RELATIVE CONTRIBUTIONS OF PHONOLOGICAL AWARENESS AND ORTHOGRAPHIC KNOWLEDGE TO THE READING PROFICIENCY OF CHINESE STUDENTS LEARNING ENGLISH AS A FOREIGN LANGUAGE

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

by

Kar Man Lee

May, 2011

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Abstract

Phonological awareness and orthographic knowledge have been shown in the literature as the two most important precursor skills underlying word identification, which is in turn integral to reading comprehension. Despite the vast population of people learning English as a foreign language (EFL), reading research with this ever expanding group is not as well established compared with that conducted with native speakers and English as a second language (ESL) learners. Questions remain as to whether EFL students rely more on phonological awareness or orthographic knowledge in the course of word identification. It is equally unclear which of them explains a greater portion of unique variance in reading comprehension. In view of the critical role of word identification in reading comprehension, it is imperative to investigate how EFL students recognize words in print, which is a prerequisite for effective understanding of text. The focus of this study was to examine the relative contributions of phonological awareness and word-specific orthographic knowledge to the English reading proficiency of 122 Chinese students learning EFL in Hong Kong (Grade 7). In addition to exploring the influence of these two foundational skills on word identification, their effect on reading comprehension was also investigated. Results indicated that word-specific orthographic knowledge accounted for a larger share of variance in both word identification and reading comprehension. Most importantly, even after the effect of phonological awareness was controlled for, it still explained unique significant variance in the two outcome variables. Educational implications were discussed with respect to reading instruction for EFL students with a logographic L1 background.

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CHAPTER ONE

INTRODUCTION

Background

Prevalence of English Worldwide

English ranks third as the most commonly spoken language in the world by the number of native speakers, following Mandarin Chinese and Spanish (Lewis, 2009). Despite the comparatively smaller population of native English speakers, the importance of English literacy is reinforced across the globe, as evidenced by its extensive use as an official language in different sovereign states, the United Nations and the European Union. Being able to read English and to extract accurate meanings from such text is deemed a necessary skill for any individual who wants to gain a competitive advantage in the international community.

In the face of keen competition intensified by globalization, non-native English speakers all over the world strive to master the language due to its critical roles in business, communication, science and technology (Nunan, 2003). In countries such as the United States, Britain and Australia, immigrants and ethnic minorities learn English in settings where English is the dominant medium of communication (Lightbown & Spada, 1993). Under this circumstance, English is defined as a second language because students are immersed in an authentic environment conducive to phonological acquisition, vocabulary building and reading development.

Even in areas where English is not the primary language—such as Japan, China and Germany—English is taught as a core subject in schools, so that students are equipped with the necessary language skills to take advantage of the global market. In these regions,

English is learned as a foreign language (as opposed to a second language) due to its limited accessibility in the students' daily lives (Nayar, 1997). In private settings, English actually serves little communicative function for social interaction. Only in the workplace can one increasingly see its practical value for occupational and commercial purposes. In addition, English instruction at school focuses more on lexical precision, grammatical accuracy and vocabulary reading rather than verbal interaction (Lochtman, 2002; Nayar, 1997; Shi, 2004). These findings are consistent with the observation of Stern (1992), who indicated that English is learned for educational reasons in a foreign language context, and immediate application is usually less of a concern.

Challenges of Learning English as a Foreign Language (EFL)

Both English as a second language (ESL) and English as a foreign language (EFL) students strive to identify words and to process written material for comprehension besides their native languages. However, their learning experiences and reading outcomes could differ due to the varying amounts, types, and quality of English input.

Over the past few decades, scholars and teachers have become increasingly aware that learning ESL is distinct from learning English as the first language (L1), and therefore, ESL should be treated as a unique specialty area of research. Less recognized, however, is the marked difference between the disciplines of ESL and EFL. Nayar (1997) called into question the longstanding ESL/EFL ambivalence in the literature:

> Although there is some sort of vague universal acceptance of the existence of two different entities called ESL and EFL, a great deal of referential fuzziness within the two and denotative overlap between the two are making the terminological distinctions unclear, impractical, and ineffective or, worse still,

in some cases, inauspicious and irrelevant. (p. 10)

The inappropriate use of ESL as an acronym synonymous to EFL not only causes terminological confusion, but also dismisses EFL students as a unique linguistic population with specific literacy needs.

In EFL contexts, students do not have as convenient access to English as their ESL counterparts because it is not the language of the majority (Gebhard, 1996; Philp & Tognini, 2009; Redfield, 1999). Deprived of the daily opportunity to negotiate meaning using the target language, their active vocabulary is usually limited and their conversational fluency is also compromised (Cohen & Olshtain, 1993). Such deficits in expressive language (i.e., oral output) can also be explained in part by their limited exposure to receptive language (i.e., auditory input). The importance of language input and its impacts on language production have been examined extensively in prior research (Carroll, 1999; Gersten, Baker, Haager, & Graves, 2005; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Krashen, 1985; Smith, 1993; Snow, 1993).

Following the same argument, EFL students' sensitivity to the sound structure of English words is relatively underdeveloped due to their inadequate exposure to oral English. Their inability to discriminate speech sounds is also translated into difficulty in applying phonological information to decode printed words. English is a language developed on the basis of an alphabetic system, with each letter corresponding to a particular sound. Due to its segmental nature, readers who have good phonological awareness can readily use grapheme-phoneme conversion as a strategy to sound out written words for identification and comprehension. However, the absence of a native-speaking environment puts EFL learners at a disadvantage to develop the phonological awareness they need to decode words effectively.

This also explains why EFL students are subjected to greater challenges to develop English literacy and to attain higher levels of reading proficiency.

Inquiries into How EFL Students Manage to Read

To compensate for the inherent environmental disadvantage described above, local schools in EFL settings are under mounting pressure to improve their students' English abilities. With reading comprehension being the top priority of most educational agendas, there is a profound need for improved literacy instruction that is substantiated by empirical research. This also results in a call for a better understanding of different components underlying the reading process. As shown in the literature, reading success is gained through a repertoire of linguistic skills, among which phonological awareness and orthographic knowledge are the two most important abilities.

Phonological awareness and orthographic knowledge have been shown in the literature as the two most important factors underlying word identification, which, in turn, are integral to reading comprehension (Hagiliassis, Pratt, & Johnston, 2006). There has also been evidence that these two precursor skills are strongly associated with multiple facets of reading development (Cunningham, Perry, & Stanovich, 2001; Ehri, 2005; Harm & Seidenberg, 2004). This study strives to add to the current body of knowledge by specifically examining these factors' contributions to the reading achievement of Chinese EFL students in Hong Kong.

In the following section, the definitions of phonological awareness and orthographic knowledge are provided. In addition, Dual Route Models are introduced to explain the operation of phonological awareness and orthographic knowledge in the process of word identification.

Operation of Two Foundational Reading Skills within Dual Route Models

Phonological Awareness

A substantial number of studies have found that phonological awareness plays a major role in word identification as well as in reading development (National Reading Panel, 2000; Stanovich, 2000). The realization that a spoken word is comprised of discrete sounds and the ability to manipulate the sound units form the basis of phonological awareness (Goswami & Bryant, 1990; Yopp, 1992).

Orthographic Knowledge

Orthographic knowledge is another critical factor in English literacy development. It is an umbrella term referring to one's familiarity with (1) the unique letter sequence defining a word, and (2) the overall spelling rules governing the entire English language system (Siegel, Share, & Geva, 1995; Vellutino, Scanlon, & Tanzman, 1994). More precisely, knowledge of the correct letter sequence that constitutes a word is defined as word-specific orthographic knowledge. Knowledge about basic English spelling conventions is called general orthographic knowledge.

Dual Route Models

The roles of phonological awareness and orthographic knowledge in word identification could be systematically understood with reference to the Dual Route Models. According to these well-known scientific hypotheses, visual word reading is achieved through the simultaneous application of two related but independent mental mechanisms (Coltheart, 1978; Coltheart, Curtis, Atkins, & Haller, 1993; Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Houghton & Zorzi, 2003). The first mechanism follows a non-lexical route, during which phonological awareness is applied to 'sound out' unfamiliar (but

regular) words or non-words. With this approach, the targeted words to be read are decoded at a sub-lexical level because each constituent letter is first translated into its respective sound before pronunciation. Accurate word reading, in this case, is based on a precondition that the vocabulary items adhere strictly to letter-sound conversion rules. If this precondition is violated, regularization errors will arise (Castles & Holmes, 1996). For example, 'have' will be mispronounced to rhyme with 'gave', 'save' and 'wave'; 'colonel' will be pronounced as /*kollonell*/.

The second mechanism follows a lexical route, in which orthographic information is employed to retrieve fully-specified lexical representations retained in the reader's memory. In this case, the targeted words to be read are limited to those previously acquired vocabulary items, whether regular or irregular. As the vocabulary items have already been learned and saved in the mental lexicon, readers can pronounce them at sight without undertaking the complicated process of decoding. This route is built on a strong visual strategy. Familiarity with the formalistic properties of words is the key to activating instant recollection of how they should be pronounced. Even when the words deviate from spelling-sound consistency, such irregularity will not impede reading accuracy.

Both routes assist with word identification in a complementary manner, meaning that the obstruction of one path will result in the automatic activation of the other to facilitate word identification performance. It is commonly agreed that phonological awareness is more necessary when very few written words are known. However, there will be a shift to greater reliance on orthographic knowledge with the growth of vocabulary (Martin, Pratt, & Fraser, 2000). In addition, data show that people who are not sensitive to phonological cues or have difficulty manipulating sounds rely more heavily on orthographic knowledge to identify

words. Likewise, people who have not established precise orthographic representations in the mental lexicon resort more frequently to phonological awareness as a compensation strategy.

Testing the Dual Route Models is beyond the scope of this study, yet understanding such theories allows insights into how phonological awareness and orthographic knowledge operate to facilitate efficient identification of written words. Central to the Dual Route frameworks is that reading unfamiliar words and non-words requires (1) considerable sensitivity to speech sounds and (2) advanced skills to convert graphemes into phonemes. In the literature, there is ample evidence that phonological deficits are one major source of word reading difficulty (Lyon, 1995; Manis, Custodio, & Szeszulski, 1993; Perfetti, 1992).

Conceptualization of Word Identification with Reference to Dual Route Models

Word identification could be understood in relation to the Dual Route Models as well. As explained previously, a word could be identified through a non-lexical route or a lexical route, depending on how closely the word adheres to letter-sound correspondences and how familiar one is with the target word. To identify an unfamiliar yet regular word, a reader can attempt to decode the word and arrive at the correct pronunciation based on its sound structure. The degree of letter-to-sound consistency determines whether the use of grapheme-phoneme rules is appropriate.

This also explains why the phonological analogy does not apply to the identification of exception words. Exception words are irregular because their letter strings do not reflect the sounds they represent. To read an exception word (e.g., colonel and yacht) correctly, one must have prior knowledge about the word so that the pronunciation specific to that particular vocabulary item could be retrieved. In addition, when an initially unfamiliar, regular word becomes familiar to a reader after repeated exposure, it can be identified

automatically without undergoing the process of letter-sound conversion. Here, reading at sight based on the orthographic structure is a visual approach that corresponds to the lexical route in the Dual Route Models.

Since word identification is a multidimensional concept, a variety of approaches have been used to assess this skill. One common task is called real word reading, during which participants are requested to read a list of real words presented visually in isolation. In most cases, the test items are organized in ascending difficulty from high-frequency, regular words to low-frequency, irregular items. Successful completion of this task results from the integration of both phonological and orthographic analyses. Another common method used to estimate word identification skills is called nonsense word reading. In this task, participants are requested to read a series of isolated pseudowords (e.g., croad, fek and jom). Although the nonsense words do not actually exist in reality, their pronunciations could be predicted from how they are spelled, and therefore, reading accuracy reflects mastery of grapheme-phoneme conversion in decoding.

Statement of the Problem

According to a report by Graddol (1997), at the turn of the millennium, there were approximately 750 million people speaking EFL in the world, the size of which was almost the combination of native English speakers (about 375 million) and ESL speakers (around 375 million). Despite the vast population of EFL learners, reading research with this ever expanding group is not as well established, in comparison to the amount of research conducted with the other two groups.

In the absence of a native-speaking environment, schools in EFL settings are under additional pressure to compensate for the inherent environmental disadvantage and to

improve their students' English reading abilities. The pressing need to optimize the chance of success drives the schools to call for more effective reading instruction. One major inquiry into literary development in EFL contexts is the investigation of the language skills underlying reading comprehension, which begins with word identification.

Despite the fact that there are divided opinions about the process by which people learn to read, word recognition is commonly identified as a key component of reading comprehension (Fukkink, Hulstin, & Simis, 2005). Words are the most basic units of a text. Each word carries a unique lexical meaning or serves a particular grammatical function. While readers do not need to understand every single word and instead can use contextual clues to infer meaning, the application of such a strategy seems unrealistic when their vocabulary base is inadequate to make sense of the context. In addition, over-reliance on guessing words to approximate meaning can cause constant disruptions in the reading process, which in turn impedes overall comprehension. Hence, it is beyond dispute that accurate, rapid and direct retrieval of a word from the mental lexicon is the key to reading success. The positive impact of efficient word recognition on reading comprehension has been well documented in research on native English speakers and ESL students (Ehri, 2005; Koda, 2005). Such a relationship is also substantiated by studies conducted with EFL students.

In view of the critical role of word identification in reading comprehension, it is imperative to determine which foundational skills contribute to effective word identification. However, few studies have examined how EFL learners recognize words in print, which is a prerequisite for the effective understanding of text. Questions remain as to whether EFL students rely more significantly on phonological awareness or orthographic knowledge when

retrieving a word's identity. It is equally unclear which of these two variables can explain a larger share of variance in reading comprehension.

In light of this, the focus of this study is to examine the relative contributions of phonological awareness and orthographic knowledge to EFL students' English literacy. Specifically, EFL students with a logographic L1 background from Hong Kong were examined. It should be noted that there are two types of orthographic knowledge, and this study only focused on the word-specific type. Word-specific orthographic knowledge, here, refers to one's knowledge about the *unique* letter string that defines a *particular* word, as opposed to the *overall* spelling conventions that determine acceptable letter combinations. In addition to exploring the influence of phonological awareness and word-specific orthographic knowledge on word identification, their effects on reading comprehension will be investigated because the ultimate goal of reading is to understand written information (Goodman, 2006). Using both word identification and reading comprehension as endpoints of this study would result in a more robust study design.

Colonial Background, Linguistic Context and Education System of Hong Kong

The colonial background and linguistic context of Hong Kong represent a unique situation, which deserves some elaboration to enhance the understanding of its education system. Hong Kong is a predominantly Chinese society with a high degree of ethnic homogeneity. Ninety-five percent of Hong Kong's population are of Chinese descent, and their dominant language for daily exchanges is Cantonese. Given the primarily monolingual nature of the city, English is very much a foreign language to the local people, and schools are almost the sole source of English language education.

Once a British colony, Hong Kong was under British administration before China resumed sovereignty over the city on July 1, 1997. During the colonial period, the small fishing village was transformed into an international metropolis. One major colonial influence brought to the city was the rising importance of English in this Chinese society. In the past, the governor and other government officials holding key positions had been British. Therefore, English was made the official language of Hong Kong. Only in the late 1970s was Chinese added as another official language.

Since the colonial period, English has taken root in Hong Kong as a significant language. Now, even after the handover, English continues to play important roles in politics, law, business and tourism. Due to this historical background, Hong Kong students are known to have relatively more opportunities to learn the language at school. In Hong Kong, students start to gain access to English through formal, mandatory education in first grade. Furthermore, native English speakers are recruited to teach in primary and secondary schools under the Native English-speaking Teacher (NET) scheme. Such emphases on early exposure to the target language and its authentic use have made English teaching and learning an integral component of Hong Kong education.

However, since the reclaiming of Chinese sovereignty in 1997, Hong Kong's education system has undergone radical changes, which are deemed mostly detrimental to the development of English language learning. Secondary schools (Grades 7 – 12) in Hong Kong have been reduced from five academic categories to three academic categories. Even more controversial is the medium of instructional reform. In response to the central government's promotion of Cantonese as the major language to be taught in schools, about three-quarters of secondary schools in the public sector have been mandated to change their medium of

instruction from English to Chinese at junior secondary levels (Grades 7– 9). This substantial reduction of English teaching in secondary schools has not only led to prevailing negative sentiment toward the policies in the local community, but has also intensified the labeling effects (So, 1992). Besides, the English skills of most Hong Kong students have declined due to less exposure to the target language in educational settings.

To many local teachers, one of the greatest obstacles impeding English education is limited exposure to the target language outside of the school setting. In Hong Kong, students do not have an authentic environment in which to put the language to use on a daily basis. Research underscores that English literacy achievement builds on a solid foundation of vocabulary knowledge, which can be acquired partly through substantial exposure to oral English (Saville-Troike, 1984). Given the spelling/sound correlations of English, English learners with training in phonology can better associate the spoken words they have heard with the corresponding written words they encounter in print. Such transferability helps the readers to uncover the meanings of words presented visually.

Despite the obvious advantages, the monolingual context of Hong Kong has proven to be sub-optimal for English language learning to take place. Hong Kong students are characterized by a particularly low level of phonemic awareness. In a study by Holm and Dodd (1996), university students from Hong Kong studying in Australia were found to perform most poorly in reading and spelling nonsense words, when compared with three other ESL groups and native speakers. Although a huge amount of resources has been directed to improve the reading abilities of Hong Kong EFL students, the students are not developing sufficient vocabulary and effective word recognition skills to comprehend texts at comparable levels as native speakers.

Furthermore, the drastic difference between the Chinese and English linguistic systems adds another level of difficulty to learning. Chinese is the L1 of most Hong Kong students, and this writing system emphasizes the importance of sight word reading. Unlike English, which is an alphabetic language, Chinese is logographic, with each character representing only one monosyllabic morpheme (DeFrancis, 1989; Mattingly, 1992; Perfetti & Zhang, 1995). Non-segmental in nature, Chinese is not open to decoding; training students to identify Chinese characters by sight serves as a more optimal approach to improve reading outcomes.

Even with regard to English teaching, local teachers tend to adopt the language approach commonly used for Chinese instruction to facilitate sight word reading in English (McDowell & Lorch, 2008). In Hong Kong, automaticity in English word identification emerges as a result of drilling, during which entire written patterns are mapped directly to their pronunciations and meanings (Wang & Geva, 2003). This mechanical approach of instruction also results in students' persistent use of rote memorization as the primary English learning strategy. Although there has been a shift to a more interactive instructional approach that elicits communicative use of the target language, consolidation of formulaic and rule-based knowledge still dominates current classroom practices.

Significance of the Study

One central focus of reading research is to examine how students use phonological awareness and orthographic knowledge to support word identification, which is a prerequisite for effectively understanding text (Juel, Griffith, & Gough, 1986; Perfetti, 1985). Over the past few decades, significantly more reading research efforts have been extended from English monolinguals to ESL learners (Geva, 2006; Grabe, 2004; Jean & Geva, 2009; Koda,

2005, 2007). This gives rise to the recognition that phonological awareness and orthographic knowledge differ considerably in their contributions to reading outcomes, especially when ESL students from diverse L1 backgrounds are examined (Akamatsu, 1999, 2003; Nakamoto, Lindsay, & Manis, 2007; Wade-Woolley, 1999). Paramount to this finding is the growing awareness that individual/group differences could impact how word identification and reading comprehension are achieved. Extending investigation to a wider range of student populations in EFL contexts, therefore, could yield more insights into this vital topic of interest.

In most ESL/EFL reading research, the subjects are primarily young children (up to Grade 2) or college students. In view of this, Koda (2007) called for more research on ESL/ESL students at upper elementary levels, middle schools and high schools. This study intentionally focused on older EFL students. Specifically, a representative sample of seventh graders with Chinese as L1 in Hong Kong was examined.

Although a significant amount of resources has been directed to improve the reading abilities of Hong Kong students, they are still not developing effective word recognition skills in order to comprehend text at comparable levels as native speakers. Hence, investigating how this specific linguistic group identifies words will allow for the introduction and implementation of specific instructional strategies to accelerate these learners' reading efficiency. When word recognition becomes an automatic process, students will be able to read more extensively with fewer impediments at the word level. As a result, additional cognitive resources can be devoted to comprehending written information.

Research Questions

Phonological awareness and word-specific orthographic knowledge are the two major

contributors of word identification, according to the literature on reading acquisition. However, their roles in word identification and reading comprehension among EFL students—in particular, those with a logographic L1 background—are less well understood. This study on seventh graders could add to the current knowledge on their contributions to reading achievement, especially among Chinese population in regions where English is not the primary language.

In the study, the relations among phonological awareness, word-specific orthographic knowledge, word identification and reading comprehension were investigated using correlational analyses and hierarchical regression analyses. One major goal was to explore the relative contributions of phonological awareness and word-specific orthographic knowledge to word identification among the Chinese EFL participants. Another goal was to determine the extent to which these students' phonological awareness and word-specific orthographic knowledge collectively and uniquely explained variance in their reading comprehension. Using both word identification and reading comprehension as endpoints, this study could provide greater insight into how this particular linguistic group developed its English literacy.

A battery of nine tests, eight of which were selected from standardized measures, was used to assess the four domains of reading. The measures included in this study were (a) the Comprehensive Test of Phonological Processing (CTOPP) (Wagner, Torgesen, & Rashotte, 1999), (b) the orthographic choice task devised by Olson, Kliegl, Davidson and Foltz (1985), (c) the Peabody Individual Achievement Test – Revised/Normative Update (PIAT-R/NU) (Frederick & Markwardt, 1989), (d) the Woodcock Reading Mastery Test – Revised / Normative Update (WRMT-R/NR) (Woodcock, 1998), (e) the Woodcock Reading Mastery

Test, and (f) the Gates-MacGinitie Reading Tests, 4th Edition (GMRT-4) (MacGinitie, MacGinitie, Maria, & Dreyer, 2000). All measures selected have been shown to have high validity and reliability. The three research questions guiding this study were:

1. To what extent are phonological awareness and word-specific orthographic knowledge associated with word identification and reading comprehension in seventh-grade Chinese EFL students?
2. What are the relative contributions of phonological awareness and word-specific orthographic knowledge to word identification in seventh-grade Chinese EFL students?
3. What are the relative contributions of phonological awareness and word-specific orthographic knowledge to reading comprehension in seventh-grade Chinese EFL students?

Research Hypothesis

In non-English-speaking regions, English is defined as a foreign language rather than as a second language. Unlike native speakers and ESL students, EFL students are deprived of a native English-speaking environment. Beyond classrooms, there are very few opportunities for students to practice English (Nayar, 1997). The input hypothesis of Krashen (1985) and the output hypothesis of Swain (1985) collectively justify the reasons for EFL students' generally lower levels of phonological awareness and greater chance of mispronouncing words. Their limited exposure to the target language might translate to weaknesses in manipulating speech sounds, which in turn impede their word reading performance. With this constraint, EFL students in Hong Kong are expected to rely more heavily on orthographic information to identify printed words and to understand written materials (Leong, Hau,

Cheng, & Tan, 2005; Leong, Tan, Cheng, & Hau, 2005).

Definition of Terms

English as a foreign language (EFL) --- EFL, as opposed to ESL, indicates the learning of English in a non-English-speaking region such as Hong Kong, Japan, France and Germany. In this region, English is not the dominant language, meaning that it is not the primary medium of day-to-day communication.

English as a second language (ESL) --- ESL refers to the learning of English in an English-speaking region such as the United States, Britain, Canada and Australia. Immigrants, refugees and students who speak a home language other than English, but study English in this region are called ESL students.

Phonological awareness --- Phonological awareness refers to one's sensitivity to the sound structure of a spoken language and the ability to manipulate speech sounds.

Orthographic knowledge --- Orthographic knowledge refers to one's familiarity with the writing system of a language.

Word-specific orthographic knowledge --- In the English language, word-specific orthographic knowledge refers to one's familiarity with the unique letter sequence that defines a word.

General orthographic knowledge --- In the English language, general orthographic knowledge refers to one's familiarity with the overall spelling conventions. Distinguishing legitimate letter strings from non-permissible letter clusters is an example of general orthographic knowledge.

Word identification --- Word identification is the ability to read sight words with automaticity and to apply decoding strategies to read unfamiliar words.

Reading comprehension --- Reading comprehension is the process of interpreting information and constructing meaning from written texts.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter presents an overview of previous research regarding the roles of phonological awareness and orthographic knowledge in reading development. The chapter contains four major sections. The first section introduces phonological awareness as a foundational skill critical to literacy acquisition. The second section analyzes the facilitative effects of orthographic knowledge on word identification and reading comprehension. In the third section, the concept of first language transfer is highlighted, with a particular focus on Chinese as L1 and English as L2. This section aims to explain how the L1 logographic writing system of Chinese students results in their greater reliance on visual information when processing English. Finally, the first language transfer effect is discussed specifically with reference to students in Hong Kong, where English is learned in the absence of a native-speaking environment.

Phonological Awareness

An Overview

Phonological awareness refers to an individual's sensitivity to the sound structure of a spoken language (Tunmer, 1989; Wagner, 1988; Yopp & Yopp, 2000). Understanding of rhyme is one fundamental component of phonological awareness (Adams, 1990). More advanced skills include distinction, segmentation, blending and manipulation of discrete speech units that fall along a continuum with phonemes at one end and syllables at the other. Consistent with this notion, Cassady, Smith, and Huber (2005) provided further details as to how sounds within a spoken word can be categorized into smaller phonological units at the four following levels.

Syllable. A syllable is the largest phonological unit in a spoken word. When segmenting a word, a split can be placed after each articulation of an uninterrupted sound. For example, the spoken word /cat/ is composed of one syllable only (/cat/).

Onset-rime. Segmentation, here, operates at the syllable level. The split takes place immediately before the vowel, dividing a syllable into an onset and a rime (e.g., /c/-/at/).

Body-coda. Segmentation also occurs within a syllable. However, the split is placed immediately after the vowel instead, dividing a syllable into a body and a coda (e.g., /ca/-/t/).

Phoneme. This is the most advanced level of segmentation. A syllable is dissected into its smallest contrastive sound units, and the split occurs between individual phonemes (e.g., /c/-/a/-/t/).

It is important to note that phonological awareness differentiates itself from phonemic awareness in terms of its scope. While the former is an umbrella term attending to the whole array of sounds that make up oral language, the latter is much more specific, focusing only on phonemes, which are the smallest distinctive units of sound in a spoken word. The realization that a spoken word is comprised of phonemes and the ability to manipulate them orally form the basis of phonemic awareness. Phonemic awareness, therefore, is only one subcategory of phonological awareness, even though it is regarded by researchers as a robust indicator of one's phonological awareness. The two terms are closely related in a hierarchical manner, but they are not identical and do not operate in mutual exclusion.

The conceptualization of phonological awareness could also be achieved by examining the tasks used to measure this language skill. Some common examples of phonological awareness tasks are (a) providing words that rhyme with other words, (b) saying the sounds of a word separately, (c) blending sounds together to make words, (d)

deleting a sound or syllable from a word and saying what remains (e.g., saying /meat/ without the /m/ is /eat/), and (e) grouping together words that start with the same sound or end with the same sound. Notably, all of these tasks focus only on oral performance. They should not involve any written materials, nor do they rely on letter knowledge.

The importance of phonological awareness in English literacy development has been widely acknowledged. The National Reading Panel (2000) reviewed evidence of effective educational practices and concluded that phonemic awareness instruction, a subcategory of phonological awareness instruction, is "one necessary instructional component within a completed and integrated reading program" (p. 8). In line with this argument, Nagy, Berninger, and Abbott (2006) added that "one of the major theoretical advances in reading research in the last 50 years has been recognition of the crucial role that phonological processes play in learning to read" (p. 136).

Roles of Phonological Awareness in Reading

A substantial volume of research has shown that mastery in English speech sounds is closely associated with higher levels of word identification and reading comprehension performance (Castles & Coltheart, 2004; Gottardo, Stanovich, & Siegel, 1996; National Reading Panel, 2000; Shapiro & Solity, 2008). A good command of phonological awareness is especially known for its causal effects on word identification (Muter, Hulme, Snowling, & Stevenson, 2004) and spelling. The correlational evidence and causal evidence revealed in the literature are presented in the sections below.

Correlational evidence. Converging evidence from meta-analysis supports the positive correlations between phonological awareness and reading. Scarborough (1998), for example, underscored that phonological awareness correlated approximately .46 with reading

in his meta-analysis. In the meta-analysis by Swanson, Trainin, Necoechea, and Hammill (2003), the authors investigated the connection between phonological awareness and real word reading, along with many other variables. Although the findings suggested that phonological awareness had been overstated for its predictive power of real word reading, the correlation between the two was confirmed. Their correlation coefficient was found to be .48, indicating a moderate level of association.

The extensive review by Castles and Colheart (2004) is probably one of the most important works in support of the correlational relationship between phonological awareness—more specifically, phonemic awareness—and reading acquisition. It should be noticed that what the authors affirmed was only a correlational relationship, but not "a causal link" due to the absence of "unequivocal evidence" (p. 101). While the authors did not necessarily dismiss the causal connection between phonological awareness and reading in theory, proving its existence was deemed a great challenge in practice for two major reasons. First, the longitudinal effects of phonological awareness on reading could be mediated by an array of extraneous factors, such as letter knowledge, verbal memory, age, IQ, etc. The very impossibility of ruling out all confounding variables and their mediating effects invalidated the claim that phonological awareness gave rise to improvements in reading. Second, accelerated reading performance after phonological training could not justify the causal link either, unless the training took place when children did not have any preexisting reading skills and letter-sound knowledge. However, as argued by Hulme and Snowling (2005), this criterion seems too demanding, if not unrealistic, because children with a total absence of alphabetic concepts are probably too young for phonological training.

Other than meta-analysis, longitudinal studies also provide an important source of correlational evidence, which highlights the role of phonological awareness as a reliable predictor of reading success (Lonigan, Burgess, & Anthony, 2000; Muter et al., 2004; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Wagner et al., 1997). To minimize the mediating effects of letter knowledge and prior reading skills on the predictive power of phonological awareness, young children at a preliterate stage are more often the focus of investigation because they usually have limited knowledge of alphabetic principles.

In the longitudinal study conducted by Parilla, Kirby, and McQuarrie (2004), the progress of 93 kindergarteners in Ontario was recorded over the course of four years from kindergarten to third grade. This study investigated the concurrent and future predictive power of phonological awareness and other phonological processing skills—namely, verbal short-term memory, naming speed and articulation rate—on word identification, as measured by real word reading, and passage comprehension. Both kindergarten and Grade 1 phonological awareness were found to account for unique variance in word identification and passage comprehension, after controlling for the effect of other phonological processing variables. Furthermore, phonological awareness in Grade 1 was the strongest predictor of word identification and passage comprehension across the three years. An important conclusion drawn from this study was that reading failure could be a result of early phonological deficits.

It is well established that phonological awareness is a powerful predictor of word identification. However, mixed results have been obtained regarding the extent to which it explains the variance in reading comprehension. In the longitudinal study by Muter et al. (2004), 90 British students, aged 4 years and 9 months on average, were followed over a

period of two years, during which numerous skills were assessed for their relative contributions to word identification and reading comprehension. Results showed that word identification achieved during the first two years of formal education could be consistently predicted by early phoneme sensitivity and letter knowledge. In contrast, vocabulary knowledge and grammatical awareness were more significant predictors of reading comprehension, independent of the effects exerted by early word recognition, phoneme sensitivity, and letter knowledge.

Causal hypothesis. Besides, advocates for phonological awareness have continued to provide evidence in support of the causal relationship between phonological awareness and other higher reading skills, such as word identification and reading comprehension (Bradley & Bryant, 1983; Hulme, Snowling, Caravolas, & Caroll, 2005). One major source of evidence is from intervention studies, which show how young students could benefit from improved phonemic awareness as a result of additional training (Ehri et al., 2001; Hatcher, Hulme, & Snowling, 2004).

Cunningham's (1990) study is especially important because he set out to examine the effectiveness of a *pure* phonemic intervention, which excluded training on letter sound correspondences. In this study, the author compared the effectiveness of implicit phonemic awareness instruction and explicit phonemic awareness instruction to kindergarteners and first graders ($N = 84$) over a period of ten weeks. The first experimental program adopted an implicit approach, with a primary focus on such drilling skills as segmenting and blending of speech sounds in a "decontextualized manner" (p. 435). The training was purely audio-based because it involved only manipulation of speech sounds orally without any reliance on print. The second experimental program was explicit in nature, covering not only the procedural

knowledge of separating and combining individual sounds, but also the application of phonemic awareness skills to actual reading tasks. A matched case-control design was used, during which the participants in each of these two experimental groups and the control group were matched by age and pretest scores.

After ten weeks of training, both experimental groups showed better performance than the control group on measures of phonemic awareness, sound-symbol correspondence knowledge, word identification and reading comprehension. Hence, instruction in phonological training, whether implicit or explicit, could accelerate reading performance. In addition, the type of instruction in phonemic awareness did make a difference in the first graders' sound-symbol correspondence knowledge, word identification performance and reading comprehension ability. Those in the explicit intervention group were found to outperform their implicit counterparts on all these three tasks at statistically significant levels. Although the gains resulted from the implicit intervention were not as substantial, this study proved that the ability to reflect on the sound structure of spoken words *alone* could result in progress in reading.

The positive impacts of phonological intervention could also be noticed in ESL learners. In their experimental study, Swanson, Hodson, and Schommer-Aikins (2005) evaluated the effectiveness of phonological awareness training, at the phoneme level, in seventh-grade poor readers who were predominantly ESL students. A total of 35 students were assigned to the treatment group, and they participated in small-group instruction sessions that emphasized phonological awareness at the phoneme level (45 minutes a day for 12 weeks). Phoneme segmentation, manipulation, and blending instruction were parts of the lessons. In addition, the instruction of orthographic rules was incorporated. On the other

hand, 33 students were assigned to the control group for comparison. Not only did the treatment group outperform the control group in the analysis of spoken words, these participants also displayed higher levels of proficiency in all other measures: real word reading, nonsense word reading, word comprehension and passage comprehension. This study's results were in line with previous L1 findings that efficient word decoding would leave more cognitive resources for comprehension of text (National Reading Panel, 2000; Tunmer & Chapman, 1998). The findings also supported the contention that "older students with phonological awareness deficiencies, including those of ELL status, can learn to read efficiently if instruction serves to resolve deficits that restrict fluent reading expression" (p. 339).

In a more recent study, Tong, Irby, Lara-Alecio, Yoon, and Mathes (2010) focused specifically on 196 Hispanic English learners, examining the effectiveness of a three-year intervention (from kindergarten to second grade) on English language and literacy acquisition. All participants were engaged in a structured English immersion (SEI) program at school, during which English was used as the sole medium of teaching. While the control group (n = 112) received regular SEI instruction, the treatment group (n = 84) was provided with structured and systematic English intervention. Part of the intervention was phonemic awareness enhancement, which focused on phoneme discrimination, segmentation and blending. Other components of the intervention included enhanced instruction in phonics, letter-sound correspondence, oral language skills, word recognition, spelling, vocabulary, fluency and comprehension. Compared to the control group, which exhibited significantly higher levels of word segmentation at the onset, the treatment group eventually caught up and outperformed the control group in the domain of phonological awareness. In a similar

fashion, despite their initial underperformance, the students in the treatment group performed better and demonstrated higher gains than their non-treatment counterparts in passage comprehension after intervention.

However, attention should be paid to the fact that the interventions implemented the studies of Swanson et al. (2005), and Tong et al. (2010) did not merely focus on phonological skills. In fact, most experimental studies identified in the literature involve training in a collection of oral language skills and reading-related skills as well. Given this, phonological awareness might not be the sole determinant of reading improvement. However, it has been broadly agreed that phonologically-based intervention is an effective means to address the instructional needs of students and to improve their literacy outcomes.

Is Phonological Awareness Alone Sufficient?

Over the years, examining the roles of phonological awareness in reading has become the center of research and dominated the intellectual discussion. The tremendous growth of the scope of phonological awareness studies has led to new insights in reading and literacy development. Simultaneously, it also gives rise to the concern that the importance of phonological awareness might have been overstated in the literature.

This argument is especially valid because 80% of English words do not adhere strictly to one-to-one letter-sound correspondences (Shankweiler & Fowler, 2004). Although English is an alphabetic langue, it is orthographically opaque or deep, meaning that there is a lack of consistency in how a spoken phoneme is mapped onto a written grapheme. Because English encompasses a large body of irregular words that violate phoneme-grapheme conversion rules, phonics instruction—analysis of the most common symbol-sound relationships—may not effectively help students to decipher correct word pronunciations.

The classic study by Clymer (1963) on the utility of phonic generalizations provided strong evidence that phonics programs could be of limited value. In this study, the author analyzed the utility of 45 phonic generalizations identified in some teacher manuals for primary grades. It was surprising that 27 of those phonic generalizations could be misleading. For example, there was a common belief that when two successive vowels are found in a syllable, pronunciation should follow the first vowel sound (such as /ɪ/ in 'fear'). However, Clymer challenged the utility of this phonics generalization by indicating that words such as 'bear' and 'earn' do not comply with this rule.

While developing a basic level of phonological sensitivity could certainly be beneficial, efficient word recognition and successful comprehension of text require more than mapping sounds to letter strings (Juel et al., 1986; Nation & Snowling, 2004; Stanovich, 1992; Stanovich, West, & Cunningham, 1991; Tunmer & Nesdale, 1985). A similar argument was put forth by Cunningham, Perry, Stanovich, and Share (2002):

> … while virtually no child with deficient phonological processing skills develops reading ability with ease, some children with adequate phonological sensitivity lag behind in the development of word recognition efficiency. Thus, if phonological processing is a necessary but not sufficient condition for the development of adequate word recognition skill, this implies that there may be another cognitive ''sticking point'' for some children. (p. 186)

In their paper, the authors posited that orthographic knowledge was probably the other skill that accounted for variance in word recognition skills not already explained by phonological factors.

While Johnston (1998) believed that phonemic awareness is underlying reading development, he agreed that the orthography of a written language plays a role in influencing how words are read. As he indicated, "… we do not need to be good phoneticians to be skilled readers. What we may need is orthographic knowledge underpinned by an adequate but not particularly precise awareness of phonemes in spoken words so that we can learn to recognize printed words with ease" (p. 199).

In fact, an increasing number of scholars are pleading for more research endeavors and instructional practices that go beyond the narrow focus on phonological awareness. For example, Berninger, Abbott, Nagy, and Carlisle (2010) objected to the overemphasis of phonological awareness at the expense of orthographic awareness and morphological awareness in literacy instruction. In their study, a series of growth curve analyses were conducted. One purpose was to compare the longitudinal development of two cohorts (Grades 1 through 4 in the younger cohort and Grades 3 through 6 in the older cohort) with respect to their phonological awareness, orthographic awareness and morphological awareness over a period of four years. Substantial growth in all three types of linguistic awareness was noticed from Grade 1 to Grade 3, meaning that these are all foundational skills that begin to develop in early schooling. The authors argued that instruction focusing on coordinating all three types of linguistic awareness could best optimize students' reading achievement. Instead of simply promoting instruction aiming at analyzing sounds in spoken words, the National Reading Panel was advised to acknowledge the importance of orthographic awareness and morphological awareness as well.

Orthographic Knowledge

An Overview

Aside from phonological awareness, orthographic knowledge is another critical factor in English literacy development. According to Perfetti (1984), orthographic knowledge refers to "the knowledge a reader has about permissible letter patterns" (p. 47). Consistent with this, Vellutino et al. (1994) defined the term with more specification. As the authors indicated, orthographic knowledge suggests "the ability to represent the unique array of letters that define a printed word, as well as the general attributes of the writing system such as segmentation dependencies, structural redundancies, and letter position frequencies" (p. 314). Based on this definition, orthographic knowledge can be categorized into two main types: word-specific orthographic knowledge and general orthographic knowledge (Hagiliassis et al., 2006; Vellutino et al., 1994).

Knowledge of each individual word's letter sequence is called word-specific orthographic knowledge. Such knowledge draws upon memory for the letter string that defines a word. With word-specific orthographic knowledge, one should be able to identify that 'cake' is a real word, whereas 'caik' is not.

Familiarity with the overall spelling patterns regulating the entire writing system is known as general orthographic knowledge. It refers to the ability to distinguish between legal and illegal sublexical clusters. For examples, both 'filk' and 'filv' are pseudowords. However, with general orthographic knowledge, one should be able to tell that 'filk' is more likely a legitimate word because its spelling follows a permissible letter sequence (as in 'milk' and 'silk') based on the English writing system.

As postulated by the Lexical Quality Hypothesis, automaticity arises from the

establishment of well-specified lexical representations (Perfetti, 1992; Perfetti & Hart, 2002). Repeated exposure to words and increased experience with print can contribute to more fine-grained orthographic representations in memory (Ehri, 2005). The transition from decoding words based on letter-sound correspondences to recognizing words orthographically in a rapid and automatic manner is deemed "a hallmark of skilled reading" (Castles & Nation, 2008, p. 1).

Why Is Orthographic Knowledge Important?

English is a writing system structured according to alphabetic principles. Its segmental nature allows decoding to take place, during which phonological awareness is activated in order for each grapheme to be translated into its equivalent phoneme (Adams, 1990). However, a mere application of grapheme-phoneme conversion rules does not always lead to the successful identification of written words. One major reason is that English belongs to a deep orthography, which lacks a high level of correspondence between written symbols and speech sounds.

While phonological awareness could be a facilitator of orthographic learning, it alone is insufficient to account for the complexity of orthographic knowledge development, especially because 80% of English words do not adhere strictly to one-to-one letter-sound correspondences (Shankweiler & Fowler, 2004). In English, a phoneme can be represented in multiple written forms. For example, the /**oo**/ sound can be spelled as 'u', 'ui', 'o', 'oe', 'o-e', 'o-b', 'ou', 'ough' and 'ew,' as in tr***u***th, fr***ui***t, t***o***, sh***oe***, m***o***v***e***, t***o***m***b***, gr***ou***p, thr***ough*** and fl***ew***, respectively. Further complicating the matter is the fact that these graphemes also have alternative pronunciations, as exemplified by r***u***b (vs. tr***u***th), b***ui***ld (vs. fr***ui***t), g***o*** (vs. t***o***), t***oe*** (vs. sh***oe***), dr***o***v***e*** (vs. m***o***v***e***), c***o***m***b*** (vs. t***o***m***b***), ***ou***t (vs. gr***ou***p), r***ough*** (vs. thr***ough***) and s***ew***

(vs. fl***ew)***. If English words are read and identified exclusively through letter-sound correspondences, confusion will easily arise because their pronunciations are not always predictable from their spellings.

The importance of orthographic knowledge is most obvious in tasks requiring the recognition of exception words. According to Ricketts, Nation, and Bishop (2007), students' difficulty with identifying exception words could be a manifestation of their poor underlying orthographic skills. 'Colonel,' 'yacht,' and 'plead' are examples of exception words that do not adhere to the common grapheme-phoneme correspondences. Unless students have already encountered an exception word in their oral vocabulary, decoding words based on general conversion rules can easily lead to misidentification (Ricketts et al., 2007; Share, 1995). This is when orthographic knowledge emerges to play a more prominent role in support of identifying irregular vocabulary items (Harm & Seidenberg, 1999; Manis, Seidenberg, Doi, McBride-Change, & Petersen, 1996; Roman, Kirby, Parilla, Wade-Wooley, and Deacon, 2009). Although Hagiliassis et al. (2006) argued that exception words can still be partially decoded, under most circumstances, they must be spelled in full in order to be recognized.

Similarly, recognizing homophones relies substantially on orthographical knowledge, during which phonological awareness only plays a minimal role (Scholes, 1998). Homophones refer to words that share an identical pronunciation, but differ in terms of orthographic representation, as exemplified by threw/through, air/heir, which/witch, bare/bear, won/one and sea/see. Proficient decoders lacking orthographic knowledge may interpret these words interchangeably because they sound alike. To access the meaning of homophones with accuracy, one must know the specific letter order that defines the target

words, and the application of phonological strategy is ineffective in discriminating between them.

This argument is corroborated by the study of Hagiliassis et al. (2006), who examined whether orthographical processing can operate as a distinct construct independent of extraneous phonological processing. In this study, a series of tests was administered to 177 native speakers (Grades 3 through 5), and the homophone verification task was identified as one of the "purest" measures of orthographic knowledge. Results showed that this task could predict variance in word recognition with little intrusion of phonological operations. In other words, decoding mediated by letter-sound conversion was inadequate to support efficient identification of homophones. Instead, orthographic knowledge was of primary importance for successful completion of this specific task.

There is broad agreement that developing proficient phonological awareness could be beneficial to nonsense word reading or the identification of unfamiliar yet regular words. However, exception word reading and reading comprehension require more than mere mapping of sounds to letter strings (Harm & Seidenberg, 1999; Manis et al., 1996; Nation & Snowling, 2004). Especially when a reading task focuses on testing an individual's understanding of written content rather than accuracy of pronunciation, skilled phonological strategies might not contribute as significantly (Juel et al., 1986; Stanovich, 1992; Stanovich et al., 1991).

Self-teaching Hypothesis

However, the concern that orthographic knowledge could result from and be enhanced by phonological awareness gives rise to doubts against its independent contribution to reading achievement (Burt, 2006). Based on the self-teaching hypothesis by Share (1995),

well-specified orthographic representations can be established incidentally through the process of phonological recoding. When decoding a novel word, one must actively associate its composite letters with their corresponding sounds. Such close attention to the internal structure of a word—i.e., letter order—provides an opportunity to acquire a new orthographic representation.

Therefore, each successful decoding actually facilitates the acquisition of spelling skills. When word-specific orthographic knowledge accumulates, a student's general orthographic knowledge will also improve because he can make more informed decisions as to whether some letter sequences are permissible or not. As a result, it is argued that the development of new orthographic representations is primarily the result of phonological recoding, which operates as a self-teaching mechanism during the process of independent reading. Furthermore, deficits in phonological awareness can impede opportunities to acquire orthographic knowledge, which in turn will compromise language learners' growth in word identification and reading comprehension abilities.

There has been converging evidence in support of the self-teaching hypothesis. Confirmation of this hypothesis is evident in studies by Cunningham (2006) and other researchers (Bowey & Miller, 2007; Bowey & Muller, 2005; Cunningham et al., 2002; Kyte & Johnson, 2006; Nation, Angell, & Castles, 2007). Since orthographic learning could be mediated by phonological recoding, orthographic knowledge and phonological awareness inevitably explain a considerable amount of overlapping variance in word identification.

Unique Contribution of Orthographic Knowledge to Reading

Despite this, there has been continuous empirical evidence that orthographic knowledge has distinct predictive power above and beyond that of phonological awareness

(Barker, Torgesen, & Wagner, 1992; Cunningham & Stanovich, 1993; Juel et al., 1986; Stanovich & West 1989; Wagner & Barker, 1994). For example, Cunningham et al. (2001) found that orthographic knowledge is a distinct factor predictive of word identification development. The authors followed 39 students, 20 boys and 19 girls, in a predominantly lower-class elementary school from first through third grades. Four phonological tasks, six measures of orthographic processing and word recognition measures were administered to the participants when they were in Grades 1, 2 and 3, respectively. The composite measure of orthographic processing skill administered in Grade 2 explained unique variance (16.3%) in third-grade students' word recognition abilities, after the influence of phonological awareness was controlled for statistically.

Further evidence comes from a more recent study by Roman et al. (2009), during which a total of 92 Canadian students from Grades 4, 6 and 8 were examined. The goal of this study was to determine the unique contribution of four major variables involved in reading development—phonological awareness, orthographic knowledge, morphological awareness and naming speed—to real word reading and nonsense word reading. The study's significance is its examination of participants of a broader age range beyond early elementary school years, as opposed to the majority of reading studies.

Results showed that orthographic knowledge contributes substantially and independently to real word reading in each grade level. In addition, it was observed to be the most essential predictor of real word reading across the three grades. The standardized coefficient value of orthographic knowledge was $B = 0.41$, whereas that of phonological awareness was only $B = .20$. The data showed that the participants relied more strongly on orthographic knowledge when reading real words. The authors attributed this finding to the

fact that the vocabulary items learned by older students were increasingly irregular. Therefore, having well-specified orthographic knowledge was a necessary condition for word identification.

The unique contribution of orthographic knowledge was also evidenced by nonsense word reading. However, when it came to sounding out pseudowords, the relative contribution of orthographic knowledge diminished. Its standardized coefficient value was only $B = 0.26$, which was smaller than that of phonological awareness ($B = .26$). As the authors explained, the participants were more likely to draw on phonological awareness to facilitate nonsense word reading because pseudowords are made-up words that cannot be recognized by sight.

First Language Effect on English Learning

Reading acquisition among young monolingual English speakers has been well researched. This process is understood to comprise a multiplicity of precursor skills, such as phonological awareness, letter recognition and print knowledge. As shown in the literature, most researchers focus their studies on different underlying fundamental skills, which are predictive of early literacy development among native speakers (Chiappe, Siegel, & Wade-Woolle, 2002; Lesaux & Siegel, 2003; Kelly, Gomez-Bellenge, Chen, & Schulz, 2008). D'Angiulli, Siegel, and Maggi (2004) came to the conclusion that the component processes involved in English reading are similar between native English speakers and linguistically diverse English learners. “The development of reading skills in ELL children is very similar to the development of reading skills in children with English as their first language” (D’Angiulli et al., 2004, p. 202).

It is true that the latent constructs in reading and reading-related skills are similar across native English speakers, ESL students and EFL learners. However, in the context of

English language learning, the roles of phonological awareness and orthographic knowledge in reading development could be further complicated by students' prior L1 literacy experience. Research on cross language transfer suggests that different L1 literacy backgrounds could influence how L2 is learned and processed (Akamatsu, 2003; Hamada & Koda, 2008; Koda, 2000). Learning ESL and EFL is distinct from learning English as a primary language because the students are already preoccupied by a well-established linguistic system before approaching the new one. The existing language mechanism would influence how a new language is perceived, read and learned. This process of applying knowledge from a native language to a second language is called first language transfer, and its operation could be unconscious.

The influence of a student's native language can be positive and negative. In general, the greater the similarity in the linguistic systems of the two languages, the greater the degree of positive transfer and correct language production in L2 (Odlin, 1989). For example, Spanish and English share phonemic, alphabetic, and orthographic commonalities. There is a high degree of overlap in letter–sound equivalents between the two languages (Honig et al., 2000). Therefore, phonemic awareness acquired in Spanish could facilitate pronunciation in English (August, Calderon, & Carlo, 2002; Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Leafstedt & Gerber, 2005; Lopez & Greenfield, 2004). On the other hand, negative transfer can take place when two languages deviate from each in their writing systems, spoken forms and grammar rules. One example of negative transfer is the persistent omission of plural forms of nouns by Chinese students. Since nouns in Chinese do not have a plural form, students tend to transfer their knowledge from L1 to L2, and this becomes a source of systematic errors in English.

A common finding on the L1 transfer effect is that students from a non-alphabetic language background generally exhibit difficulty in decoding English words. Chinese is a typical example of a non-alphabetic language. In the Chinese writing system, letters are not the basic units of the language. Instead, each character is composed of intricately interwoven strokes laid out in a square-shaped pattern. Because a Chinese character is unsegmental in nature (Leong, 1997; Perfetti, Liu, & Tan, 2005), pronunciation can hardly be achieved through grapheme-phoneme conversion as done in the English language. As a result, the principle of phonological assembly does not apply in Chinese reading. Based on the theory of language transfer, the lack of decoding experience in Chinese as L1 can be translated into deficiencies in analyzing the sound structure of English.

On the other hand, Chinese students are known for relying more on graphic-visual strategies when reading and spelling English words. This is because their native language belongs to a logographic system, which features a direct mapping between orthography and semantics (Tong & McBride-Chang, 2010; Wang & Geva, 2003; Wang, Koda, & Perfetti, 2003). A typical Chinese character represents only one monosyllabic morpheme (DeFrancis, 1989; Mattingly, 1992; Perfetti & Zhang, 1995). Reading Chinese does not require sounding out the constituent components of a character. Instead, it draws upon visual-orthographic analyses. Establishing fully-specified orthographic representations is a prerequisite (Taft, Zhu, & Peng, 1999). Although some researchers contend that phonological information is also activated when one reads Chinese characters for meaning (Perfetti & Zhang, 1995; Xu, Pollatsek, & Potter, 1999), orthographic analyses are essentially the predominant approach for successful identification. Since Chinese students are trained to perceive each Chinese character as a holistic visual symbol through rote memorization, consistent attention to the

formal features when reading in L1 prompts a student to apply a similar approach when reading English as L2.

Comparative studies provide further evidence in support of such L1 effects on English learning. In many of these studies, Chinese and Korean students are examined side-by-side with regard to their cognitive processes in learning to read English. As highlighted previously, Chinese belongs to a logographic writing system, and visual-orthographic analysis is central to reading the language. In contrast, Korean shares a similar alphabetic principle that characterizes English. Hangul is the alphabet of the Korean language, and reading in Korean is basically a process of decoding. The fundamental difference between Chinese and Korean provides an excellent ground for investigating the influences of L1 on reading acquisition in English.

In a study conducted by Wang, Koda and Perfetti (2003), Chinese ESL college students (n = 20) were compared with Korean ESL college students (n = 21) for their relative reliance on phonological processing and orthographic processing when identifying English words. One major finding was that the Chinese participants demonstrated a stronger use of visual-orthographic information than their Korean peers on a phonemic deletion task. During this task, the two groups were instructed to delete a designated phoneme from a word, followed by saying aloud the remaining part of that word and writing down the new word formed. One example was to remove the /t/ sound from the word “might.” Taking away the designed phoneme should result in a new word: “my.” The purpose of this task was two-fold: (i) to examine the participants’ ability to manipulate sub-lexical phonological structure in English, and (ii) to access spelling knowledge of the new word.

Compared to the Korean participants, the Chinese participants performed more poorly when asked to manipulate individual English phonemes at the oral level. The average score of the Chinese participants was 55.77 (*SD* = 18:66), which was approximately 13 points lower than that of the Korean participants (*M* = 69.23, *SD* = 18:37). In addition, the Chinese participants produce more written responses that were wrong in terms of pronunciation, but were acceptable orthographically (e.g., "me" and "may"). Their underperformance in deleting phonemes orally and their phonologically-based written errors suggested that logographic L1 readers incline to "rely on word based processes in analyzing the sub-lexical elements of the English words" (p. 142). The findings also provided evidence in support of the authors' hypothesis that alphabetic and non-alphabetic L1 reading experiences have significant effects on students learning to read English as L2.

Further evidence supporting this argument can be found in another study by Wang and Koda (2005). In this study, Chinese adult ESL students (*n* = 18) and Korean adult ESL students (*n* = 16) were tested on their word identification skills, as measured by real word reading and nonsense word reading. This study revealed that the Korean students were generally more accurate in naming nonsense words than their Chinese peers. Nonsense words are pseudowords that a reader has never encountered before. To correctly name a nonsense word, one must draw upon phonology knowledge. As indicated by the authors, the Korean participants performed better on the nonsense word reading task because they could capitalize on their L1 alphabetic reading experience and apply decoding skills to read an alphabetic L2. Comparatively speaking, the Chinese students were at a disadvantage because their logographic L1 background did not provide them with sufficient training and experience to complete tasks that required merely grapheme-phoneme mapping.

Although all subjects in the studies mentioned above were ESL students instead of EFL learners, the findings had strong implications for English reading development because they validated an important theoretical assumption that students' L1 linguistic backgrounds could impact their English learning progress. Such findings may also be applicable to EFL contexts.

Phonological Awareness and Orthographic Knowledge in Chinese EFL Students

With consistent evidence that Chinese learners generally have difficulty manipulating English sounds, it can be assumed that Hong Kong students speaking Cantonese, a Chinese dialect, and reading traditional Chinese are also subjected to a similar L1 transfer effect when learning English. It is also very likely that they rely less on phonological skills, but more on visual-orthographic strategies to process English. However, only a few studies have been conducted to examine the relative contributions of orthographic knowledge and phonological awareness to the reading outcomes, as measured by word identification and reading comprehension, of this particular linguistic population. After the above review of the literature, three major studies have been identified that are closely relevant to this researcher's topics of interest.

The first study was conducted by Holm and Dodd (1996), who compared 40 students from Hong Kong, China, Vietnam and Australia (ten from each group) at the University of Queensland with regard to their performance on tasks assessing phonological awareness, word reading and spelling in English. It was found that the ESL university students from Hong Kong did not perform differently from the other ESL groups in reading and spelling real words. However, these students' performance on phonological awareness tasks as well as those measuring reading and spelling pseudowords was significantly inferior to those of

the other three groups. With only limited phonological awareness at the syllabic and phonemic levels, the Hong Kong students did not have the skills necessary to process nonsense words for reading and spelling.

As highlighted by the authors, the Hong Kong participants included in the study were all well educated and highly literate. However, they simply did not possess the phonological awareness to facilitate identification and spelling of nonsense words. One reason for this was that they lacked training in phonological assembly when learning their primary language, Cantonese. Hence, the transfer of relevant skills from L1 to L2 was unlikely. In addition, the second language instruction these Hong Kong students received did not emphasize the importance of phonological awareness and grapheme-phoneme correspondences. The fact that the Hong Kong participants were capable of reading and spelling real words in the absence of phonological awareness suggested that they must have resorted to the orthographic route to complete the tasks.

In another reading study on Hong Kong EFL students, Leong et al. (2005b) demonstrated that 156 Hong Kong EFL students between Grades 4 to 6 showed greater reliance on orthographic and lexical knowledge than on phonological information when reading and spelling English words. In the study, three tasks were devised to assess the participants' orthographic and lexical knowledge, including Past Tense, Orthographic Choice and Orthographic-phonemic Choice. In addition, three tests were devised to measure phonological awareness: Pig Latin, Phoneme Deletion and Spoonerism. A decontextualized individual English word reading task and a spelling task were the two dependent variables in this study. Both regular words and exception words were included in these two indicators of literacy. Multiple regression, principal component analysis and structural equation modeling

were utilized to analyze the performances of the participants. It was postulated that this sample of Hong Kong students in the upper elementary grades would rely more heavily on orthographic and lexical knowledge than on phonological sensitivity when reading and spelling English words.

The results of the multiple regression analyses highlighted the greater effects of orthographic and lexical knowledge on English word reading and English word spelling. The Past Tense Task alone, a measure of orthographic and lexical knowledge, already accounted for most of the variance (61.5%) in word reading, whereas the Spoonerism Task, a measure of phonological sensitivity, only added an extra 10.5% to the predictive power. For word spelling, similar results were obtained. The Past Tense Task contributed to 62.2% of the variance, whereas the Spoonerism Task only contributed an additional 2.9%.

According to the principal component analysis, two components capturing 78.7% of the total variance were included in the final solution. The three tasks tapping orthographic and lexical knowledge and those tapping phonological sensitivity were found to load distinctively on the two components extracted. This provided supportive evidence that orthographic and lexical knowledge, as well as phonological sensitivity, were independent despite their high correlation (r = .86).

In the structural equation model, the three indicators of orthographic and lexical knowledge had a considerably high predictive power, with a loading of .83 on literacy, as measured by reading and spelling regular and exception words. In contrast, the three tasks measuring phonological sensitivity had a much lower predictive power, and their loading was only .20. Therefore, the data supported the conclusion that orthographic knowledge plays a

considerably more important role in English word reading and spelling among Hong Kong students of older ages.

All data pointed to the greater relative importance of orthographic and lexical knowledge than of phonological sensitivity for this sample of Hong Kong students. The authors attributed this finding to the prevalent use of the "teaching for meaning" instructional strategy during English lessons, which invariantly undermined the application of phoneme-grapheme conversion (Leong et al., 2005b, p. 78). Another explanation suggested by the authors was the L1 transfer effect; it is possible that the participants' native language learning affected their reading strategies in English. Repeated exposure and rote memorization remain the dominant approaches for students to learn Chinese characters in educational settings (Shu, Chen, Anderson, Wu, & Xuan, 2003). The extensive amount of drilling practice they received in L1 could result in their persistent use of the same skills for L2 English reading.

To further explore the interrelationships among orthographic knowledge, phonological sensitivity, and word identification, Leong et al. (2005a) conducted a two-wave developmental study involving a cohort of 108 Cantonese-speaking students in Grades 4 and 5 in Hong Kong. A battery of nine tests on orthographic knowledge, phonological sensitivity and word identification—as measured by reading and spelling of both regular and exception words—was administered twice to the EFL participants within a one-year interval.

Data obtained from this study's structural equation analyses indicated that the orthographic construct was crucial to successful word identification. Time 1 word identification correlated much higher with concurrent orthographic knowledge (r = .92) than with concurrent phonological sensitivity (r = .72). Again, Time 2 word identification had a higher correlation with Time 1 orthographic knowledge (r = .91) than with Time 1

phonological sensitivity (r = .75). One conclusion of the authors was that the Hong Kong participants in this study "attempted to use their knowledge of spelling patterns and word relations and reinforced this orthographic knowledge by their less well developed phonological sensitivity skills in learning to read English regular and exception words and to spell them" (Leong et al., 2005a p. 598).

However, it should be noted that Time 2 word identification was best predicted by Time 1 word identification (β = .90). Time 1 orthographic knowledge and Time 1 phonological sensitivity only added negligibly to the predictive power of the model (β = .04 and β = .04, respectively). Such small standardized beta coefficients mean that their unique contributions to the variance in Time 2 word identification were minimal. Despite this, it would be potentially misleading to say that Time 1 orthographic knowledge and Time 1 phonological sensitivity were not important in this case. The standardized beta coefficients only reflected the relative importance of each predictor based on its *unique* contribution. However, the predictor variables in this study were confounded, as evidenced by their moderate to strong intercorrelations. Therefore, Time 1 orthographic knowledge and Time 1 phonological sensitivity might not have added much to the explained variance in Time 2 word identification, over and above that which had been accounted for by Time 1 word identification. Their collective contribution should not be overlooked.

Taken together, all these pivotal studies on Hong Kong students led to the conclusion that orthographic knowledge plays a major role in English word reading and spelling among Hong Kong students with a non-alphabetic language as L1. They provided supportive evidence to justify subsequent investigations along this line of reasoning. However, one limitation of these studies is that they only used word reading and spelling as measures of

reading outcomes. Although assessing these two domains is important, given that they are indicators of one's literacy level, reading includes more than word-level processing. Therefore, examining the relative contributions of phonological awareness and orthographic knowledge to reading and spelling isolated words can only provide partial insights into how reading develops. Of greater importance is including reading comprehension as one of the outcome measures. Further investigation into how these two variables contribute to the variance in reading comprehension can help fill the gap in the existing body of knowledge.

Summary

The importance of English literacy is reinforced all over the world, thus necessitating a better understanding of the factors underlying this linguistic system. One central focus of reading research is examining the roles of phonological awareness and orthographic knowledge in lexical processing. Phonological awareness assists decoding, which in turn facilitates word retrieval by mapping the sound properties (audio input) of a written word with the acoustic representation of that word retained in the mental lexicon. Orthographic knowledge, on the other hand, facilitates word retrieval through a direct route of matching the formal features of a word, or visual stimuli, with its established mental representation. The operations of these two mechanisms are not mutually exclusive, but there may be greater reliance on one than on the other during the process of recognizing words in print.

Research to date suggests that typical Chinese students in ESL contexts rely more heavily on orthographic knowledge to learn English. This is because their first language belongs to a logographic writing system, and reading Chinese does not require phonological assembly. Basically, retrieving the meaning and pronunciation of a Chinese character draws upon visual-orthographic analyses. The substantial amount of rote memorization training

Chinese students receive in L1 probably drives them to apply similar strategies to L2 English reading. Although there exist fewer studies examining Hong Kong students in EFL contexts, available data also indicate a similar L1 transfer effect. With only limited phonological awareness, this particular linguistic group tends to use visual-graphic cues to help with English word reading and spelling. Collectively, studies on Chinese students, regardless of learning ESL or learning EFL, indicate a similar trend in the underlying mechanism of English literacy development.

In most reading research, the subjects are primarily young children (up to Grade 3) and adults. The underlying assumption is that different language skills are acquired in stages. Phonological awareness and orthographic knowledge are often considered as fundamental reading skills required for higher learning later in life. Therefore, these skills are commonly expected to be fully established at a young age. While the fact that different skills are acquired at different stages in life is not under dispute, Hong Kong lacks an optimal English-speaking environment; therefore, the chronological stage of skill learning could be postponed in Hong Kong students. As such, Hong Kong students in Grade 7 could still be in the process of developing these language-learning skills, while lagging behind students of similar ages in native English-speaking countries. However, there is a knowledge gap in adolescents regarding both of these skills, as not much is known in this group in Hong Kong.

The ultimate goal of reading is to derive accurate meaning from connected texts. Therefore, examining the relative contributions of phonological awareness and orthographic knowledge to the identification of isolated words can only provide partial insights into how reading skills develop. Further investigation into how these two variables contribute to the variance in Hong Kong adolescents' reading comprehension can better supplement the gap.

CHAPTER THREE

METHODOLOGY

This was a study on 122 seventh-grade Chinese students learning EFL in Hong Kong. It sought to examine the observed variance in word identification and reading comprehension by phonological awareness and word-specific orthographic knowledge. To assess these reading-related skills, a battery of nine subtests was used, eight of which were chosen from standardized measures. In this study, a two-phase study design was used for two purposes: selection of a representative sample and data collection. Before initiation of the study, a pilot test was conducted to guide the selection of a grade-appropriate reading comprehension test to assess the participants' skill levels.

This chapter first starts with a brief description of the Hong Kong education system, and it provides background information about the context in which this study was undertaken. Then, the results of the pilot test are reported. Details about the sampling procedures, participants, data collection and instruments are discussed in the remaining parts of this chapter as well.

Restatement of the Research Questions

Phonological awareness and word-specific orthographic knowledge are the two foundational skills underlying word identification, which is the ability to recognize familiar words by sight and to read unfamiliar words based on decoding strategies. On the other hand, mastery in identifying isolated words is essential for effective comprehension of written texts. Despite the importance of these skills, the contributions of phonological awareness and word-specific orthographic knowledge to word identification and reading comprehension among EFL students, especially those with a logographic L1 background, remains unclear.

Therefore, this study sought to fill this gap and add to the knowledge by addressing the research questions below:

1. To what extent are phonological awareness and word-specific orthographic knowledge associated with word identification and reading comprehension in seventh-grade Chinese EFL students?
2. What are the relative contributions of phonological awareness and word-specific orthographic knowledge to word identification in seventh-grade Chinese EFL students?
3. What are the relative contributions of phonological awareness and word-specific orthographic knowledge to reading comprehension in seventh-grade Chinese EFL students?

Education System in Hong Kong

The education systems in Hong Kong and the United States are different in terms of school structure, curriculum, instruction, student allocation and tracking/streaming practice. Therefore, understanding the context in which this study was carried out and the characteristics of the participants requires some background knowledge about the local school system.

In Hong Kong, kindergarten education is not compulsory and English is introduced formally as a core subject in first grade. Despite the emphasis on English as a key learning area in primary schools (Grades 1-6) and secondary schools (Grades 7-12), Hong Kong students do not have a many opportunities to apply the language in classrooms. Early education focuses on building a strong foundation in alphabetic principles and vocabulary learning. Grammar practice is central to the entire educational experience before tertiary-

level study. The skills of sight word reading emerges as a result of drilling, during which students are trained to *look and say*, mapping the whole written words directly to their pronunciations and meanings. This mechanical approach of instruction is also translated into the students' constant use of rote memorization as the primary tactic of English learning. Generally speaking, the development of phonological awareness and the application of phonics skills receive little attention in Hong Kong classrooms (McBride-Chang, Bialystok, Chong, & Li, 2004).

There are two types of local secondary schools in Hong Kong with different media of instruction. According to the language policy for Hong Kong schools, primary school graduates will be allocated to either an English as the Medium of Instruction (EMI) secondary school or a Chinese as the Medium of Instruction (CMI) secondary school after completing Grade 6. Admission decisions are largely based on the students' academic performance, with their parents' preferences taken into consideration. This streaming system results in high achievers being placed almost exclusively in EMI schools. Those who are academically less competent are, therefore, limited to schools using Chinese as the medium of instruction.

In addition, secondary schools in Hong Kong can be further categorized into three bands according to their academic standards, with Band 1 being the most advanced, Band 2 being average, and Band 3 being below average. EMI schools, given their strong academic standings, are primarily Band 1 schools. On the other hand, CMI schools vary substantially in their performance. A small number of distinguished CMI schools are under Band 1 because they have proven themselves to be capable of providing quality education. However, most CMI schools in Hong Kong fall into the Band 2 and Band 3 categories.

Pilot Test

One goal of this study was to identify the major source of variance in reading comprehension in a group of Hong Kong seventh graders. The Gates-MacGinitie Reading Tests, 4th Edition (GMRT-4, 2000) was selected to approximate the participants' ability to extract correct information from text. The GMRT-4 consists of leveled tests tailored specifically to each grade from kindergarten through twelfth grade in the United States. Since the seventh graders involved in this study were all EFL learners and their English proficiency was not equivalent to that of their native counterparts, it was imperative to first decide which particular test level from this standardized measure corresponded to their achievement level before starting the study. As a result, a pilot test was conducted to guide the selection of an appropriate test level. Unlike the GMRT-4, other measures assessing phonological awareness, word-specific orthographic knowledge and word identification were designed for a wide age range. Therefore, the very same tools could be administered to the participants of varying language abilities.

During the pilot test, Levels 3, 4 and 5 of the GMRT-4 (Comprehension Section, Form S) were administered to a sample of 61 seventh graders studying EFL in Hong Kong. This sample group was comprised of nine students from an EMI Band 1 school, 16 students from a CMI Band 1 school, and 36 students from a CMI Band 3 school. None of these students attended the three participating schools involved in the actual study. Each test session lasted for 35 minutes (1 hour 45 minutes in total), and the students completed the tests on separate days. Table 1 summarizes the means and standard deviations for the three GMRT-4 reading comprehension tests.

Table 1

Means and standard deviations for three GMRT-4 reading comprehension tests (N = 61)

		EMI Band 1 student (n = 9)		CMI Band 1 student (n = 16)		CMI Band 3 student (n = 36)		Total	
Test	Max score	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Level 3	48	33.89	2.93	29.06	3.17	13.50	3.03	20.59	9.21
Level 4	48	29.22	3.53	*25.63*	3.44	11.36	3.64	17.74	8.55
Level 5	48	25.56	3.05	22.94	3.51	9.81	3.08	15.57	7.70

Note. GMRT-4 = Gates-MacGinitie Reading Tests, 4th Edition.

Levels 3, 4 and 5 of the GMRT-4 were designed for U.S. students in Grades 3, 4 and 5, respectively. Results indicated that floor effects were apparent when Levels 4 and 5 were administered to participants from the CMI Band 3 school. The data hit the bottom end of the distribution because the tasks were too difficult for this low-achieving group. Out of 48 points, the students earned less than 12 on average, meaning that they did not even score above the chance level on those two tests. Relatively speaking, Level 3 was the most appropriate test level to assess students with wide-ranging abilities. The average score of all participants was 20.59, with a standard deviation of 9.21. Even though this level still posed a challenge to the low achievers, it could provide more room for discrimination when compared with the other two levels and therefore, it was selected for use in the final study.

Sampling

In order to ensure that the participants in the final study were representative of the seventh-grade student population in Hong Kong, a two-phase study design was used. In phase one, a total of 507 seventh graders covering the three bands of local secondary schools were administered a reading comprehension test from the GMRT-4 (Level 3, Form S). Based

on the test scores obtained, the participants were divided into four achievement groups, and 31 students were randomly selected from each group for further testing in phase two. With these sampling procedures in place, the ultimate sample was expected to better reflect the seventh graders in Hong Kong who had a wide range of reading comprehension abilities. The details are as follows:

Phase One

Phase one of this study only focused on assessing reading comprehension proficiency. Guided by the pilot test results, Level 3 of the GMRT-4 (Comprehension section, Form S) was administered to 507 seventh graders from three local schools in June 2009. Of this sample, 199 students were studying in a Band 1 EMI school, 145 from a Band 2 CMI school, and 163 from a Band 3 CMI school. In 35 minutes, the participants were instructed to answer 48 multiple-choice questions derived from 11 short passages. One score was given to each correct answer, with a total maximum score of 48. The test was conducted as a regular part of classroom activities. Individual school teachers were responsible for administering the test to their students during class time and scoring the test subsequently. Guidelines for test administration and scoring were provided to ensure consistency.

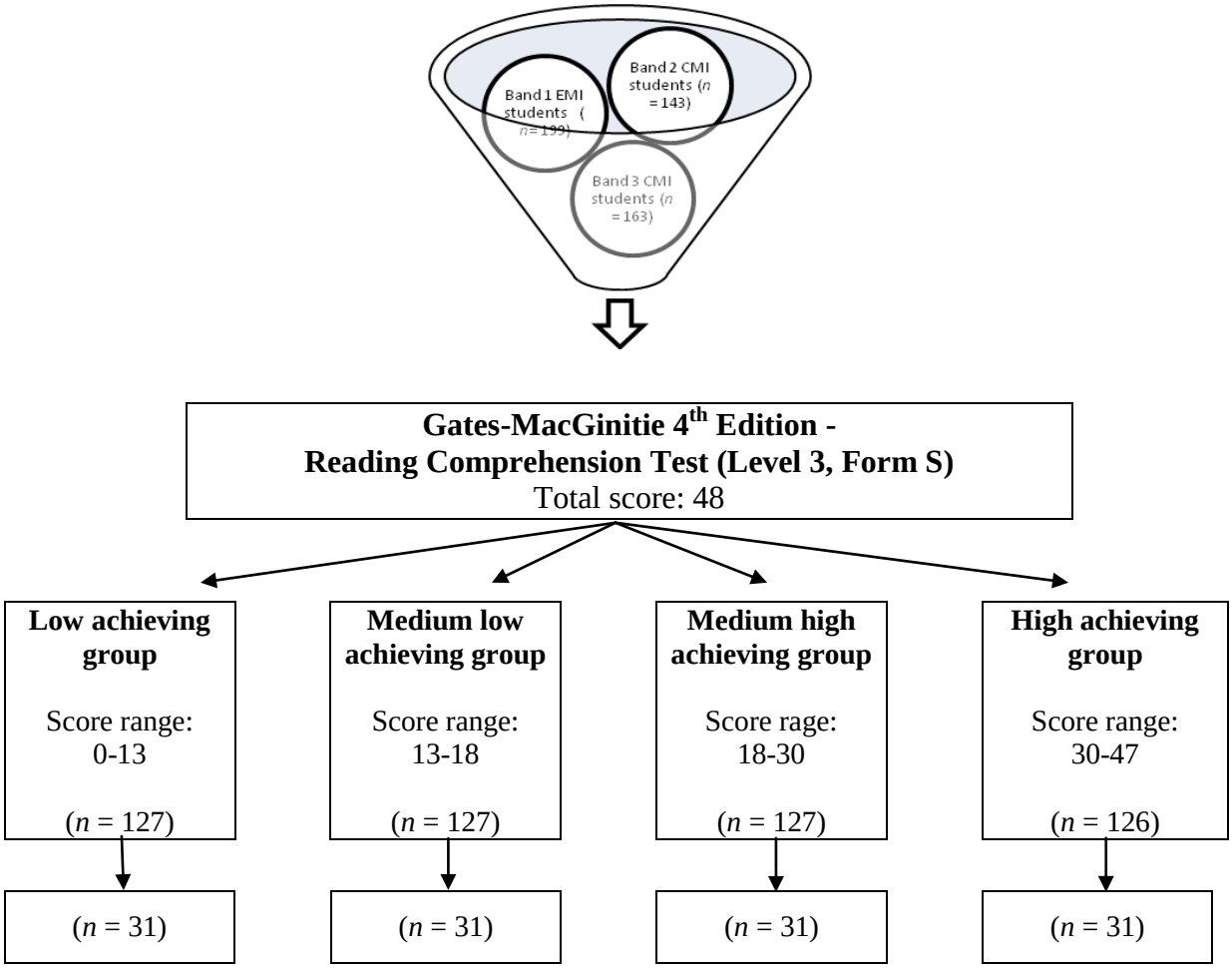
Based on the reading comprehension test scores reported by the teachers, the 507 students were ranked from highest to lowest, regardless of the school to which they belonged. They were then segmented into four achievement subgroups (low, medium-low, medium-high and high), defined by the 25^{th}, 50^{th} and 75^{th}-percentile cutoff points.

Phase Two

In phase one, the 507 students had already been categorized into four achievement groups based on their reading comprehension abilities. Phase two of this study started in July 2009. At this stage, 31 students were randomly drawn from each achievement group for further testing. As a result, a total of 124 students were admitted to the second phase of the

study. If a pre-selected student was not available for testing in stage two, an alternate student within the same school and percentile group would be randomly selected as the replacement. Since all students with comparable performance were first allocated into relatively homogenous subgroups before simple random sampling was applied, the problem of underrepresentation could be potentially avoided. Figure 1 is a graphic representation of the sampling procedure.

Figure 1. Graphic representation of the sampling procedure.



All participants admitted to phase two were administered three additional types of measures in the following order: word-specific orthographic knowledge, phonological awareness and word identification. At this stage, a total of eight subtests were carried out in two separate sessions based on the individual schools' schedules. The first session was a group session, which assessed only word-specific orthographic knowledge. The second session was an individual session, during which the phonological awareness and word identification measures were administered successively. Implementation details will be presented in the section regarding data collection.

Testing in phase two was carried out in the midst of a swine flu pandemic. As the Hong Kong Education Bureau advised temporary school closure to prevent the spread of the virus, only 74 out of the 124 participants were able to complete all the eight subtests as planned. The rest (35 from the Band 2 school and 15 from the Band 3 school) could only complete the word-specific orthographic subtests administered in the group session. They were not able to proceed to and take part in the individual session, which assessed their phonological awareness and word identification. The study was resumed in November 2009, and two participants were dropped from the study because they were absent on the date of testing. Ultimately, 48 participants (34 from the Band 2 school and 14 from the Band 3 school) completed all the remaining subtests, which constituted a final sample size of 122.

Participants

Phase One

In phase one of this study, a total of 507 seventh graders in Hong Kong were

recruited, and all of them were administered a standardized reading comprehension test (i.e., the GMRT-4, Level 3, Form S). Of this sample, 251of the students were male while 256 were female. They represented a fairly equal gender distribution, with a male-female ratio of almost 1:1. Their ages ranged from 12 to 15.3 years old (*M*: 13.2; *SD*: .54). There were two major inclusion criteria. First, the participants should be Chinese, speaking Cantonese as L1 in Hong Kong. Second, they should be in Grade 7 at the time when this study was initiated.

Seventh graders from three secondary schools of different academic standings were intentionally targeted for this study. Three schools consented to participate in the study, each of which represented one of the three ability bands defined by the local education bureau. One hundred and ninety-nine of the participants attended a prestigious Band 1 EMI school in Hong Kong, a high-achieving school renowned for its academic excellence and, therefore, allowed to use English as the primary language of instruction. The next group consisted of 144 participants from a Band 2 CMI school where English instruction was limited to English language lessons only. Even though this was an average-performing school, its students struggled with English language and their English standards were comparable to those of Band 3 students (Personal Communication with the principal, July 2, 2009). The remaining 164 participants studied attended a Band 3 Chinese medium school, which was ranked toward the low end of the academic spectrum. The students of this low-achieving school were in need of additional academic support. Table 2 summarizes the gender distribution of these 507 seventh graders and presents the crosstab of school bands by achievement group.

Table 2

Gender distribution of participants in phase one and crosstab of school band by achievement group (N = 507)

	Band 1 EMI school (n = 199)		Band 2 CMI school (n = 145)		Band 3 CMI school (n = 163)		Total	
	N	(%)	*N*	(%)	*N*	(%)	*N*	(%)
Gender								
Male	83	(41.71)	68	(46.90)	100	(61.35)	251	(49.51)
Female	116	(58.29)	77	(53.10)	63	(38.65)	256	(50.49)
Achievement group								
Low	0	(0)	45	(31.03)	82	(50.31)	127	(25.05)
Medium-low	3	(1.52)	56	(38.62)	68	(41.72)	127	(25.05)
Medium-high	71	(35.68)	43	(29.66)	13	(7.98)	127	(25.05)
High	125	(62.80)	1	(0.69)	0	(0)	126	(24.85)

Note. EMI school = school using English as the medium of instruction; CMI school = school using Chinese as the medium of instruction.

Phase Two

In phase two of this study, a stratified random sample of 124 students from the original pool of 507 students were invited to take part in further testing. One student from the Band 2 school and one student from the Band 3 school, however, did not complete all subtests administered at this stage. Therefore, they were removed from the report. As a result, the final sample was comprised of 122 participants, including 50 Band 1 students, 34 Band 2 students and 38 Band 3 students. There were 64 boys (52.46%) and 58 girls (47.54%). Their ages ranged between 12.1 and 15.2 years old (M = 13.2, SD = 0.68). These participants displayed a broad range of reading comprehension levels due to the application of stratified random sampling procedures. Table 3 summarizes the gender distribution of the 122 seventh

graders and presents the crosstab of school bands by achievement group.

Table 3

Gender distribution of participants in phase two and crosstab of school band by achievement group (N = 122)

	Band 1 EMI school (n = 50)		Band 2 CMI school (n = 34)		Band 3 CMI school (n = 38)		Total	
	N	(%)	N	(%)	N	(%)	N	(%)
Gender								
Male	20	(40)	19	(55.88)	25	(65.79)	64	(52.46)
Female	30	(60)	15	(44.12)	13	(34.21)	58	(47.54)
Achievement group								
Low	0	(0)	15	(44.12)	16	(42.11)	31	(25.41)
Medium-low	1	(2)	11	(32.35)	17	(44.74)	29	(23.77)
Medium-high	18	(36)	8	(23.53)	5	(13.15)	31	(25.41)
High	31	(62)	0	(0)	0	(0)	31	(25.41)

Note. EMI school = school using English as the medium of instruction; CMI school = school using Chinese as the medium of instruction.

Of the 122 participants in the final sample, 74 of them were able to complete all subtests as scheduled. However, due to the swine flu outbreak, 48 students had to take the phonological awareness subtests and the word identification subtests three months later. These affected participants included 34 CMI Band 2 students and 14 CMI Band 3 students. Based on their standardized reading comprehension test scores, 22 of them were low achievers, 17 belonged to the medium-low achieving group, and 9 belonged to the medium-high achieving group. Table 4 summarizes the descriptive statistics for the 74 early test takers and the 48 late test takers, as well as presents the crosstab of school bands by

achievement group.

Table 4

Gender distribution of test takers at different times and crosstab of school bands by achievement group (N = 122)

	Band 1EMI school (n = 50)		Band 2 CMI school (n = 34)		Band 3 CMI school (n = 38)		Total	
	N	(%)	*N*	(%)	*N*	(%)	*N*	(%)
Early test taker								
Gender								
Male	20	(40)	0	(0)	16	(42.11)	36	(29.51)
Female	30	(60)	0	(0)	8	(21.05)	38	(31.15)
Achievement group								
Low	0	(0)	0	(0)	9	(23.68)	9	(7.38)
Medium-low	1	(2)	0	(0)	11	(28.95)	12	(9.84)
Medium-high	18	(36)	0	(0)	4	(10.53)	22	(18.03)
High	31	(62)	0	(0)	0	(0)	31	(25.41)
Late test taker								
Gender								
Male	0	(0)	19	(55.88)	9	(23.68)	28	(22.95)
Female	0	(0)	15	(44.12)	5	(13.16)	20	(16.39)
Achievement group								
Low	0	(0)	15	(44.12)	7	(18.42)	22	(18.03)
Medium-low	0	(0)	11	(32.35)	6	(15.79)	17	(13.93)
Medium-high	0	(0)	8	(23.53)	1	(2.63)	9	(7.38)
High	0	(0)	0	(0)	0	(0)	0	(0)

Note: EMI school = school using English as the medium of instruction; CMI school = school using Chinese as the medium of instruction.

Data Collection in Phase Two

Testing in phase two was conducted solely by the principal investigator. Each participant was scheduled to take part in two different sessions and to complete a total of eight subtests. The first session was a group session, which assessed word-specific orthographic knowledge over a period of 46 minutes. The second session was conducted on an individual basis, during which the phonological awareness and word identification measures were administered consecutively. The completion time of the individual session varied from 25 minutes to 45 minutes, depending on the participants' English abilities and their mastery of the tasks.

Group Session

During the group session, two measures were used to provide estimates of the participants' word-specific orthographic knowledge. The first one was called the Orthographic Choice Task. This instrument was devised by Olson, Kliegl, Davidson and Foltz (1985) and widely used by researchers. In this test, 80 pairs of phonologically matched words with alternate spellings (e.g., rain vs. rane) were listed on the test. The participants had to recognize the correct word spellings against their heterographic homophonic foils and check the box next to each correct answer in 6 minutes.

The second measure was the Spelling Subtest from the Peabody Individual Achievement Test - Revised / Normative Update (PIAT-R/NU, 1998). It was originally designed as a one-on-one assessment. However, several modifications were made in order to adapt this multiple-choice test for a whole-class administration. First, to standardize the

presentation of the test items, a digital audio version of the questions was prepared. Instead of conducting the test with the participants individually, the examiner played the recording to groups, who were instructed to mark their choices on the answer sheets provided. In addition, all participants were required to start with Item 16 of the Spelling Subtest (a conservative starting point, according to the examiner's manual) and proceeded through Item 100 (the last question available). When computing the raw scores, any unanswered items below Item 16 were counted as correct. Scoring ended when five errors were identified in seven consecutive items, which was also an indication of a ceiling. Any items above the ceiling criterion, regardless whether they were correct or not, were not counted.

Individual session

In the individual session, each participant met with the examiner individually to complete different tasks tapping on phonological awareness and word identification skills. Four subtests from the Comprehensive Test of Phonological Processing (CTOPP, 1999) were selected to provide an estimate of the participants' overall phonological awareness. The subtests included (a) Ellison, (b) Blending Words, (c) Blending Nonwords and (d) Segmenting Nonwords. Except the Ellison Subtest, items from the other three subtests were presented via the CTOPP CD to standardize the presentation of sound units. The examiner began each subtest with practice items, followed by giving immediate feedback to the participants' responses. Regardless of the age and ability of the participants, everyone started with Item 1, and each subtest ended when three consecutive errors were identified.

The word identification assessment followed immediately after the phonological awareness assessment. The Word Identification Subtest and the Word Attack Subtest from the Woodcock Reading Mastery Test – Revised / Normative Update (WRMT-R/NR, 1998) were administered to the participants individually. The Word Identification Subtest focused on real word reading, which required the participants to read aloud a list of isolated words. Item 26 was chosen as the starting point for the participants in the high and medium-high achieving groups due to their perceivably better English abilities. The rest of the participants, on the other hand, started with Item 20. When a participant failed to read the first six items correctly on the designated easel page, the examiner would proceed with the test backward until the participant established a basal of six consecutive correct responses.

On the other hand, the Word Attack Subtest emphasized nonsense word reading. Given that the test items were all pseudowords, successful pronunciation relied heavily on decoding skills. All participants in this study began with two practice items, as instructed in the examiner's manual. They then proceeded directly to Item 1.

All items in the Word Identification and Word Attack Subtests were arranged in order of difficulty, and each subtest would be terminated when the ceiling criterion was reached: six errors in succession that end with the last item on the easel page. For an answer to be considered correct, the participants were required to produce a natural reading of each test item in approximately five seconds. Figure 2 summarizes the procedures for test administration in phase two.

Figure 2. Procedures of test administration in phase two.

<table>
<tr><th colspan="3">Group Session (46 mins)</th></tr>
<tr><td>Word-specific

Orthographic Knowledge:</td><td colspan="2">Olson, Kliegl, Davidson and Foltz (1985)

• Orthographic Choice Task (6 mins)

Peabody Individual Achievement Test- Revised / Normative Update (PIAT T-R/NU, 1998)

• Spelling Subtest (40 mins)</td></tr>
<tr><td colspan="3">⇩</td></tr>
<tr><th colspan="3">Individual Session (25-45 mins)</th></tr>
<tr><td>Phonological Awareness:

Comprehensive Test of Phonological Processing (CTOPP, 1999)

• Ellison Subtest
• Blending Words Subtest
• Blending Nonwords Subtest
• Segmenting Nonwords Subtest

* Test duration varies based on participants' English abilities and their mastery of each subtest.</td><td>+</td><td>Word Identification:

Woodcock Reading Mastery Test – Revised / Normative Update (WRMT-R/NR, 1998)

• Word Identification Subtest (real word reading)
• Word Attack Subtest (nonsense word reading)

* Test duration varies based on participants' English abilities and their mastery of each subtest.</td></tr>
</table>

Instruments

Phonological Awareness

Four individually administered subtests from the CTOPP (the 7 through 24-year-old version) were used to assess the participants' mastery of English sound structures. They included (a) Ellison, (b) Blending Words, (c) Blending Nonwords and (d) Segmenting Nonwords, all of which require participants to give oral responses. The CTOPP is a well-constructed measurement device. With a normative sample of 1,656 persons from school-age and adult populations, it closely approximates the U.S. population with regard to gender, race, ethnicity, rural or urban residence, family income, parent education and disability. The CTOPP shows a high degree of internal consistency reliability, test-retest reliability and inter-rater reliability, as evidenced by most of its subtests having coefficient alphas of .80 or higher. In terms of content validity, the discrimination indexes of most test items reach the acceptable level of .35 or above.

Ellison subtest. This is an individually administered oral test, during which participants are asked to say aloud the remaining parts of a spoken word after removal of a designated syllable or phoneme from it. In the test, the examiner first presents a stimulus word orally, followed by a participant repeating the word with the omission of a particular sound, as instructed. Each correct response should end up being a legitimate word by itself. For example, saying /toothbrush/ without saying /tooth/ will result in /brush/. There are altogether six practice items and 20 test items, which are arranged in order of difficulty. Participants are challenged with increasingly difficult stimuli as they proceed through the assessment. The test ends when three consecutive errors are made, which means a ceiling has been reached.

Blending words subtest. This is an individually administered oral assessment consisting of six practice items and 20 test items. It measures participants' ability to sound out a word by integrating its composite phonological units. In the test, participants first listen to a series of isolated sounds presented on the CTOPP audio CD. Then, they are asked to put the sounds together and say aloud the whole words that they formulate. The test items are arranged in order of difficulty, starting with blending syllables into words (e.g. /num/ /ber/ → /number/) and proceeding to blending phonemes into words (e.g. /m/-/a/-/th/-/e/-/m/-/a/-/t/-/i/-/c/-/s/ → /mathematics/). The test ends when three consecutive errors are made, which means a ceiling has been established.

Blending nonwords subtest. This is an oral test administered on an individual basis. It provides a measure of participants' ability to combine speech sounds to form nonwords. In the test, participants first listen to a series of isolated sounds presented on the CTOPP audio CD. Then, they are asked to put the segments together and read aloud the nonwords they formulate (e.g., blending /k/ and /o/ constitutes /ko/). There are six practice items and 18 test items in total, which are arranged in order of difficulty. When a participant misses three test questions in succession, the test is terminated.

Segmenting nonwords subtest. This is an individually administered oral test with three practice items and 20 test items. It measures participants' ability to apply decoding skills and to divide a spoken nonword into its constituent phonological components. In the segmentation task, participants are asked to repeat the nonwords presented on the CTOPP audio CD, followed by splitting the stimuli into phonemes and reading aloud each composite sound (e.g., segmenting /seb/ into /s/, /e/ and /b/). The test items are arranged in order of ascending difficulty, and the ceiling criterion is three successively failed items.

Word-specific Orthographic Knowledge

Word-specific orthographic knowledge is another foundational skill of interest in this study. Two measures were used to access the participants' ability to recognize correct word spellings. The first measure was the Orthographic Choice Task devised by Olson, Kliegl, Davidson and Foltz (1985). According to Hagiliassis et al. (2006), this instrument "reflects the ability to recognize correct orthographic patterns for target words, independent of phonology" (p. 237). Since it is deemed a *purer* measure of orthographic processing, it is widely used within the research community.

In addition, the Spelling Subtest (Form L) from the PIAT-R/NU was selected to assess the participants' word-specific orthographic knowledge. The PIAT-R/NU is a standardized measure for use with people from preschool to post-high school (ages 5-18). To ensure adequate representation of the student population in the United States, it was normed on a national sample of 1,563 individuals from kindergarten through Grade 12. The Spelling Subtest of the PIAT-R/NU is a reliable measure. Its median split-half reliability coefficient (by grade) is .95, whereas its median test-retest reliability (by age group) is just as high (.90). In addition, the correlation between the Spelling Subtest from the PIAT-R/NU and that of the original PIAT is r = .50, which provides considerable evidence of its construct validity.

Orthographic choice task. This task is designed to measure knowledge of word spelling. Altogether, 80 pairs of letter strings are presented in two columns. One item in each pair indicates the correct spelling of a real word, whereas the other is simply a pseudohomophone (e.g., rain vs. rane). Participants are requested to identify the correctly spelled words and to check the box next to their answers. Given that the real word and its homophone foil are identical in pronunciation, participants need to draw upon their word-

specific orthographic knowledge to select the correct answer. The raw scores are calculated based on the total number of correct responses. In this study, the completion time was established as six minutes only. Therefore, the participants were required to recognize the correct spellings of words with automaticity.

Spelling subtest. This is a multiple-choice test designed to measure knowledge of spelling. As opposed to a dictation test, which emphasizes the production of correct spellings, this examination focuses on recognizing specific letter strings defining individual English words. A modified version was used, and only 85 test items were included in it for the present study. All items progress from requiring operations on lower to higher levels of lexical complexity. Participants listen to each stimulus item three times: first in isolation (e.g., 'glass'); then in a sentence context (e.g., 'the window is made of glass'); and finally, in isolation again (e.g., 'glass'). Subsequently, they must choose the correct spelling of the orally presented word from the four options listed on the answer sheet. The three foils in each question are meant to closely resemble the right answer in terms of letter sequence and phonetic feature (e.g., 'glass' vs. 'glash', 'glas' and 'glase'). The foils also cover the most typical types of errors, such as omission of letters, inversions, doubling, etc. A ceiling is reached when five errors are made in seven consecutive responses.

Word Identification

The participants' word identification skills were assessed by the Word Identification Subtest and the Word Attack Subtest from the WRMT-R/NR (Form G). The WRMT-R/NR is a standardized measure extensively used in educational, clinical and research contexts. Standardized on 6,089 children and adults representative of the U.S. population, it was developed for use with individuals across a wide age range, spanning 5 years through 75+

years of age (Grades K-16). The reliability and validity information provided in the manual is based on the previous 1989 version instead of on the latest re-normed version. The median split-half reliability coefficients of the Word Identification and Word Attack Subtests are .97 and .87, respectively. In addition, the correlations between the two subtests from the WRMT-R and the Woodcock-Johnson Reading Tests at four selected grades (Grades 1, 3, 4 and 8) are moderate on average, most of which exceed .60.

Word identification subtest. This 106-item test is a measure of sight word reading and assesses participants' automaticity in identifying and pronouncing real words. Participants are first presented with a list of printed words arranged in order of difficulty. They are then instructed to produce a natural reading of each test item in about five seconds, and the assessment ends when six consecutive errors are made. Some examples of the test items are 'play', 'twilight', 'causation' and 'quadruped'. It is important to note that this individually administered test only focuses on measuring accuracy of pronunciation. Assessment of word knowledge is beyond its scope; therefore, participants are not required to demonstrate comprehension of word meaning.

Word attack subtest. This is a pseudoword reading test comprised of two practice items and 45 test items. Pseudowords are nonsense words composed of letter strings that deviate from familiar orthographic patterns. Successful decoding and pronunciation of these words largely lie in the application of letter-sound rules. In this test, participants are first presented with a list of printed pseudowords ranging from the monosyllabic (e.g., 'dee', 'ap' and 'ift') to the multisyllabic (e.g., 'translibsodge' and 'monglustamer'). They then have to sound out each test item in about five seconds by using their phonic and structural analysis skills. The test is administered individually and ends when a participant makes six

consecutive errors.

Reading Comprehension

The GMRT-4 was administered to assess the participants' ability to understand connected text. Form S, Level 3 was chosen, as guided by the results of the pilot study. This test was originally devised for use with U.S. students in Grade 3. The GMRT-4 is a well-developed reading achievement test, assessing core literacy skills from kindergarten through post-high school levels (Johnson, 2004). Norms were obtained by administering the test to a sample of 65,000 students in Fall 1998 and Spring 1999, and these students were from both private and public schools all over the country. According to the publisher's manual, the alternate form reliability for the GMRT-4 ranges from .74 to .92. The test-retest reliability exceeds .88. The test's Kuder-Richardson 20 (KR-20) reliability is reported to be .91. Content validity is established through an extensive test development process.

Reading comprehension. This is a timed nonverbal reading comprehension test devised for group administration. In 35 minutes, participants must read 11 short passages silently (each of which is approximately three paragraphs in length) and complete 48 multiple-choice questions with the passages in view. The passages features a variety of writing styles because they are selected from published materials covering diverse topics on science, social studies, and the arts. In addition, as the test proceeds, the passages are characterized by greater linguistic complexity and increased textual sophistication. Likewise, the questions become progressively more cognitively demanding. In addition to focusing on a mere understanding of factual, explicit information at the literal level, the questions cover more advanced skills such as analysis and evaluation of arguments. The raw scores are calculated based on the total number of correct responses obtained.

Table 5

Summary of measures used in the study

Skills assessed	Sources of instrument	Measures	Duration
Phonological awareness	Comprehensive Test of Phonological Processing (CTOPP, 1999)	Ellison subtest – say aloud the remaining parts of a spoken word after removal of a particular sound unit from it • individually administered test • discontinued after 3 errors are made Blending words subtest – combine individual sounds together in order to pronounce some real words • individually administered test • discontinued after 3 errors are made Blending nonwords subtest – put the smaller parts of some made-up words together and sound out the words as a whole • individually administered test • discontinued after 3 errors are made Segmenting nonwords subtest - split some orally presented nonwords into their constituent units of sound • individually administered test • discontinued after 3 errors are made	Depends on the abilities of participants

Skills assessed	Sources of instrument	Measures	Duration
Word-specific orthographic knowledge	Olson, Kliegl, Davidson and Foltz (1985)	Orthographic choice task administered in groups • recognize correct word spellings against their heterographic homophonic foils • 80 item pairs	6 mins
	Peabody Individual Achievement Test - Revised / Normative Update (PIAT-R, 1998)	Spelling subtest (Form L) administered in groups • choose the correct spelling of words based on the prerecorded questions • 100 multiple choice items	40 mins
Word identification	Woodcock Reading Mastery Test – Revised / Normative Update (WRMT-R/NR, 1998)	Word identification subtest (Form G) • individually administered test • real word reading - read aloud real words presented visually in isolation • terminated after six consecutive errors. Word attack subtest (Form G) • individually administered test • nonsense word reading - read aloud nonsense words presented visually in isolation • terminated after six consecutive errors.	Depends on the abilities of participants
Reading comprehension	Gates-MacGinitie Reading Tests – 4th Edition (GMRT-4, 2000)	Passage comprehension subtest (Form S, Level 3) • group administered test • 48 multiple choice items based on 11 passages	35 mins

Limitations

Three local secondary schools consented to participate in this study, each of which represented one of the three ability bands defined by the local education bureau. Therefore, the 507 EFL learners recruited in phase one and the 122 participants admitted into phase two of this study were supposed to be representative of Hong Kong's seventh-grade student population. However, it was noticed that the English reading abilities of the Band 2 CMI participants were comparable to those of their Band 3 counterparts. This was confirmed by the school principal of the Band 3 school that his seventh graders started with particularly lower English proficiency, but they would catch up with the norm when they proceeded to higher grade levels.

In addition, test administration was interrupted by the swine flu pandemic, resulting in 74 participants completing all subtests in phase two as planned, and 48 participants being rescheduled to take some of the subtests three months later. This time discrepancy could be a potential factor influencing the test performance of the two groups. In order to see whether there was any group difference caused by test administration at different time points, a series of independent samples *t*-tests were conducted, and the effect sizes were examined.

Summary

To summarize, in this study on seventh-grade EFL students in Hong Kong, a two-phase study design was employed to provide a comprehensive assessment of the participants' abilities in the domains of (1) phonological awareness, (2) word-specific orthographic knowledge, (3) word identification and (4) reading comprehension. In phase one, Level 3 of the GMRT-4 (Form S) was first administered to 507 Cantonese-speaking seventh graders from three local secondary schools. Based on the standardized reading comprehension test

scores, the participants were categorized into four achievement groups defined by the 25th, 50th and 75th percentile cutoff points. Then, 31 students were randomly selected from each of the four subgroups for further testing, and a total of 124 participants were admitted to the second phase of the study.

In phase two, the Orthographic Choice Task created by Olson et al. (1985) and the Spelling Subtest from the PIAT-R were administered in a group session to assess the participants' word-specific orthographic knowledge. Four subtests from the CTOPP and two subtests from the WRMT-R/NR were administered in an individual session to assess their phonological awareness and word identification, respectively. Two students were dropped from the report because they did not complete the whole battery of tests. Of the 124 participants admitted to phase two, 74 were able to complete all the eight subtests as planned. However, 50 participants were unable to take the subtests measuring phonological awareness and word identification due to the 2009 swine flu pandemic. Testing resumed four months later. Two students were dropped from the study because they were absent on the test days, thus resulting in a final sample of 122 participants.

CHAPTER FOUR

RESULTS

A total of 122 seventh-grade Chinese students studying EFL in Hong Kong completed a battery of nine subtests measuring phonological awareness, word-specific orthographic knowledge, word identification and reading comprehension. SPSS 17.0 was used to calculate descriptive and inferential statistics. Chapter four is primarily a report of the results. It first starts with a descriptive analysis of the participants' performance in each subtest. The next section presents the findings generated from correlational analyses. The emphasis is put on the associations between the two independent variables (i.e. phonological awareness and word-specific orthographic knowledge) and the two dependent variables (i.e. word identification and reading comprehension). In the last section, a series of hierarchical regression analyses were conducted to sort out the unique sources of variation in the reading outcomes. It was hypothesized that the order of variable entry could make a difference in the results and conclusions. To resolve this problem, separate hierarchical regression analyses were carried out for each dependent variable, reversing the order of the independent variables entered. The purpose of this procedure was to determine the relative importance of each independent variable based on how much it added to the explained variance, over and above that which had been accounted for by others (Cohen & Cohen, 1983). Besides, the beta weights of the independent variables were examined to further understand their relative contributions to word identification and reading comprehension.

Descriptive Analysis

First of all, descriptive statistics were computed for all subtests on phonological awareness, word-specific orthographic knowledge, word identification and reading

comprehension. Raw scores based on the total correct responses were used to provide preliminary information on the participants' performance. In addition, to make comparisons across the nine subtests, the raw scores were further converted onto a common scale with a mean of 100 and a standard deviation of 15 (based on the conversion tables available in the examiner's manuals). However, the standard scores for the Orthographic Choice Task were not available because this subtest was not selected from a standardized measure. Table 6 presents the means and standard deviations for each subtest.

With reference to the raw scores, it could be concluded that the participants' overall performance was not very good. Among the nine subtests administered, only the Spelling Subtest and the Orthographic Choice Task had a mean score above 50 percent of the maximum score. On the other hand, the participants did most poorly on the subtest measuring nonword segmentation. Their mean score was only 3.26 out of 20 possible points and the standard deviation was 2.66.

Interpretation based on the raw scores, however, provided limited information on the participants' relative strengths and weaknesses. To address this issue, all raw scores were transformed to standard scores with a mean of 100 and a standard deviation of 15 based on the specifications in the examiner's manuals. The standard scores for the Orthographic Choice Task, however, were not available because this subtest was not selected from a standardized measure. When the raw scores were converted to their equivalent standard scores with the same mean and standard deviation, direct comparison of student performance across subtests was possible.

Table 6

Means and standard deviations for each subtest for Chinese EFL students (N = 122)

	Raw Score				Standard Score	
Subtest	Maximum	Median	*M*	*SD*	*M*	*SD*
Phonological Awareness						
CTOPP Ellison	20	6	6.25	3.53	77.54	12.25
CTOPP Blending Words	20	6	5.78	2.76	76.27	10.03
CTOPP Blending Nonwords	18	4	4.00	2.99	86.19	11.23
CTOPP Segmenting Nonwords	20	3	3.26	2.66	78.69	9.85
Orthographic Knowledge						
PIAT-R/NU Spelling	100	53.5	55.61	19.57	108.42	20.73
Orthographic Choice	80	44.5	43.15	21.45	--	--
Word Identification						
WRMT-R/NR Word Identification	106	46.5	44.36	14.07	91.65	10.86
WRMT-R/NR Word Attack	45	8	9.72	6.93	88.43	12.23
Reading Comprehension						
GMRT-4 Reading Comprehension	48	18	21.12	10.47	90.45	14.62

Note. CTOPP = Comprehensive Test of Phonological Processing; PIAT-R/NU = Peabody Individual Achievement Test – Revised/Normative Update; WRMT-R/NR = Woodcock Reading Mastery Test – Revised / Normative Update; GMRT-4 = Gates-MacGinitie Reading Tests, 4th Edition.

All raw scores were converted into standard scores (M = 100, SD = 15).

Based on the standard scores, the group was the weakest in the four phonological awareness subtests. The average standard scores only ranged from 76.27 (*SD* = 10.03) for the Blending Words Subtest to 86.19 (*SD* = 11.23) for the Blending Nonwords Subtest. Obviously, manipulating English sound units presented a profound challenge to the participants. This might be, in part, due to their rather underdeveloped English phonology, which is common in this typical linguistic group (Holm & Dodd, 1996).

Relatively speaking, word-specific orthographic knowledge was the strongest attribute identified in the participants. As shown in Table 6, the average standard score of the Spelling Subtest was 108.42 (*SD* = 20.73), which was also the highest score achieved by the group. The finding that they were more proficient in recognizing correctly spelled words was substantiated by previous studies on the Chinese population (Wang & Geva, 2003).

Differences in Performances between Early and Late Test Takers

Due to the outbreak of swine flu, administration of six subtests in phase two was interrupted. These subtests included Ellison, Blending Words, Blending Nonwords, Word Identification and Word Attack, all of which had to be administered on an individual basis. The first four subtests sought to measure phonological awareness. The last two assessed real word reading and nonsense word reading, both of which were indicators of word identification.

Out of the 122 participants in the final sample, 74 of them were able to complete all the six subtests as scheduled in early July 2009. Testing for the remaining 48 participants was

postponed to early November, 2009. Twenty-two of them had been categorized into the low achieving group, 17 to the medium-low achieving group and nine to the medium-high achieving group. Table 7 presents the distribution of early test takers and late test takers by achievement group.

Table 7

Distribution of early test takers and late test takers by achievement group (N = 122)

	Low achieving group	Medium-low achieving group	Medium-high achieving group	High achieving group	Total
Early test taker					
Band 1 EMI school	0	1	18	31	60
Band 2 CMI school	0	0	0	0	0
Band 3 CMI school	9	11	4	0	24
	9	12	22	31	74
Late test taker					
Band 1 EMI school	0	0	0	0	0
Band 2 CMI school	15	11	8	0	34
Band 3 CMI school	7	6	1	0	14
	22	17	9	0	48

Note. EMI school = school using English as the medium of instruction; CMI school = school using Chinese as the medium of instruction.

Since the six subtests were carried out at two time points with three months apart, it was important to examine if this would affect the participants' performances. To this end, a series of independent-samples *t*-tests were conducted to see whether the early test takers and the late test takers within each achievement group differed significantly in their mean scores. However, due to the small sample size of each achievement group, the analyses might have insufficient power to detect any significant effects even if they existed. Therefore, effect sizes and confidence intervals were reported along with the *p*-values in order to provide more complete information.

Low Achieving Group

There were altogether nine early test takers and 22 late test takers in the low achieving group. Independent-samples *t*-test was conducted to compare their mean scores on the Ellison, Blending Words, Blending Nonwords, Segmenting Nonwords, Word Identification and Word Attack Subtests. The magnitude of effect sizes was interpreted based on Cohen's (1988) standard that a small effect is .2, a medium effect is .5, a large effect is .8, and a very large effect is 1.3. Table 8 is a summary of the results.

Table 8

Group differences for phonological awareness subtests and word identification subtests between early test takers and late test takers in the low achieving group

	Early Test Taker (n = 9)		Late Test Taker (n = 22)			
Subtest	*M*	*SD*	*M*	*SD*	*t* (29)	*d*
Phonological Awareness						
CTOPP Ellison (20)	4.89	2.15	3.73	1.83	-1.53	-0.56
CTOPP Blending Words (20)	3.56	1.51	4.59	2.24	1.27	0.60
CTOPP Blending Nonwords (18)	2.78	1.30	2.68	2.57	-0.11	-0.06
CTOPP Segmenting Nonwords (20)	1.22	1.64	2.09	1.72	1.30	0.52
Word Identification						
WRMT-R/NR Word Identification (106)	31.78	9.52	32.64	8.76	0.24	0.09
WRMT-R/NR Word Attack (45)	4.67	3.81	5.14	4.86	0.26	0.11

Note. CTOPP = Comprehensive Test of Phonological Processing; WRMT-R/NR = Woodcock Reading Mastery Test – Revised / Normative Update.
Maximum scores are indicated in parentheses next to each subtest.
All *p*-values are not significant.

Ellison. There was no significant difference in the Ellison scores for the early test takers (M = 4.89, SD = 2.15) and the late test takers (M = 3.73, SD = 1.83); t(29) = -1.53, p > .05. These results suggested that the test delay did not have a substantial impact on their performance statistically. The difference between their average scores was -1.16, with a 95% confidence interval from to -2.72. to .40. The effect size was medium (d = -.56).

Blending words. There was no significant difference in the Blending Words scores for the early test takers (M = 3.56, SD = 1.51) and the late test takers (M = 4.59, SD = 2.24); t(29) = 1.27, $p > .05$. The difference between their average scores was 1.04, with a 95% confidence interval from -.64. to 2.71. The effect size was medium (d = .60).

Blending nonwords. There was no significant difference in the Blending Nonwords scores for the early test takers (M = 2.78, SD = 1.30) and the late test takers (M = 2.68, SD = 2.57); t(29) = -.11, $p > .05$. The difference between their average scores was only -0.10, with a 95% confidence interval from -1.95 to 1.76. The effect size was trivial (d = -.06).

Segmenting nonwords. There was no significant difference in the Segmenting Nonwords scores for the early test takers (M = 1.22, SD = 1.64) and the late test takers (M = 2.09, SD = 1.72); t(29) = 1.30, $p > .05$. The difference between their average scores was 0.87, with a 95% confidence interval from -.50. to 2.24. The effect size was medium (d = .52).

Word identification. Results show that the difference in the Word Identification scores was not significant, $t(29) = .24$, $p > .05$. The early test takers (M = 31.78, SD = 9.52) overall performed in similar ways as the late test takers (M = 32.64, SD = 8.76). The difference between their average scores was only 0.86, with a 95% confidence interval from -6.41 to 8.13. The effect size was trivial (d = .09).

Word attack. Results show that the difference in the Word Attack scores was not significant, $t(29) = .26$, $p > .05$. The early test takers (M = 4.67, SD = 3.81) overall performed in similar ways as the late test takers (M = 5.14, SD = 4.86). The difference between their average scores was only 0.47, with a 95% confidence interval from -3.25 to 4.19. The effect size was trivial (d = .11).

Medium-low Achieving Group

There were altogether 12 early test takers and 17 late test takers in the medium-low achieving group. Independent-samples *t*-test was conducted to compare their mean scores on the six subtests. The magnitude of effect sizes was interpreted based on Cohen's (1988) standard that a small effect is .2, a medium effect is .5, a large effect is .8, and a very large effect is 1.3. Table 9 is a summary of the results.

Table 9

Group differences for phonological awareness subtests and word identification subtests between early test takers and late test takers in the medium-low achieving group

	Early Test Taker (n = 12)		Late Test Taker (n = 17)			
Subtest	*M*	*SD*	*M*	*SD*	*t* (27)	*d*
Phonological Awareness						
CTOPP Ellison (20)	6.00	3.33	4.59	2.12	-1.41	-0.54
CTOPP Blending Words (20)	4.75	2.22	4.71	2.17	-0.05	-0.02
CTOPP Blending Nonwords (18)	2.75	1.91	3.12	2.12	0.50	0.18
CTOPP Segmenting Nonwords (20)	2.00	2.41	3.00	1.84	1.27	0.48
Word Identification						
WRMT-R/NR Word Identification (106)	32.67	14.10	39.47	9.74	1.54	0.59
WRMT-R/NR Word Attack (45)	6.17	5.94	6.94	3.93	0.42	0.16

Note. CTOPP = Comprehensive Test of Phonological Processing; WRMT-R/NR = Woodcock Reading Mastery Test – Revised / Normative Update.

Maximum scores are indicated in parentheses next to each subtest.

All *p*-values are not significant.

Ellison. There was no significant difference in the Ellison scores for the early test takers (M = 6, SD = 3.33) and the late test takers (M = 4.59, SD = 2.12); t(27) = -1.40, p > .05. These results suggested that postponing the subtest did not have a substantial impact on their performance statistically. The difference between the average Ellison scores in the two groups was -1.41, with a 95% confidence interval from -3.49 to .66. The effect size was medium (d = -.54).

Blending words. There was no significant difference in the Blending Words scores for the early test takers (M = 4.75, SD = 2.22) and the late test takers (M = 4.71, SD = 2.17); t(27) = -.05, p > .05. The difference between their average scores was only -0.04, with a 95% confidence interval from -1.74 to 1.65. The effect size was trivial (d = -.02).

Blending nonwords. There was no significant difference in the Blending Nonwords scores for the early test takers (M = 2.75, SD = 1.91) and the late test takers (M = 3.12, SD = 2.12); t(27) = .50, p > .05. The difference between their average scores was only 0.37, with a 95% confidence interval from -1.21 to 1.94. The effect size was trivial (d = .18).

Segmenting nonwords. There was no significant difference in the Segmenting Nonwords scores for the early test takers (M = 2, SD = 2.41) and the late test takers (M = 3, SD = 1.84); t(27) = 1.27, p > .05. The difference between their average scores was 1, with a 95% confidence interval from -.62 to 2.62. The effect size was small (d = .48).

Word identification. Results show that the difference in the Word Identification scores was not significant, t(27) = 1.54, p > .05. The early test takers (M = 32.67, SD = 14.10) overall performed in similar ways as the late test takers (M = 39.47, SD = 9.74). The difference between their average scores was 6.8, with a 95% confidence interval from -2.26. to 15.87. The effect size was medium (d = .59).

Word attack. Results show that the difference in the Word Attack scores was not significant, t(27) = .42, p > .05. The early test takers (M = 6.17, SD = 5.94) overall performed in similar ways as the late test takers (M = 6.94, SD = 3.93). The difference between their

average scores was only 0.77, with a 95% confidence interval from -2.98 to 4.53. The effect size was trivial (d = .16).

Medium-high Achieving Group

There were altogether 22 early test takers and nine late test takers in the medium–high achieving group. Independent-samples *t*-test was conducted to compare their mean scores on the six subtests. Interpretation of effect sizes was based on Cohen's (1988) notion that 0.2 is indicative of a small effect, 0.5 a medium, 0.8 a large and 1.3 a very large effect. Table 10 is a summary of the results.

Table 10

Group differences for phonological awareness subtests and word identification subtests between early test takers and late test takers in the medium-high achieving group

	Early Test Taker (n = 22)		Late Test Taker (n = 9)			
Subtest	*M*	*SD*	*M*	*SD*	*t* (29)	*d*
Phonological Awareness						
CTOPP Ellison (20)	7.55	2.81	(3.33)	1.66	-4.19***	-2.12
CTOPP Blending Words (20)	6.05	1.86	4.44	2.07	-2.11*	-0.80
CTOPP Blending Nonwords (18)	3.95	2.28	2.22	2.17	-1.95	-0.97
CTOPP Segmenting Nonwords (20)	3.41	1.47	2.78	1.99	-0.98	-0.34
Word Identification						
WRMT-R/NR Word Identification (106)	50.59	7.18	42.44	7.80	-2.80**	-1.07
WRMT-R/NR Word Attack (45)	12.14	4.97	6.89	5.42	-2.60*	0.99

Note. CTOPP = Comprehensive Test of Phonological Processing; WRMT-R/NR = Woodcock Reading Mastery Test – Revised / Normative Update.

Maximum scores are indicated in parentheses next to each subtest.

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

Ellison. Results show that the difference in the Ellison scores was significant t(29) = -4.19, $p < .001$. Early test takers ($M = 7.55$, $SD = 2.81$) on the average performed better than the late test takers ($M = 3.33$, $SD = 1.66$). The difference between their average scores was -4.21, with a 95% confidence interval from -6.27 to -2.16. The effect size was very large ($d = -2.12$).

Blending words. Results show that the difference in the Blending Words scores was significant, $t(29) = -2.11$, $p < .05$. Early test takers ($M = 6.05$, $SD = 1.86$) on the average performed better than the late test takers ($M = 4.44$, $SD = 2.07$). The difference between their average scores was -1.60, with a 95% confidence interval from -3.16 to -.05. The effect size was large ($d = -.80$).

Blending nonwords. There was no significant difference in the Blending Nonwords scores for the early test takers ($M = 3.95$, $SD = 2.28$) and the late test takers (2.22, $SD = 2.17$); $t(29) = -1.95$, $p > .05$. The difference between their average scores was -1.73, with a 95% confidence interval from -3.55 to .09. The effect size was medium ($d = -.79$).

Segmenting nonwords. There was no significant difference in the Segmenting Nonwords scores for the early test takers ($M = 3.41$, $SD = 1.47$) and the late test takers ($M = 2.78$, $SD = 1.99$); $t(29) = -.98$, $p > .05$. The difference between their average scores was -0.63, with a 95% confidence interval from -1.95 to .69. The effect size was small ($d = -.34$).

Word identification. Results show that the difference in the Word Identification scores was significant, $t(29) = -2.8$, $p < .05$. The early test takers ($M = 50.59$, $SD = 7.18$) in general performed better than the late test takers ($M = 42.44$, $SD = 7.80$). The difference between their average scores was -8.15, with a 95% confidence interval from -14.10 to -2.20. The effect size was large ($d = -1.07$).

Word attack. Results show that the difference in the Word Attack scores was

significant, $t(29) = -2.60$, $p < .05$. The early test takers ($M = 12.14$, $SD = 4.97$) in general performed better than the late test takers ($M = 6.89$, $SD = 5.42$). The difference between their average scores was -5.25, with a 95% confidence interval from -9.37 to -1.12. The effect size was large ($d = -.99$).

Summary

Independent-samples *t*-tests were used to evaluate the differences in average scores between the test takers in July and those in November. For the low achieving group, no statistically significant difference was detected between the early test takers ($n = 9$) and the late test takers ($n = 22$) across the six subtests ($p > .05$). However, examination of the effect sizes suggested that the early test takers generally outperformed their peers on the Ellison Subtest, yet the late test takers did better on the Blending Words and Segmenting Nonwords Subtests. Given the inconsistent findings, there was no compelling evidence to conclude that the three-month time gap in test administration had any effects on student performance.

For the medium-low achieving group, differences in the average scores between the early test takers ($n = 12$) and the late test takers ($n = 17$) did not attain a statistically significance level as well ($p > .05$). However, when the effect sizes were taken into account, the early test takers outperformed their peers on the Ellison Subtest, yet the late test takers did better on the Word Identification Subtest. Again, it was difficult to conclude whether the time effect (if any) was positive or negative in direction.

For the medium-high achieving group, the early test takers ($n = 9$) were found to perform significantly better than the late test takers ($n = 22$) on four out of the six subtests, namely, Ellison, Blending Words, Word Identification and Word Attacks. Although no statistically significant difference was detected in their average Blending Nonwords scores, a medium effect size $d = -.79$ was obtained. These provided strong evidence that the early test

takers outperformed the late test takers on all tasks except the one assessing nonword segmentation.

Further analyses were conducted to examine if the two groups performed differently on the three subtests (i.e. the Spelling Subtest, the Orthographic Choice Task and the Reading Comprehension Subtest) they completed at the same time. Results showed that the early test takers set out to have a better mastery in reading-related skills. This was evidenced in their significantly better performance on both the Spelling Subtest and the Orthographic Choice Task, with $p < .05$ and $p < .01$ respectively. Even though a statistically difference was not detected in their reading comprehension scores, a medium effect size of $d = -.62$ was noticed, suggesting that the difference was of practical importance. All these pointed to an intrinsic heterogeneity of the two groups in their reading ability, which justified their persistent discrepancy in all test scores.

To sum up, examination of both the *t*-test results and the effect sizes indicated that the late test takers did not seem to have an advantage due to the delayed test administration. There was no strong evidence to support that the two groups differed statistically and practically because the subtests were carried out at different times. This conclusion held true irrespective of the achievement group to which the participants belonged.

Correlational Analyses

In order to evaluate the strength of the relationship between variables, a series of correlational analyses were conducted. First of all, an intercorrelation matrix was formed with all subtests included. Inspection of this matrix could uncover how phonological awareness and word-specific orthographic knowledge were related to word identification and reading comprehension. Then, there was a specific discussion on the interrelationships among the four phonological awareness subtests. Also, the association between the two

word-specific orthographic tasks was examined.

Research Question 1

To what extent are phonological awareness and word-specific orthographic knowledge associated with word identification and reading comprehension in seventh-grade Chinese EFL students?

To address the first research question, correlation coefficients were computed to examine how the two independent variables (i.e. phonological awareness and word-specific orthographic knowledge) were related to the two dependent variables (i.e. word identification and reading comprehension) in the sample. Table 11 shows the correlation matrix for all subtests included in this study.

Table 11

Correlations between phonological awareness, word-specific orthographic knowledge, word identification and reading comprehension scores for Chinese EFL students (N = 122)

	1	2	3	4	5	6	7	8	9
1. Ellison	--								
2. Blending Words	.64	--							
3. Blending Nonwords	.62	.71	--						
4. Segmenting Nonwords	.51	.64	.70	--					
5. Spelling	.63	.58	.62	.57	--				
6. Orthographic Choice	.62	.56	.60	.58	.95	--			
7. Word Identification	.68	.66	.68	.64	.87	.86	--		
8. Word Attack	.68	.63	.66	.60	.73	.72	.84	--	
9. Reading Comprehension	.59	.58	.55	.52	.79	.77	.79	.67	--

Note. Standard scores (M = 100, SD = 15) were used for analysis.

All coefficients are significant at the $p < .001$ level.

First of all, phonological awareness and word-specific orthographic knowledge were examined in relation to word identification (as measured by the Word Identification Subtest and the Word Attack Subtests). As shown in Table 11, all correlations were positive at a statistically significant level ($p < .001$). This meant an increase in the value of one variable would be accompanied by a simultaneous increase in the value of another. Results indicated that word identification correlated moderately with the four phonological awareness variables (*rs* = .60-.68). Comparatively, its correlations with the two variables of word-specific orthographic knowledge were higher, ranging from .72 to .87.

Of equal importance was to investigate how phonological awareness and word-specific orthographic knowledge were related to reading comprehension, a process which goes beyond identification of isolated words and requires a higher degree of cognitive demand. Analysis revealed that phonological awareness correlated less highly with reading comprehension (*rs* = .52-.59), as compared with its correlations with real word reading (*rs* = .64-.68) and nonsense word reading (*rs* = 60-.68). On the other hand, orthographic knowledge remained strongly associated with reading comprehension (*rs* =.77-.79).

In summary, the correlations with word identification were higher for word-specific orthographic knowledge (*rs* =.72-.87) than for phonological awareness (*rs* =.60-.68). Similarly, the correlations with the reading comprehension (another dependent variable of interest) were higher for word-specific orthographic knowledge (*rs* =.77-.79) than for phonological awareness (*rs* =.52-.59).

Intercorrelations among the Phonological Awareness Tasks

In this study, a total of four subtests from the CTOPP were selected to provide an estimate of the participants' overall phonological awareness. They included Ellison, Blending

Words, Blending Nonwords and Segmenting Nonwords. The intercorrelations of these four subtests were specifically verified before proceeding to more sophisticated statistical analyses to address the next two research questions. The matrix of their correlation coefficients is illustrated in Table 12.

Table 12

Intercorrelations among the four CTOPP phonological awareness subtests for 7th Grade Chinese EFL learners (*N* = 122)

	Ellison	Blending Words	Blending Nonwords	Segmenting Nonwords
Ellison	--			
Blending Words	.64	--		
Blending Nonwords	.62	.71	--	
Segmenting Nonwords	.51	.64	.70	--

Note. CTOPP = Comprehensive Test of Phonological Processing.

All correlations are significant at the $p < .001$ level.

It can be seen from Table 12 that all the four subtests from the CTOPP were positively correlated. In addition, their associations were moderate to strong (*rs* = .51 - .71) at a statistically significant level ($p < .001$). These suggested that while they were extracting certain unique information about phonological awareness, they reflected in part the same underlying construct.

As indicated in Table 12, the Ellison Subtest was best correlated with the Blending

Words Subtest (r = .64). Their moderate correlation indicated that they tended to measure different aspects of the same broad ability. This was further affirmed by the CTOPP Examiner's Manual, which details the procedures to derive a Primary Phonological Awareness Composite Score from the Ellison scores and the Blending Words scores. As a result, use of this composite score was preferred for the subsequent hierarchical regression analyses because it constituted a more precise estimate of phonological awareness related to *real word* stimuli.

In addition, the strongest correlation existed between the Blending Nonwords Subtest and the Segmenting Nonwords Subtest (r = .70). The fact that these two subtests yielded rather consistent performance supported the use of an additional composite score for subsequent hierarchical regression analyses. This was further justified by the CTOPP Examiner's Manual, which details the procedures to combine these two subtest scores to form an Alternate Phonological Awareness Composite Score. Using this composite score could provide a better estimate of phonological awareness related to *nonword* stimuli.

Intercorrelation between the Word-specific Orthographic Tasks

In this study, word-specific orthographic knowledge was assessed by two tasks. First, the Spelling Subtest (Form L) from the PIAT-R/NU was selected to assess the participants' word-specific orthographic knowledge. Besides, the Orthographic Choice Task devised by Olson, Kliegl, Davidson and Foltz (1985) was used. The intercorrelation of these two variables was verified before proceeding to more sophisticated statistical analyses to address the next two research questions.

The Spelling Subtest and the Orthographic Choice Task were positively correlated at a statistically significant level ($p < .001$). The correlation coefficient reached .95 and such a

high correlation suggested that the two tasks essentially tap into the same underlying construct, bringing overlapping information to analyses. To avoid the problem of multicollinearity, only the standard scores of the Spelling Subtest were used for subsequent hierarchical regression analyses.

Hierarchical Regression Analyses

Hierarchal regression analyses were conducted to partition the shared variance explained in word identification and reading comprehension by different independent variables. Before running the analyses, two composites for phonological awareness were computed as guided by the CCTOPP Examiner's Manual. Primary Phonological Awareness Composite was derived from the Ellison Subtest and the Blending Words Subtest. First of all, the raw scores of these two subtests were converted into their corresponding standard scores (M = 10, SD = 3) as instructed in the manual. Then, the sum of these two initial standard scores was further converted into Primary Phonological Awareness Composite (M = 100, SD = 15). This composite score was indicative of a participant's performance in tasks related to real word stimuli.

The same method was applied to the calculation of Alternate Phonological Awareness Composite, which was derived from the two remaining subtests: Blending Nonwords and Segmenting Nonwords. This composite score was formed to provide additional information, indicating a participant's performance in tasks related to nonword stimuli. Composites were used because the four subtests measuring phonological awareness correlated moderately to strongly with one another (rs = .51 to .71). This showed that they actually captured some overlapping portions of a broader ability.

Word-specific orthographic knowledge was another independent variable of interest. In this study, two tasks had been administered to assess the participants' word-specific orthographic knowledge. With a high correlation of $r = .94$, they essentially conveyed the same information. Therefore, including both of them in the hierarchical regression analyses would contribute to the problem of multicollinearity. As a result, only the PIAT Spelling Subtest scores were used for subsequent analyses and the Orthographic Choice scores were dropped from all models.

After reducing the initial six independent variables into three (namely, Primarily Phonological Awareness Composite, Alternate Phonological Awareness Composite and Word-specific Orthographic Knowledge), it was important to ensure that only those contributing significantly to the explained variance of the target reading outcome were included in each model. To determine the optimal set of significant independent variables for each model, a stepwise regression was first carried out. Only those with a *p*-value less than .05 were retained in the final equations. Those which failed to attain a statistically significant level were eliminated.

Research Question 2

What are the relative contributions of phonological awareness and word-specific orthographic knowledge to word identification in seventh-grade Chinese EFL students?

The second goal of this study was to investigate the relative contributions of phonological awareness and word-specific orthographic knowledge to word identification with regard to the 122 seventh-grade students in Hong Kong. More specifically, it was of interest to determine which of the independent variables could better explain the variance in word identification.

In this study, two tasks (namely, the Word Identification Subtest and the Word Attack subtest) were administered to assess word identification skills. For use in analyses, a single composite indicative of the participants' overall word identification ability was calculated. The raw scores of the Word Identification and Word Attack Subtests from the WRMT-R/NR were first translated into their respective W scores (Rasch-based ability scores) based on the computation instructions in the examiner's manual. Then, the averaged W scores were further transformed into Word Identification Composite (M = 100, SD = 15) according to the conversion table provided.

To identify the minimum set of independent variables needed to significantly explain the variance in word identification, a stepwise regression was first conducted. Results showed that word-specific orthographic knowledge, Primary Phonological Awareness Composite and Alternate Phonological Awareness Composite were all statistically significant. The first two had a p-value of less than .001, whereas the last one had a p-value of less than .01. Therefore, none of them were dropped from the final equation.

Prior to running hierarchical regression analyses, the intercorrelations of the final three selected independent variables (i.e. orthographic knowledge, Primary Phonological Awareness Composites and Alternate Phonological Awareness Composite) and the dependent variable (i.e. Word Identification Composite) were examined. Table 13 is the correlation matrix.

Table 13

Intercorrelations for word-specific orthographic knowledge, Primary Phonological Awareness Composite, Alternate Phonological Awareness Composite and Word Identification Composite (N = 122)

Variable	1	2	3	4
1. Word-specific orthographic knowledge				
2. Primary Phonological Awareness Composite	.70			
3. Alternate Phonological Awareness Composite	.65	.72		
4. Word Identification Composite	.85	.76	.73	

Note. All correlations are significant at the $p < .01$ level.

As expected, the three independent variables were moderately to strongly correlated with one another (*rs* = .65 - .72). They conveyed overlapping information and the influence of one variable might not be easily separated from that of the other. At the same time, Word Identification Composite correlated more strongly with orthographic knowledge (r = .85) than the two Phonological Awareness Composites (*rs* = .73-76)

Finally, separate hierarchical regression analyses were carried out to address the second research question of this study. In the first hierarchical regression analysis, Word Identification Composite was the dependent variable. Word-specific orthographic knowledge (as measured by the Spelling Subtest) was entered as the first independent variable at Step 1. Primary Phonological Awareness Composite and Alternate Phonological Awareness Composite were entered at Step 2 simultaneously (summarized in Table 14).

Table 14

Hierarchical regression analysis with Word Identification Composite as dependent variable (N = 122)

Variable	*SEB*	β	R^2	Adjusted R^2	ΔR^2
Step 1			.715	.713	.715
Word-specific orthographic knowledge	.026	.846***			
Step 2			.797	.791	.081
Word-specific orthographic knowledge	.033	.543***			
Primary Phonological Awareness Composite	.061	.270***			
Alternate Phonological Awareness Composite	.061	.176**			

Note. Word Identification Composite (comprised the standard scores of the Word Identification and Word Attack Subtests).
Word-specific orthographic knowledge (comprised the standard scores of the Spelling Subtest).
Primary Phonological Awareness Composite (comprised the standard scores of the Ellison and Blending Words Subtests).
Alternate Phonological Awareness Composite (comprised the standard scores of the Blending Nonwords and Segmenting Nonwords Subtests).
** $p < .01$. *** $p < .001$.

Examination of the standardized beta values could explain the relative importance of different independent variables in the model. A standardized beta value indicated the number of standard deviations that the outcome will change as a result of one standard deviation change in the independent variable. Thus, the higher the beta value, the greater the impact of the independent variable on the dependent variable.

When word-specific orthographic knowledge was entered at step 1 in the model, it had a standardized beta weight of $\beta = .85$ ($p < .001$). When Primary Phonological Awareness Composite and Alternate Phonological Awareness Composite were added at step 2, the standardized beta weight of orthographic knowledge dropped from $\beta = .85$ to $\beta = .54$ at a *p*-value less than .001. On the other hand, the standardized beta weights of the two phonological awareness variables were only $\beta = .27$ ($p < .001$) and $\beta = .18$ ($p < .01$), respectively. Even though all standardized beta values were statistically significant, word-specific orthographic knowledge had a much greater relative association with real word reading.

Collectively, word-specific orthographic knowledge, Primary Phonological Awareness Composite and Alternate Phonological Awareness Composite explained 79.7% of the variance in real word reading ($R^2 = .80$, $F(3, 118) = 153.95$, $p < .001$). Adjusting for the number of independent variables, they jointly explained 79.1% of the variance, which represented a large multivariate effect size.

Word-specific orthographic knowledge alone accounted for 71.5% of the variance in word identification when entered at Step 1 ($R^2 = .72$, $F(1, 120) = 301.63$, $p < .001$). Adding Primary Phonological Awareness Composite and Alternate Phonological Awareness Composite in the second step explained an additional 8.1% of the variance ($R^2 = .80$, $F(3,118) = 153.95$, $p < .001$). Even though this block of phonological awareness variables provided significant incremental validity, it represented only a small multivariate effect size.

To disentangle the relationship of phonological awareness and word-specific orthographic knowledge, another hierarchical analysis was carried out, reversing the order of the independent variables entered into the model. This time, Word Identification Composite remained to be the dependent variable. However, the independent variables were entered in a different order. First of all, Primary Phonological Awareness Composite and Alternate

Phonological Awareness Composite were entered as a block at Step 1. Then, word-specific orthographic knowledge was entered at Step 2. This procedure helped determine whether word-specific orthographic knowledge contributed variance to word identification that was not already explained by phonological awareness. Table 15 presents the hierarchical regression analysis reversing the entry order.

Table 15

Hierarchical regression analysis with Word Identification Composite as dependent variable, reversing the entry order of independent variables (N = 122)

Variable	*SEB*	β	R^2	Adjusted R^2	ΔR^2
Step 1			.658	.652	.658
Primary Phonological Awareness Composite	.073	.523***			
Alternate Phonological Awareness Composite	.076	.348***			
Step 2			.797	.791	.139
Primary Phonological Awareness Composite	.061	.270**			
Alternate Phonological Awareness Composite	.061	.176**			
Word-specific orthographic knowledge	.033	.543***			

Note. Word Identification Composite (comprised the standard scores of the Word Identification and Word Attack Subtests)

Word-specific orthographic knowledge (comprised the standard scores of the Spelling Subtest)

Primary Phonological Awareness Composite (comprised the standard scores of the Ellison and Blending Words Subtests).

Alternate Phonological Awareness Composite (comprised the standard scores of the Blending Nonwords and Segmenting Nonwords Subtests).

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

Results indicated that the influence of word-specific orthographic knowledge on word identification was independent of phonological awareness. The two Phonological Awareness Composites collectively accounted for 65.8% of the variance in Word Identification Composite when they were entered at Step 1 ($R^2 = .66$, $F(2, 119) = 114.44$, $p < .001$). When word-specific orthographic knowledge was introduced at Step 2, it could explain an additional 13.9 % of the variance. In addition, the increase was found to be statistically significant ($R^2 = .80$, $F(3, 118) = 1543.95$, $p < .001$). Thus, performance on the Spelling Subtest was able to contribute uniquely to real word reading after phonological awareness had been taken into account.

To sum up, while phonological awareness and word-specific orthographic knowledge explained a considerable amount of shared variance in word identification, they also made a unique contribution distinct from one another. The first regression showed that phonological awareness only explained 8.1% of the variance in word identification, over and above the 71.5% explained by word-specific orthographic knowledge. The second regression showed that word-specific orthographic knowledge explained 13.9% of the variance in word identification, over and above the 65.8% explained by phonological awareness. Examination of the standardized beta coefficients further affirmed that word-specific orthographic knowledge could make a stronger unique contribution to word identification than phonological awareness.

Research Question 3

What are the relative contributions of phonological awareness and word-specific orthographic knowledge to reading comprehension in seventh-grade Chinese EFL students?

Another major concern of this study was to investigate the relative contributions of

phonological awareness and word-specific orthographic knowledge to reading comprehension in the Chinese EFL sample. Similarly, a stepwise regression was first conducted to identify the minimum set of independent variables needed to significantly explain the variance in reading comprehension. Results showed that Alternate Phonological Awareness Composite did not attain a statistically significant level ($p > .05$) and therefore, it was eliminated from the final equation.

Again, prior to running hierarchical regression analyses, the intercorrelations of the final two selected independent variables (i.e. word-specific orthographic knowledge, Primary Phonological Awareness Composite) and the dependent variable (i.e. reading comprehension) were examined. Table 16 is the correlation matrix.

Table 16

Intercorrelations for word-specific orthographic knowledge, Primary Phonological Awareness Composite and reading comprehension ($N = 122$)

Variable	1	2	3
1. Word-specific orthographic knowledge			
2. Primary Phonological Awareness Composite	.67		
3. Reading comprehension	.78	.64	

Note. All correlations are significant at the $p < .01$ level.

As expected, the two independent variables (i.e. word-specific orthographic knowledge and Primary Phonological Awareness Composite) were interrelated. Their moderate correlation ($r = .67$) suggested that they conveyed overlapping information. Also,

the influence of one variable might not be easily separated from that of the other. At the same time, reading comprehension correlated more strongly with word-specific orthographic knowledge (r = .78) than the Primary Phonological Awareness Composite (r = .64.)

To determine which of the two independent variables accounted for a larger amount of variance in reading comprehension, separate hierarchical regression analyses were performed. In the first hierarchical regression analysis, reading comprehension was entered as the dependent variable. Word-specific orthographic knowledge was entered at Step 1, whereas Primary Phonological Awareness Composite was entered at Step 2 (summarized in Table 17).

Table 17

Hierarchical regression analysis with reading comprehension as dependent variable (N = 122)

Variable	*SEB*	β	R^2	Adjusted R^2	ΔR^2
Step 1			.614	.611	.614
Word-specific orthographic knowledge	.040	.784***			
Step 2			.631	.625	.017
Word-specific orthographic knowledge	.055	.658***			
Primary Phonological Awareness Composite	.093	.180*			

Note. Word-specific orthographic knowledge (comprised the standard scores of the Spelling Subtest)

Primary Phonological Awareness Composite (comprised the standard scores of the Ellison and Blending Words Subtests).

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

When entered at Step 1 in the model, word-specific orthographic knowledge had a standardized beta coefficient of β =.78 ($p < .001$). This suggested that word-specific orthographic knowledge related quite strongly to reading comprehension. The standardized beta value remained significant even if it decreased to β = .66 ($p < .001$) when Primary Phonological Awareness Composite was included in the regression model. On the other hand, the standardized beta value of Primary Phonological Awareness Composite was only β = .18. ($p < .05$). Therefore, it could be concluded that word-specific orthographic knowledge far outperformed phonological awareness regarding its influence on reading comprehension.

Results from the hierarchical regression analysis showed that 63.1% of the variance in the reading comprehension scores could be explained jointly by word-specific orthographic knowledge and Primary Phonological Awareness Composite ($R^2 = .63$, $F(2,119) = 101.65$, $p < .001$). Adjusting for the number of independent variables, they jointly explained 62.5% of the variance.

Word-specific orthographic knowledge alone accounted for most of the variance (61.4%) in the reading comprehension scores when entered at Step 1 ($R^2 = .61$, $F(1, 120) = 190.87$, $p < .001$). Performance on the phonological awareness measures could only increase R^2 by 1.7% ($R^2 = .63$, $F(2,119) = 101.65$, $p < .001$). Even though the phonological awareness variable still provided significant incremental validity, it represented only a small multivariate effect size.

Similarly, another hierarchical analysis was carried out, reversing the order of the variables entered into the model. The dependent variable remained to be reading comprehension. However, Primary Phonological Awareness Composite was entered at Step

1, whereas word-specific orthographic knowledge was entered at Step 2. This procedure helped determine whether word-specific orthographic knowledge contributed variance to reading comprehension that was not already explained by phonological awareness. Table 18 presents the hierarchical regression analysis reversing the entry order.

Table 18

Hierarchical regression analysis with reading comprehension as dependent variable (N = 122)

Variable	*SEB*	β	R^2	Adjusted R^2	ΔR^2
Step 1			.406	.401	.406
Primary Phonological Awareness Composite	.085	.638***			
Step 2			.631	.625	.224
Primary Phonological Awareness Composite	.093	.180*			
Word-specific orthographic knowledge	.055	.658***			

Note. Word-specific orthographic knowledge (comprised the standard scores of the Spelling Subtest)
Primary Phonological Awareness Composite (comprised the standard scores of the Ellison and Blending Words Subtests).
* $p < .05$. *** $p < .001$.

Results indicated that the influence of word-specific orthographic knowledge was independent of phonological awareness. Primary Phonological Awareness Composite accounted for 40.6% of the variance in reading comprehension when entered at Step 1 (R^2 = .41, $F(1, 120) = 82.67$, $p < .001$). Word-specific orthographic knowledge could significantly explain 22.5% of the variance when entered at Step 2, over and above phonological awareness (R^2 = .63, $F(2,119) = 101.65$, $p < .001$). Thus, performance on the Spelling Subtest

was able to uniquely explain the variance in reading comprehension after phonological awareness had been taken into account.

In summary, it was noticed that word-specific orthographic knowledge and phonological awareness explained a considerable amount of shared variance in reading comprehension. Although the effect of word-specific orthographic knowledge on reading comprehension was mediated by phonological awareness, it still made a unique contribution at a statistically significant level. Based on the second regression, word-specific orthographic knowledge explained 22.4% of the variance in reading comprehension, over and above the 40.6% explained by phonological awareness. On the contrary, the unique contribution of phonological awareness was limited. It only explained 1.7% of the variance in reading comprehension, over and above the 61.4% explained by word-specific orthographic knowledge. Examination of the standardized beta coefficients further affirmed that word-specific orthographic knowledge was the most important independent variable ($\beta = .65$, $p < .001$), which explained unique variance in reading comprehension.

CHAPTER FIVE

DISCUSSION

Considerable reading research on English native speakers has been conducted to examine the interplay between phonological awareness and orthographic knowledge in word identification (Gayan & Olson, 2001; Parilla et al., 2004). Another major area of reading research is investigating the roles of word identification, along with others variables, in reading comprehension (Perfetti, 1985; Zinar 2002). Few studies, however, focus on these four skills specifically, and even fewer research efforts have been devoted to disentangling their various interrelationships in ESL and EFL student populations.

To fill in this gap in knowledge, this study examined the relative contributions of phonological awareness and word-specific orthographic knowledge to the reading outcomes of 122 Chinese EFL seventh graders in Hong Kong. It was believed that using only word identification as a measure of reading outcome falls short of providing full insight into one's reading proficiency because reading success goes beyond the word level (Schatschneider et al., 2004). Therefore, in addition to exploring the influences of phonological awareness and word-specific orthographic knowledge on word identification, reading comprehension was included in this study's investigation. Hierarchical regression analyses were used to examine how the variance in word identification and reading comprehension can be explained by various tasks measuring phonological awareness and word-specific orthographic knowledge. Using both word identification and reading comprehension as endpoints could provide more complete information about how this particular linguistic group developed English literacy.

Correlational Analyses

One major finding of this study was that the two fundamental linguistic skills—namely, phonological awareness and word-specific orthographic knowledge—are closely related to the participants' performance on tasks that assess word identification efficiency and reading comprehension ability. The participants who performed best in terms of reading comprehension also displayed (a) effective identification of isolated real words and nonsense words, (b) adeptness in distinguishing correct word spellings from their homophone foils, and (c) sensitivity to the sound structures of spoken words.

The results of the correlational analyses showed that phonological awareness is positively associated with word identification and, to a lesser degree, with reading comprehension. This indicates that the better the participants detected and manipulated English speech sounds, the better they performed in reading aloud real words, deciphering the pronunciations of nonsense words, and extracting information from written materials. These findings support the longstanding notion that phonological skills and reading proficiency are closely related (Castles & Coltheart, 2004). They are also in line with the argument that strengthening students' sensitivity to the sound structure of spoken English is a critical step to improving their reading achievement, no matter whether they are native English speakers, ESL learners, or EFL students (Keung & Ho, 2009; Rack, Hulme, & Snowling, 1993; Torgesen et al., 1999).

The correlational analyses also asserted that word-specific orthographic knowledge is another important factor associated with the growth of word identification and reading comprehension. As exemplified by the sample of this study, greater mastery of the multiple-choice spelling task and of the orthographic choice task correlates with better reading

outcomes. In fact, the close relationship between word-specific orthographic knowledge and word identification has been well documented (Roman et al., 2009). Having a solid foundation in orthographic knowledge is usually accompanied by automaticity in word identification, which in turn saves cognitive resources for higher level comprehension processes.

In addition, word-specific orthographic knowledge, when compared against phonological awareness, demonstrated stronger correlations with both word identification and reading comprehension in the EFL seventh graders with Chinese as L1. As orthographic knowledge was confirmed to be more closely associated with all reading outcomes of interest, it provided initial evidence to support the proposition that priority should be given to enhance the participants' word-specific spelling. While building the skills to distinguish and to articulate English speech sounds might have a very positive effect on reading achievement, developing rich orthographic knowledge seems to be of greater importance, as it can potentially yield better reading outcomes.

Hierarchical Regression Analyses

The pivotal role of word-specific orthographic knowledge among the Chinese EFL participants was further affirmed by the hierarchical regression analyses. A major finding of this study was that word-specific orthographic knowledge explains a larger amount of variance in word identification.

Collectively, phonological awareness and word-specific orthographic knowledge explained a substantial portion (79.7%) of the variance in word identification, as indicated by real word reading and nonsense word reading. Each of the independent variables also provided significant unique contributions. Comparatively speaking, word-specific

orthographic knowledge has a greater relative contribution to word identification than phonological awareness. It explained 13.9% of the variance, over and above that already accounted for by phonological awareness. On the other hand, phonological awareness could only explain 8.1% of the variance after controlling for word-specific orthographic knowledge.

In other words, the seventh-grade grade EFL participants in this study were less likely to use sound information for word reading. Instead, they were more attentive to visual representations and formal features that assist identification, which is a recurring finding in research on students with a non-alphabetic L1 background (Wang & Koda, 2005; Wang et al., 2003). More specifically, our data are consistent with those obtained by Leong et al. (2005a; 2005b), who indicated that older Hong Kong students relied more heavily on orthographic cues when reading and spelling words. This finding may seem intriguing, when considering that English is an alphabetic language and that English words are composed of letters representing sounds. Given the phonemic basis of English word construction, a widely accepted postulation holds that the application of grapheme-phoneme correspondences is the fundamental approach to analyzing words, especially those that are unfamiliar to readers. However, this apparently logical assumption is not always affirmed, as exemplified by the Hong Kong participants in this study.

Perhaps the most interesting finding of this study rests in the more imbalanced contributions of phonological awareness and word-specific orthographic knowledge to reading comprehension. Results showed that these two fundamental skills jointly explain 63.1% of the variance in reading comprehension. However, word-specific orthographic knowledge alone accounts for 22.4% of the variance, over and above that explained by

phonological awareness. On the contrary, the unique contribution of phonological awareness was limited; it only explained an addition 1.7% of the variance, after controlling for word-specific orthographic knowledge. Two conclusions could be drawn from this. First of all, word-specific orthographic knowledge is a skill independent of phonological awareness, as evidenced by its unique contribution to reading comprehension. Second, Hong Kong students tend to focus more on the visual structure of words than on the sound properties when reading for comprehension.

It is important to note that these findings do not necessarily deny the importance of phonological awareness as a determining factor of successful reading comprehension, especially because phonological awareness and word-specific orthographic knowledge are closely correlated. They do, however, indicate that word-specific orthographic knowledge is a much more important variable influencing reading comprehension success—at least in this specific linguistic group.

It is true that a precursor skill such as phonological awareness might be insufficient to account for the complex mechanism underlying reading comprehension. Yet the marked weakness of this study's Chinese EFL participants in distinguishing English phonological properties probably made them use word-specific orthographic knowledge as a compensatory method to understand English passages. Coherent with the dual-route frameworks, their detour to the lexical route (orthographic) could possibly be a consequence of an underdeveloped non-lexical (phonological) route.

Reasons for Greater Attention to Visual Features of Words

Taken together, the findings of this study confirm the hypothesis that the Hong Kong participants with Chinese as L1 have greater reliance on word-specific orthographic

knowledge than on phonological awareness when identifying words in print and comprehending connected text. There are several reasons why Hong Kong students in general have greater mastery of orthographic knowledge, and why they tend to rely more significantly on the direct visual route when reading isolated words and understanding related text.

First of all, limited exposure to oral English is one plausible reason for these seventh graders' heavy dependence on word-specific orthographic knowledge to facilitate English learning. According to Gough and Tunmer's (1986) *Simple View of Reading*, comprehension is the joint result of word-level decoding skills and listening comprehension skills (R = D x C). Central to this theory is the belief that comprehension emerges when one can (1) translate words in print into their constituent sounds and (2) understand the words when they are presented orally. A deficit in either one of these skills will adversely affect reading comprehension performance.

Although this popular model of reading has been criticized for being too simple for a complex process, it does highlight some challenges confronted by EFL students in Hong Kong. First of all, Hong Kong students' ability to decode words phonologically could be compromised due to their insufficient exposure to English sounds. Furthermore, their listening comprehension will also be impaired because they lack the opportunity to interact with native English speakers. Eventually, lack of decoding skills and listening comprehension skills will be translated into delayed literacy development (Gebhard, 1996; Redfield, 1999).

Furthermore, the transfer of reading skills from L1 to L2 could explain Hong Kong students' persistent use of the whole-word approach to process English written information.

Chinese is the L1 of Hong Kong students, and this writing system emphasizes the importance of sight word reading. Unlike English, which is an alphabetic language, Chinese is a logographic language, with each character representing only one monosyllabic morpheme (DeFrancis, 1989; Mattingly, 1992; Perfetti & Zhang, 1995). Non-segmental in nature, Chinese is not open to decoding, and phonological assembly is of little use for identification purposes. In contrast, identifying characters from memory by sight emerges as a more effective approach to improving reading outcomes. Therefore, Hong Kong students are trained to map each symbol (as a whole unit) directly onto its pronunciation and meaning based on rote memorization (Wang & Geva, 2003). Such L1 literacy experience has been found to confine the ways in which these students learn English (McDowell & Lorch, 2008).

Evidence supporting this cross-linguistic influence comes from comparative studies showing that students with a logographic L1 background tend to pay more attention to orthographic information than their alphabetic counterparts for English word identification (Koda, 2000). Even when reading for meaning in English, the students also show an inclination to draw upon graphic information and requisite visual skills to complete the tasks (Perfetti, Liu, & Tan, 2002; Wang et al., 2003). These findings, considered together, explain the continued underachievement of Hong Kong students in English sound manipulation, which greatly involves phonological decoding (Holm & Dodd, 1996; McDowell & Lorch, 2008). Results from this study also corroborate the recurring finding that students with a non-alphabetic L1 background are more attentive to visual representations.

The teaching practices in Hong Kong also account for the impaired phonological awareness of its local students (Leong et al., 2005a; 2005b). In Hong Kong, drilling remains a prevalent pedagogical strategy in classrooms despite recent reforms to the education

system. During English lessons, most students are taught to read by rote, memorizing the spelling, meaning and pronunciation of each word. In addition, the primary focus of the curriculum is on syntactic and semantic development, at the expense of phonology. The participants in this study were no exception, and they only received preliminary training in phonics skills. Those from the English medium school might have received more exposure to L2 input, but nonetheless, they were not introduced to systematic decoding strategies to aid pronunciation.

Educational Implications

This study's results bear important implications for education policy and classroom practice. To devise reading instruction that best accommodates the specific needs of Chinese EFL students, it is imperative to first understand how this specific group identifies English language at the word level, which is critical to efficient comprehension of written text in subsequent stages. In this study, Chinese EFL participants were found to demonstrate a much higher level of word-specific orthographic knowledge than phonological awareness (Wade–Woolley & Siegel, 1997). In addition, word-specific orthographic knowledge even surpassed phonological awareness to explain greater variance in word identification and reading comprehension. As stated previously, all these observations can be attributed to the L1 literacy experience of the Hong Kong participants. Moreover, the local schools' emphasis on the whole-word approach to teaching English further fosters the students' sight word reading skills at the expense of phonological analyses (McBride-Chang et al., 2004).

In view of the fact that the participants' strength was in orthographic processing instead of decoding, it would be of vital importance to capitalize on this strength and to optimize their English reading development. Therefore, a concerted effort is recommended to

help EFL students—especially those with a logographic L1 background—establish precise orthographic representations in the mental lexicon, as advocated by Perfetti (1997). The reason for developing automaticity in visual word identification is obvious; it would reserve more cognitive capacity to handle increasingly complex processing in reading, such as extracting information from the text and making inferences (Coltheart et al., 2001; Taguchi, Takayasu-Maass, & Gorsuch, 2004).

Attention should be paid to the fact that most word identification tasks focus primarily on articulation accuracy, and the demonstration of semantic knowledge is not a concern. However, the ultimate purpose of reading is more than simply pronouncing words with accuracy (Scholes, 1998). Of greater importance is understanding the information presented visually and making sense of connected text (Goodman, 2006). When the goal of reading is comprehension, being able to retrieve word meaning in a rapid and automatic manner is critical. Although retrieving semantic information through decoding is possible, it is often criticized for being an exhaustive procedure. In addition, reading comprehension resting in letter-by-letter decoding is counterproductive because cognitive resources are divided between assembling pronunciations for individual words and deriving meaning from the text (Ehri, 2005; National Reading Panel, 2000).

Comparatively, mastery of orthographic knowledge seems to provide a better alternative to accelerate the processing of written information. With a good command of word-specific orthographic knowledge, one can readily identify the letter strings characterizing individual printed words. Such familiarity with the words' visual and formalistic features also allows for a direct mapping from orthography to semantics without a detour to the phonological route. The ability to make instant connections between form and

meaning without significant reliance on sound information is especially important to EFL learners, who are generally weak in phonological awareness.

On the other hand, the importance of phonological awareness in literacy development should not be underestimated. The present study showed that phonological awareness is strongly positively associated with word-specific orthographic knowledge, which is in turn a robust predictor of word identification and reading comprehension. Despite the correlation between phonological awareness and word-specific orthographic knowledge, the direction of the causal relationship is yet to be determined. Hence, several issues should be considered before determining whether and to what extent phonological awareness should be incorporated as a core component into the EFL reading curriculum.

First of all, it is necessary to determine whether the development of profound word-specific orthographic knowledge is contingent upon phonological awareness. If improved phonological awareness does not bring about substantial growth in word-specific orthographic knowledge, then focusing instruction on strategies to analyze and to manipulate speech sounds is not justified. On the contrary, if deficits in phonological awareness severely impede orthographic learning, then intervention should be in place to foster this precursor skill, without which subsequent reading development would be hindered.

Once the causal relationship is affirmed, the next logical step is to examine how refined phonological awareness is needed for Chinese EFL students to continue to advance their reading skills. Even though phonological awareness is important, there is still a debate regarding which level of phonological awareness one should process in order to optimize literacy development.

As shown in the study by Scarborough et al. (1998), a surprisingly large number of normally-achieving adolescents and well-educated adults managed to become proficient readers without having a solid knowledge of how speech is structured at the phonemic level. In the study, the adolescent participants (eighth graders) showed substantial variability in their accuracy on a number of phonemic awareness tasks. Interestingly, although these participants had strong past and present reading skills, many of them exhibited great difficulty in segmenting speech into phonemes. On the other hand, the adult participants (undergraduates in teacher education) generally did not display a high level of competence in phonemic segmentation either.

One of the most important conclusions by the authors was that some people might not need to have phonemic-level segmentation skills in order to be good readers. Their study featured a group of participants who had never known how to convert a grapheme into its corresponding phoneme. Still, this did not impede the participants from pursuing higher levels of education, suggesting that one might not need to grasp the notion of phonemes in order to be successful in reading acquisition. Therefore, before providing intensive and extensive phonological awareness training to Hong Kong students, further research is warranted to verify whether advanced skills in analyzing spoken words at the phoneme level is necessary, or whether learning to segment words into larger sound units (e.g., syllables) is already sufficient.

Another related concern is the efficacy of implementing phonological awareness instruction or intervention in EFL settings, where environmental support for the acquisition of English sounds is suboptimal. In Hong Kong, Cantonese is the primary spoken language of the residents, and such a monolingual environment is detrimental to English learning.

Although English is perceived to be more superior, the prevalence of Cantonese in the city leaves little room for the international language to function with wide applications in local communities. Limited exposure to spoken English on a daily basis is a common problem confronted by most students learning EFL (Redfield, 1999). One major disadvantage is that it reduces one's opportunity to interact with verbal stimuli, leading to a weak foundation in English oral language skills. An accompanying negative result is deficiencies in phonological awareness, as exemplified by the Hong Kong participants in this study.

Given that the monolingual speaking environment does not lend support to the acquisition of English speech sounds, schools are usually burdened with the main, if not sole, responsibility to improve EFL students' sensitivity to the sound structure of the foreign language. However, what is learned in school is not reinforced beyond classroom contexts, hindering EFL students' efforts to develop a solid level of phonological awareness necessary for optimal alphabetic decoding. Substantial efforts, therefore, may be needed to make only small advances in their phonological skills. If this is indeed the case, such minimal gains may not justify the investment of time, effort and resources involved in providing intervention, especially when resources available to educational endeavors are usually limited.

Future Studies

This study was conducted in the midst of a swine flu epidemic, and test administration was interrupted because an early summer break was recommended to impede the spread of the virus. The administration of six subtests to 48 participants was postponed for three months. Although the results of *t*-tests and the examination of effect sizes did not reveal any impact of this delay on student performance, repeating the study using a larger representative sample is recommended.

The results of correlational analyses and hierarchical regression analyses confirm the importance of word-specific orthographic knowledge in word identification and reading comprehension. This finding is interpreted as promoting reading instruction geared at consolidating spelling skills, especially to EFL students with a logographic L1 background in Hong Kong. However, questions remain as to whether and how much valuable class time should be devoted to improving phonological awareness, a domain with which Chinese students in Hong Kong continue to struggle (Holm & Dodd, 1996; McDowell & Lorch, 2008). Additional experimental research is needed to examine whether these students will gain an advantage in their learning of orthographic knowledge after phonological awareness intervention. It is also important to investigate whether they will outperform those receiving only intensive spelling training on various word identification tests and reading comprehension tests.

Another concern is that the present study only focuses on one EFL student group: Cantonese-speaking seventh graders with Chinese as L1 in Hong Kong. The generalizability of the results may be of concern. The study would provide a better understanding of the dynamics involved in EFL reading if other student populations (e.g., Chinese students speaking Mandarin, Korean, Japanese, etc.) were included. Comparing students with diverse linguistic backgrounds will shed more light on how different L1 writing systems impact their English literacy acquisition.

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APPENDIX A

HUMAN SUBJECTS APPROVAL

UNIVERSITY of HOUSTON

COMMITTEES FOR THE PROTECTION OF HUMAN SUBJECTS

June 8, 2009

Ms. Lee M. Kar
c/o Dr. Lilia M. Ruban
Curriculum and Instruction

Dear Ms. Kar:

The University of Houston Committee for the Protection of Human Subjects (COM1) reviewed your research proposal entitled "Relative Contributions of Phonological Awareness and Orthographic Knowledge to Hong Kong Students' Word Identification and Reading Comprehension" on June 5, 2009, according to institutional guidelines.

The Committee has given your project unconditional approval; however, reapplication will be required:

1. Annually
2. Prior to any change in the approved protocol.
3. Upon development of unexpected problems or unusual complications

Thus, if you will still be collecting data on this project on **May 1, 2010**, you must reapply to this Committee for approval before this date if you wish to prevent an interruption of your data collection procedures.

If you have any questions, please contact Alicia Vargas at (713) 743-9215.

Sincerely yours,

Christy Nesmith for

Dr. Ekere J. Essien, Ph.D,
Committee for the Protection of Human Subjects (COM1)

PLEASE NOTE: (1) All subjects must receive a copy of the informed consent document. If you are using a consent document that requires subject signatures, remember that signed copies must be retained for a minimum of 3 years, or 5 years for externally supported projects. Signed consents from student projects will be retained by the faculty sponsor. Faculty are responsible for retaining signed consents for their own projects; however, if the faculty leaves the university, access must be possible for UH in the event of an agency audit. (2) Research investigators will promptly report to the IRB any injuries or other unanticipated problems involving risks to subjects and others.

Protocol Number: 09279-01 Full Review_____ Expedited Review __X__

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