinese L1 young adults in Canada and in Mainland China. In comparison to younger learners, older learners are more likely to acquire new vocabulary
through independent reading (Xu, 2015; Zhang, 2009). Educated in an environment where Chinese was the societal language and language of school instruction, the Chinese L1 young adults in Mainland China had developed good reading skills by the time they entered university. This group of Chinese L1 young adults would be required to read independently and extensively as university students, which in turn led to an increase in their vocabulary. According to Cunningham and Stanovich (1997), better reading practice leads to increased vocabulary. Although the Chinese L1 young adults in Canada had less Chinese print exposure in general, they may also be able to acquire new vocabulary through reading, considering that most students in this group had completed at least part of high school in Chinese before immigrating to Canada.

Character reading may be particularly important for vocabulary learning among speakers of Chinese due to the unique characteristics of the Chinese language and writing system. As mentioned earlier, there is an abundance of homophones in Chinese (McBride-Chang et al., 2003; Packard, 2000). It is not an easy task to differentiate homophonic morphemes purely based on the oral language because they have identical pronunciations. Learning to read enables children to understand that homophones are indeed different morphemes with different meanings, as they are also represented by different orthographic forms. Notably, although Chinese character reading significantly predicted Chinese vocabulary for both groups of learners, the relationship was stronger for the Chinese L1 young adults in Mainland China. Because this group of young adults were educated in a Chinese L1 speaking context, it is likely that they were exposed to a larger amount of Chinese print than their counterparts educated in an English-speaking context in Canada. Moreover, in contrast to only one-fourth of the Chinese L1 young adults in Canada who did leisure reading in Chinese at home for an hour daily, half of the
Chinese L1 young adults in Mainland China did leisure reading in Chinese at home for an hour daily. As a result, Chinese L1 young adults in Mainland China may have had more opportunities to acquire new vocabulary through reading. They were also likely to be more effective learners due to their superior reading skills. Therefore, Chinese character reading may play a bigger role in Chinese vocabulary for Chinese learners immersed in a Chinese-dominant learning environment.

**Theoretical and Educational Implications**

With respect to theoretical implications, findings of the current study point to the need to broaden the concept of Chinese morphological awareness. Because Chinese has an abundance of homophones and homographs, homophone and homograph awareness should be considered important aspects of morphological awareness in Chinese and systematically investigated in future research. The current study also demonstrates that character reading skill is crucial for vocabulary performance among older Chinese students. While previous studies examining vocabulary skill have often focused on the contributions of metalinguistic skills (e.g., Chen et al., 2009; Cheung et al., 2010; Liu et al., 2013; Liu & McBride-Chang, 2009; McBride-Chang, Tardif et al., 2008; Zhou et al., 2012), this finding suggests that Chinese reading should also be included as a factor in a broader framework of vocabulary development. Given that Chinese has an abundance of homophones (Packard, 2000), the findings of the current study suggest that older Chinese students need to have good character reading skill in order to acquire new vocabulary in Chinese. Furthermore, given the current study used correlational data, the findings of the study may imply that having better vocabulary enables older Chinese students to read more effectively. This reciprocal relationship needs to be further investigated by future studies.
The results of the current study also provide educational implications for improving Chinese vocabulary. Because awareness of homographs is crucial for developing vocabulary skill in older students, instructional methods directing students’ attention to homographs across different words may foster meaning acquisition of new words. In addition, given the important role of character reading in vocabulary skill observed in the two groups, educators in both learning environments should encourage students to increase the volume of reading and discuss meanings of new words encountered in reading activities.

Limitations and Future Research

While the findings of current study shed light on vocabulary skill of Chinese L1 young adults educated in different learning environments, several limitations need to be addressed. First, the Chinese homograph awareness measure used in the current study appears to be relatively easy for older Chinese L1 students; future research should design more challenging items to better capture homograph awareness. Another limitation of the measure is that it contained both compound and derived words. To increase measurement validity, compounds and derived words should be included in separate measures of homograph awareness. Third, the current study did not include a measure of homophone awareness. Because both homophone awareness and homograph awareness have been shown to be important for vocabulary skill, they should be measured simultaneously within the same study. Fourth, the current study assessed Chinese vocabulary with a written task and therefore may have exaggerated the role of character reading in vocabulary skill. Nevertheless, given that the participants of the study were university students, it is feasible that they acquired a larger proportion of new vocabulary through reading. Finally, the current study adopted a concurrent design. Longitudinal data need
to be collected in the future to assess the causal relationships between the predictor variables and Chinese vocabulary.

Despite the limitations, the current study fills a gap in our knowledge of vocabulary skill in older Chinese students by exploring factors that influence vocabulary skill in older learners across different learning environments. The most important finding is that homograph awareness of both compound and derived words is related to Chinese vocabulary skill for older Chinese L1 students who vary in the extent of their exposure to Chinese. The current study also suggests that just like compound awareness, derivational awareness may play a role in Chinese literacy development. Finally, Chinese character reading contributes to Chinese vocabulary skill among older Chinese students, as most vocabulary can be acquired during reading. The findings of the current study help to refine the theoretical frameworks of Chinese morphological awareness and vocabulary, and have practical implications for educators and policy makers in both Chinese- and English-dominant learning contexts.
Chapter 10: General Discussion

Through two interrelated studies, the findings of the current thesis shed light on vocabulary skill among older learners in different languages and across different learning contexts. Study 1 showed that despite their different L1 backgrounds, English derivational awareness and word reading were significant predictors of English vocabulary for both the Spanish-English and Chinese-English bilingual adolescents. However, English phonological awareness was a significant predictor for the Chinese-English bilingual adolescents only. Study 2 showed that Chinese homograph awareness and character reading were significant predictors of Chinese vocabulary for the Chinese L1 young adults in both Canada and Mainland China. Phonological awareness measured in English, on the other hand, was not related to Chinese vocabulary in either group.

Results of the two studies underscore the important role that morphological awareness plays in vocabulary skill for older students. Specifically, derivational awareness is crucial for English vocabulary skill, whereas the awareness of homographs (both compound and derived words) is crucial for Chinese vocabulary knowledge. Since derivation is the predominant word formation process in English, it is not surprising that derivational awareness is strongly related to English vocabulary skill. On the other hand, although compounding is the major word formation process in Chinese, the findings of the current thesis suggest that the awareness of homograph meaning in both compound and derived words are associated with Chinese vocabulary skill, probably because compound and derived words have similar structures in Chinese. Taken together, the findings of the current thesis demonstrate that the awareness of morphological structure is important for English vocabulary skill and the awareness of homograph meaning is important for Chinese vocabulary skill.
Findings of the current thesis revealed that word reading was crucial for English vocabulary skill for both the Spanish-English and Chinese-English bilingual adolescents; similarly, character reading was crucial for Chinese vocabulary skill for both Chinese L1 young adults in Canada and Chinese L1 young adults in Mainland China. These findings indicate that for older students, reading may be a particularly important way for acquiring new words, regardless of the L1 background and the language learning context.

The current thesis found that English phonological awareness was related to English vocabulary skill for older Chinese L1 students. Compared with the Spanish-English bilingual adolescents, the Chinese-English bilingual adolescents were still in the process of developing English phonological awareness. Thus, sensitivity to English phonological structure may be more important for English vocabulary skill for these learners. On the other hand, given that there is a lack of phoneme-grapheme correspondences in Chinese, phonological awareness, measured in English, did not contribute to Chinese vocabulary skill for either the Chinese L1 young adults educated in Canada or those in Mainland China.

In conclusion, the findings of the current thesis help refine the theoretical framework of vocabulary development for older learners from different L1 backgrounds and across different learning contexts by underscoring the importance of morphological awareness and word reading in vocabulary skill. Consequently, instructional methods designed to improve vocabulary skill among older students must also enhance morphological awareness and word reading. It appears that for older learners, an effective way to increase their vocabulary may be to encourage them to read independently and broadly. Finally, given the limitations and the questions arising from the current thesis, the findings need to be replicated by future studies with improved morphological awareness measures and longitudinal designs.
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Appendices
Appendix A: Chinese Homographic Awareness Task

中文词素意识测验

练习1: 书包 (a) 面包 (b) 钱包 (c) 菜包 答案________
练习2: 花草 (a) 花篮 (b) 花钱 (c) 花招 答案________

<table>
<thead>
<tr>
<th>序号</th>
<th>目标词</th>
<th>选项</th>
<th>答案</th>
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<td>(a)  生病</td>
<td>(b)  生瓜</td>
</tr>
<tr>
<td>2</td>
<td>商量</td>
<td>(a)  商店</td>
<td>(b)  商定</td>
</tr>
<tr>
<td>3</td>
<td>反战</td>
<td>(a)  反复</td>
<td>(b)  反贪</td>
</tr>
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<td>(a)  毕业</td>
<td>(b)  工业</td>
</tr>
<tr>
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<td>中式</td>
<td>(a)  新式</td>
<td>(b)  公式</td>
</tr>
<tr>
<td>6</td>
<td>毛线</td>
<td>(a)  直线</td>
<td>(b)  光线</td>
</tr>
<tr>
<td>7</td>
<td>风气</td>
<td>(a)  风向</td>
<td>(b)  风俗</td>
</tr>
<tr>
<td>8</td>
<td>复活</td>
<td>(a)  复仇</td>
<td>(b)  复杂</td>
</tr>
<tr>
<td>9</td>
<td>信服</td>
<td>(a)  佩服</td>
<td>(b)  制服</td>
</tr>
<tr>
<td>10</td>
<td>桌子</td>
<td>(a)  裙子</td>
<td>(b)  弟子</td>
</tr>
<tr>
<td>11</td>
<td>月光</td>
<td>(a)  火光</td>
<td>(b)  吃光</td>
</tr>
<tr>
<td>12</td>
<td>美化</td>
<td>(a)  消化</td>
<td>(b)  融化</td>
</tr>
<tr>
<td>13</td>
<td>弹性</td>
<td>(a)  酸性</td>
<td>(b)  任性</td>
</tr>
<tr>
<td>14</td>
<td>教员</td>
<td>(a)  演员</td>
<td>(b)  幅员</td>
</tr>
<tr>
<td>15</td>
<td>作家</td>
<td>(a)  搬家</td>
<td>(b)  画家</td>
</tr>
<tr>
<td>16</td>
<td>老师</td>
<td>(a)  老练</td>
<td>(b)  老年</td>
</tr>
<tr>
<td>17</td>
<td>晚会</td>
<td>(a)  宴会</td>
<td>(b)  机会</td>
</tr>
<tr>
<td>18</td>
<td>安全</td>
<td>(a)  安装</td>
<td>(b)  安心</td>
</tr>
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<td>石头</td>
<td>(a)  洗头</td>
<td>(b)  摇头</td>
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<td>冒充</td>
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<td>准确</td>
<td>(a)  准许</td>
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<td>(a)</td>
<td>消息</td>
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<td>(a)</td>
<td>流浪</td>
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<td>25</td>
<td>鸟儿</td>
<td>(a)</td>
<td>健儿</td>
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<tr>
<td>26</td>
<td>面谈</td>
<td>(a)</td>
<td>面粉</td>
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<td>初一</td>
<td>(a)</td>
<td>初级</td>
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<td>28</td>
<td>松针</td>
<td>(a)</td>
<td>松软</td>
</tr>
<tr>
<td>29</td>
<td>渔民</td>
<td>(a)</td>
<td>军民</td>
</tr>
<tr>
<td>30</td>
<td>可怕</td>
<td>(a)</td>
<td>可靠</td>
</tr>
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<td>开门</td>
<td>(a)</td>
<td>开箱</td>
</tr>
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<td>32</td>
<td>射手</td>
<td>(a)</td>
<td>棋手</td>
</tr>
<tr>
<td>33</td>
<td>娇气</td>
<td>(a)</td>
<td>充气</td>
</tr>
<tr>
<td>34</td>
<td>热情</td>
<td>(a)</td>
<td>热爱</td>
</tr>
<tr>
<td>35</td>
<td>医学</td>
<td>(a)</td>
<td>同学</td>
</tr>
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<td>36</td>
<td>草席</td>
<td>(a)</td>
<td>草帽</td>
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<td>读者</td>
<td>(a)</td>
<td>学者</td>
</tr>
<tr>
<td>38</td>
<td>容貌</td>
<td>(a)</td>
<td>容器</td>
</tr>
<tr>
<td>39</td>
<td>湿度</td>
<td>(a)</td>
<td>制度</td>
</tr>
<tr>
<td>40</td>
<td>明白</td>
<td>(a)</td>
<td>明朝</td>
</tr>
</tbody>
</table>
Appendix B: Chinese Compound Awareness Task

中文词汇产生测验

这是一个造词的活动。在下面你听到和读到的每一个句子描述一个你从来没听到过或见过的新奇的事物的。
请尽可能地根据句子意思发挥你的想象力，给出一个你认为最合适，最能表达这个事物的词语。词语越简短越好。我们先举几个例子来学习一下。（提供反馈和正确答案）

第一组练习项目：
1. 我们把用竹子编成的篮子叫做什么呢？______
2. 我们把红色的星星叫做什么呢？______
3. 我们把可以用来睡觉的袋子叫做什么呢？______
4. 我们把用草制成的伞叫做什么呢？______
5. 我们把车辆的摆动叫做什么呢？______
6. 我们把重量很轻的大象叫做什么呢？______

第一组测试项目：
1. 我们把字从书本上扫掉叫做什么呢？______
2. 我们把长满刺的轮子叫做什么呢？______
3. 我们把树木稀疏的森林叫做什么呢？______
4. 我们把用叶子做成的盘子叫做什么呢？______
5. 我们把形状像蛇一样的兰花叫做什么呢？______
6. 我们把星星的闪光叫做什么呢？______
7. 我们把马在跳舞叫做什么呢？______
8. 我们把听起来很冷的音乐叫做什么呢？______
9. 我们把闻起来酸的冰叫做什么呢？______
10. 我们把长得像青蛙一样的鸟叫做什么呢？______
11. 我们把大雾随风的流动叫做什么呢？______
12. 我们把金子折起来叫起来叫做什么呢？______
13. 我们把非常粘的铁叫做什么呢？______
14. 我们把形状像眼睛一样的果子叫做什么呢？______
15. 我们把摸起来很滑的书叫做什么呢？______
第二组练习项目:

1. 我们把用砖头和瓦建成的房子叫做什么呢？________
2. 我们把街道上专门用来洒水的车叫做什么呢？________
3. 我们把专门从事饲养动物的人员叫什么呢？________
4. 我们把长得像螃蟹和蜘蛛一样的鸟叫做什么呢？________
5. 我们把专门用来切石头的刀叫什么？________
6. 我们把专门用来漂白照片的机器叫什么？________

第二组测试项目:

1. 我们把像云彩和月亮一样的枕头叫做什么呢？________
2. 我们把能喷出烟的山洞叫做什么呢？________
3. 一种经过特殊训练后可以给盲人导引道路的猪，我们把它叫做什么呢？________
4. 我们把用石头和网搭成的屋子叫做什么呢？________
5. 能够把人缩小但不能缩小别的东西的镜子, 我们叫它什么呢？________
6. 我们把一个专门负责回收手套的工厂叫做什么呢？________
7. 我们把专门吃铁的怪物叫做什么？________
8. 我们把形状像虫子一样的树根上开的花叫做什么呢？________
9. 我们把专门用来粉碎树叶的机器叫做什么呢？________
10. 一种专门用来播种白菜的车，我们把它叫做什么呢？________
Appendix C: English Derivational Morphology Task

**Practice items:**

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Sentence</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. farm</td>
<td>My uncle is a ...</td>
<td></td>
</tr>
<tr>
<td>B. warm</td>
<td>He chose the jacket for its…</td>
<td></td>
</tr>
<tr>
<td>C. improve</td>
<td>His work showed great…</td>
<td></td>
</tr>
</tbody>
</table>

**Test items**

1. music    That lady with the piano is a… _________
2. popular  The singer enjoyed his… _________
3. profit    Selling lemonade in summer is… _________
4. slow     I was glad that I wasn’t the … _________
5. local     The birds migrated to a new… _________
6. produce  The play was a grand … _________
7. vary      The time of his arrival is… _________
8. wide      We measured the rivers … _________
9. assist    The teacher will give you… _________
10. calm     The teacher asked us to walk… _________
11. magic    He was a very good… _________
12. strong   He wanted to show off his … _________
13. discuss  Mom and Dad had a long boring… _________
14. appear  He cared about his …
15. remark  The speed of the car was…
16. major  He won the vote by a …
17. density  The smoke in the room was very …
18. mystery  The dark glasses made the man look …
19. permit  Father refused to give …
20. human  The kind man was known for his…
21. original  The painter was known for his…
22. continue  She loved to talk, she talked …
23. humor  The story was quite …
24. absorb  She chose the sponge for its …
25. glory  The view from the hilltop was …
26. reason  Hi argument was quite….
27. decompose  I am interested in study of chemical….
28. real  The deadline set by the teacher was…
29. material  She loves clothes more than anything else, she is very…
30. masculine  He demonstrates a lot of …
31. converse  He is a great ….