

**CROSS-LANGUAGE TRANSFER OF READING ABILITY: EVIDENCE FROM
TAIWANESE NINTH-GRADE ADOLESCENTS**

A Dissertation

by

HUI-KAI CHUANG

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2010

Major Subject: Curriculum and Instruction

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ABSTRACT

Cross-Language Transfer of Reading Ability: Evidence from Taiwanese
Ninth-Grade Adolescents. (May 2010)

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The influence of reading ability on cross-language transfer in Mandarin-speaking ninth graders was explored. Each participant's native language (L1-Mandarin Chinese) and second language (L2-English) were assessed. Although the relationship between L1 and L2 reading ability has been discussed in many previous studies, few studies have examined this relationship among L2 readers whose L1 is sharply different from their L2, who are at the junior-high-school age range, and who are learning English in a setting where English is not used in daily communication (e.g., English as a foreign language).

To investigate the role of L1 reading competence in the language reading ability transfer, a reformed public examination, called the Basic Competency Test (BCT), was applied in this study. The 30,000 Taiwanese ninth grade participants, randomly selected from the pool of the national examination involved in a consecutive six-year period, were considered as a whole and then disaggregated into six groups based on the year they took the BCT.

A preliminary analysis was about reliability coefficients of twelve examinations (six in Mandarin Chinese reading, and six in English reading) used in the present study. Scores from both Mandarin Chinese and English reading comprehension tests were subjected to descriptive, correlational, and regression analyses.

Both correlation and regression analyses revealed congruent results that provided support for the positive influence of Mandarin Chinese reading competence on English reading ability, that is, L2 reading ability is dependent on L1 reading competence. The finding supported the Linguistic Interdependence Hypothesis. In addition, participants' gender and school district also played statistically significant roles to affect the cross-language transfer of reading ability, whereas the length of time in English exposure had no statistically significant effect on the language reading ability transfer. Thus, cross-language transfer in reading ability was influenced by learners' L1 reading competence, gender, and school district.

This suggested educational policy makers in Taiwan that boost native-Chinese speaking students' Mandarin knowledge help support the development of English reading ability. Apparently, if students' L1 reading abilities can be built up more soundly, their L2 reading ability should be easier to acquire.

DEDICATION

To my Grandma, Dr. Su-Mei Chiu, a respectable and brave woman.

Thank you for all of your love, encouragement, and foresight.

You fostered a love for education inside me.

Words cannot express how much your gift means to my life.

ACKNOWLEDGEMENTS

There are a number of people to whom I am grateful. I especially express my sincere gratitude to my co-chairs, Dr. R. Malatesha Joshi and Dr. Laurie Q. Dixon, for their endless support, mentorship, and insightful suggestions throughout this research. Their guidance was invaluable throughout the program. I believe that I would not have been able to achieve the completion of this work without their assistance and patience. Thanks also go to the other members of my advisory committee, Dr. Janet Hammer and Dr. Lauren Cifuentes, for their guidance and comments during this study. Words cannot express the appreciation I have for all of you. I will be forever grateful.

A special thank you is also extended to my friends, Michelle Chen and Dr. Ker-Sang Chen, who have been conscientious and supportive in helping me to better articulate thoughts throughout the research. They devoted their time and effort in reading and editing my writing.

Finally, to my father, Wen-Shiung Chuang, my mother, Yu-Mei Chen, sister, Dr. Hui-Lun Chuang, brother-in-law, Dr. Po-Yaur Hsu, and little nephew, Yuan-Xi Hsu, I express sincere appreciation for their consistent faith in me and emotional support from beginning to end.

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CHAPTER I

INTRODUCTION

Learning a second language (L2) can be a difficult task for learners in diverse ways (Abadzi, 1996; Ellis, 2006; Myburgh, Poggenpoel, & Van Rensburg, 2004). Each language contains its own system of rules for how sounds may be combined into meaningful speech patterns. Meaningful patterns of word order may vary across different languages and learning the different patterns can be a challenge. The standard word order in English, for instance, is Subject-Verb-Object (S-V-O) while it may be S-O-V or some other pattern in another language (e.g., both SOV and OSV are valid orders frequently used in Mandarin Chinese). The word order regulations are often troublesome for students learning to grasp a second language. If L2 learners are to avoid mistakes when producing the second language (either speaking or writing) they need to be aware that rule systems are not the same for all languages.

One of the major differences between teenagers or adults learning a second/foreign language and children learning their first language (L1) is that the former has a fully developed language system before they start to learn a second language and teenagers or adults can use more conscious mental processing than the intuitive processing of a child (Krashen, 1977; Krashen, Long, & Scarcella, 1979; Muñoz, 2006a, 2006b, 2008). Thus, one of the important issues concerning second language learning is whether or not and also how learners' native language may have an impact on their acquisition of

The dissertation follows the style of *Reading Research Quarterly*.

subsequent ones. For the past few decades, research in second language acquisition has examined the influence of L1 on L2 and many of the experimental results have suggested that L1 does play a significant role in L2 learning and processing (Chan, 2004; Cobo-Lewis, Eilers, Pearson, & Umbel, 2002; Dufva & Voeten, 1999; Dulay & Burt, 1974; Dulay, Burt, & Krashen, 1982; Keung & Ho, 2009; Sparks, Patton, Ganschow, & Humbach, 2009; Sparks, Patton, Ganschow, Humbach, & Javorsky, 2008; Wang, Perfetti, & Liu, 2005). Academic development in the first language has been found to generate positive effects on second language learning (Bialystok, 1991; Collier, 1992; Sparks et al., 2009; Sparks et al., 2008). Academic skills, literacy development, concept formation, subject knowledge, and strategy development learned in L1 transfer to L2. In contrast to the positive effects of language transfer, some studies have shown the negative influence of L1 on L2 in some way (Jing, 2008; Koya, 2003; van Weijen, van den Bergh, Rijlaarsdam, & Sanders, 2009).

Research showed that the relationship between L1 proficiency and L2 reading have certain linguistic elements that strongly affect the transfer of L1 reading ability to L2 reading (Figueredo, 2006; Lee & Schallert, 1997; Perkins, Brutton, & Pohlmann, 1989; Yamashita, 2001; 2004). There is a widely known hypothesis concerning the relationship between L1 and L2 reading abilities: the linguistic interdependence hypothesis (Bernhardt & Kamil, 1995; Cummins, 1979, 1980, 1981; Yamashita, 2007). The linguistic interdependence hypothesis refers to transferring from L1 to L2; certain L1 knowledge can be positively transferred during the process of L2 acquisition. It assumes that there is a common underlying cognitive ability between L1 and L2; that is, two

languages which overlap and share a common operating system and both languages are distinct but are supported by shared concepts and knowledge derived from learning, experience, cognitive and language abilities of learners. If a learner has an initial high level of L1 development, a similar level of competence is possible in L2.

Chuang, Joshi, and Quiroz (2009) found that L1-Chinese students in Taiwan who received more formal L2-English instruction along with more exposure to English were able to achieve a higher performance on English reading tests. The finding does not follow the linguistic interdependence hypothesis that transfers L1 reading to L2 reading. Instead, more L2 exposure the learners had, the higher L2 proficiency they acquired. Even if students had a certain level of L1 knowledge, they still needed to have more holistic instruction in L2 learning in order to achieve higher skill levels. In general, the finding supports that a certain level of L2 facilitates development of academic knowledge in L2 faster with less effort.

Background

Increasingly, English has been considered an “international” (McKay, 2002; Smith, 1976) or a “global” language (Crystal, 2003). As stated in Crystal, over 70 countries around the world teach English as a special class, where English is a required foreign language (e.g., English as a Foreign Language – EFL). More than 85 percent of international organizations around the world require English as the official language of use, and numerous academic publications are written in English (e.g., Krashen, 2003). This language is widely used as a medium of scientific and technological information

(Crystal, 2000; Hu, 2007) and is the main language prominent in business, education, world news, international communication (e.g., airline pilots), sports, and entertainment (Crystal, 2000; Su, 2006). The number of worldwide English language learners has been increasing. Taiwan, like many other Asian countries, is currently in a transitioning period in teaching and learning English and trying to catch up with the “English fever” trend (Chang, 2008; Krashen, 2003). In this section, two problems will be addressed: (a) the Educational context for learning English in Taiwan and (b) the differences between Chinese and English orthographic systems.

English Learning Context

Taiwan, formerly called Formosa (which means “the beautiful island”), a name coined by the Portuguese who visited the island in 1590, is located in the Pacific Ocean off the southeast coast of China, separated by the Taiwan Strait. During the era of Japanese occupation (1895-1945), the Japanese language was mandated as both the official and national language in Taiwan. After World War II, the official language of Taiwan changed to Traditional Mandarin Chinese. The reason for changing the official language back to Mandarin Chinese was to replace Japanese as the educational language (Oladejo, 2006; Tsao, 1999; Young, 1987) and to create a medium to communicate between its diverse ethno-linguistic groups. Nowadays, all children are taught Mandarin Chinese at school but this is not necessarily the language spoken at home with family. For example, around 70% and 15% of the population fluently speaks two dialects, Taiwanese and Hakka respectively (Huang, 1991; Oladejo, 2006; Tsao, 1999). In other

words, Mandarin Chinese is a significant medium of instruction in all-level educational systems and plays a decisive role in students' scholastic achievement.

In contrast to English as a second language (ESL) settings where English is served as a primary language for academic instruction and is used for everyday communication, English in Taiwan is taught as a foreign language (e.g., EFL), in which English is a class subject in schools rather than a daily communication medium among students. In Taiwan, the significance of English has been acknowledged since 1945 due to the "language-in-education policy" (Tsao, 1999), in which English was taught as a mandated subject from junior high school onward (Chang, 2008; Taga, 1976; Tsao, 1999). Over the past six decades, the EFL subject was not introduced until junior high school. Students were required to study English for 6-7 years (3 years in junior high school, 3 years in senior high school and 1 optional year of Freshman English in college). Acceptable entrance exam scores in the English section was one of the major prerequisites to be admitted to senior high school, college, and graduate school. Even though English learning was optional in college-level education, it was included in the entrance examination for all levels. During that period (1945-2000), English was taught as a subject rather than as a communicative tool and English teaching primarily focused on forms (e.g., Grammar Translation Method – GTM; Brown, 2001) and on reading and less on its practical use as a spoken language. Taiwanese EFL students often emphasized their study more on basic components of English texts instead of comprehensive meaning of the texts.

In response to globalization and the need to provide equal opportunities for students to receive quality English education and to raise non-native English speaking students' communicative competence in English, various Asian countries, such as Taiwan, Korea, and Japan, have introduced a number of substantial changes in their English language educational policies (Butler, 2004). The Ministry of Education (MOE) of Taiwan officially enacted a new educational policy in 2001 - the so-called 9-year curriculum educational reform - of learning EFL in Taiwan elementary schools. Chang, Wu, and Ku (2005) stated that the new policy focuses not only on the curriculum content but also on instructional form and assessments. Chang (2008) stated that the English educational reform is about changes in teaching methods and materials and the grade level at which English starts being officially taught. In order to improve students' oral skills in English, Communicative Language Teaching (CLT) has been introduced into the EFL context. English teachers have started paying more attention to oral skills than to focus-on-form. The new educational policy has affected the style of English education from grade 5 starting in the 2001 school year and starting in 3rd grade in the 2005 academic year.

The emphasis of the previous English education policy was on developing reading and writing skills for academic purposes while the current educational reform assesses the importance of communicative competence by adding oral and listening skills to the original focus of reading and writing skills. The goals in the new English education policy of junior high school in Taiwan is to develop students' abilities to independently deal with and then solve comprehension problems when reading English texts (Ministry

of Education of Taiwan, 2000b). Furthermore, MOE in Taiwan reformed an entrance examination, the Basic Competency Test (BCT), to replace the previous Secondary School Joint Entrance Examination, in order to meet the new curriculum objectives when the new educational policy was issued.

Orthographic Systems

The Chinese and English languages have substantially distinct orthographic features that differ from each other in many ways (McBride-Chang, Cheung, Chow, Chow, & Choi, 2006). Unlike the English phonetic script (Keung & Ho, 2009), Chinese is expressed as morphosyllabic units (Cheung, McBride-Chang, & Chow, 2006; DeFrancis, 1989; Keung & Ho, 2009; Law, Wong, & Kong, 2006; Leong & Joshi, 1997; Leong, Tan, Cheng, & Hau, 2005; McCarthy, 1995; Wang, Yang, & Chen, 2009), in which a small percentage (approximately 10%) of written characters are pictographic, logographic or ideographic (Aro, 2006; Ho, 2003), whereas the majority of Chinese characters are compound words consisting of phonetic radicals and semantic radicals which play important roles to represent word meaning (Chen, 1992; Chen & Weekes, 2004; Cheung et al., 2006; Ho, 2003; Ho, Ng, & Ng, 2003; Hsiao & Schillcock, 2006). The semantic radicals represent the meaning of words and phonetic radicals express the approximate pronunciation of words. Readers are sometimes able to define or pronounce a character based on the functions of the two elements in Chinese. There are two sets of Chinese character systems widely used among native-Chinese communities: Traditional Chinese is used in Taiwan, Hong Kong, and Macau, while simplified Chinese is widely used in China, Singapore, and Malaysia.

The current study began as an attempt to investigate the literacy background with Taiwanese ninth-graders who learned English as a foreign language and whose L1 (e.g., Mandarin Chinese) was sharply different from their L2 (e.g., English), particularly in morphology, syntax, and writing system: Mandarin Chinese is morphosyllabic, and English is alphabetic. Although the majority of Taiwanese people speak a dialect (e.g., Taiwanese or Hakka) as their home language, Mandarin Chinese is still considered their first language in terms of a language first learned to read and write. The study specifically examined the possible relationships among ninth-grade Taiwanese students' reading achievement in both L1 and L2 by controlling other factors (e.g., gender, school district). This study specifically focused on Taiwanese junior-high-school students because this age range (e.g., 12-13 years old) of students is officially required to start learning English as a foreign language. Thus, due to the sharp difference of orthographic systems in the two languages, they had to learn to adjust their reading processes and strategies across L1 and L2.

Statement of Research Problem

Reading is understanding written information (Snow, 2002), and it is perhaps the most important medium for acquiring skills and knowledge. A reader is severely handicapped by low reading achievement which results in low overall academic achievement. Reading comprehension ability is highly correlated with students' performance in school subjects (Collins, Onwuegbuzie, & Jiao, 2008; Klicpera & Schabmann, 1993; Mayes, Calhoun, Bixler, & Zimmerman, 2009; Savolainen, Ahonen,

Aro, Tolvanen, & Holopainen, 2008; Stanovich, 1986). Reading in L1, in general, shares numerous basic elements with reading in L2 and the processes may also differ greatly for acquisition of language ability. Reading, whether in L1, L2, or an additional language, is a highly complex process because readers need to shift symbols they see to sounds, sounds to words, then words to meaning. Although some reading processes are believed to be universal (Cummins, 1979, 1980, 1981), reading in L2 may require additional demands on the reader due to the proficiency level of L2 language as well as previous literacy experiences and knowledge (Wurr, 2003). Moreover, reading, in either L1 or L2 context, involves the reader, the text, and the interaction between the reader and text to gain comprehension of the information that is portrayed (Brantmeier, 2005).

Various studies have attempted to verify which hypothesis can better explain the relationship between L1 reading and L2 reading proficiency (Cobo-Lewis, Eilers, Pearson, & Umbel, 2002; Cummins, 1991; Durgunoğlu, 2002; Figueredo, 2006; Jiang & Kuehn, 2001; Lee & Schallert, 1997; Lopez & Greenfield, 2004; Luelsdorff, 1986; Taillefer, 1996; Yamashita, 2002a, 2002b, 2002c). Findings from those studies, however, have been inconsistent. Some agree with positive transfer in reading between two languages (Cobo-Lewis, Eilers, Pearson, & Umbel, 2002; Cummins, 1991; Durgunoğlu, 2002; Figueredo, 2006; Jiang & Kuehn, 2001; Lee & Schallert, 1997; Lopez & Greenfield, 2004; Yamashita, 2002a, 2002b), while other studies indicate negative transfer (Figueredo, 2006; Luelsdorff, 1986; Taillefer, 1996). It also can be said that reading in L2 is similar to and different from reading in L1. In addition, different L1 orthography systems will result in different extents of L2 literacy proficiency transferred

from their L1 learning (Wang, Koda, & Perfetti, 2003). Wang et al. (2003), for instance, found that Korean EFL students with their alphabetic L1 literacy background performed more highly overall than Chinese EFL students with non-alphabetic L1 literacy background and made fewer errors in both reading and writing. Although the relationship between L1 and L2 reading processes has been discussed in existing literature, few studies focused on EFL readers at middle-school age whose L1 orthographic system is sharply different from their L2's and in an EFL setting where English is not used in daily life.

As noted earlier, the influence of L1 reading ability on L2 reading has been a primary concern since Cummins' proposals (1979, 1980, 1981, 1991) regarding linguistic interdependence hypothesis. In his theory, all languages are only different in their surface manifestations. They share underlying and common literate knowledge and skills. The interest in the influence of L1 reading on L2 reading can also be noticed in Alderson's (1984) question of whether reading in a foreign language is a reading problem or a language problem. A reading problem refers to a defect to predict, analyze, assume, integrate, and retrieve relevant knowledge across languages (Alderson, 1984; Bernhardt & Kamil, 1995; Yamashita, 2001). On the other hand, a language problem refers to an unskilled defect to process L2 linguistic properties, such as phonology, morphology, syntax, orthography, or vocabulary (Alderson, 1984; Bernhardt & Kamil, 1995; Yamashita, 2001). According to Alderson (1984), the difficulties in L2 reading are influenced by both reading and language problems. He further clarified that it is most

likely a reading problem when learners have higher levels of L2 proficiency, but is a language problem at lower levels of L2 proficiency (Yamashita, 2001).

Many researchers have investigated the reading processes and relationships between L1 and L2 reading when both L1 and L2 orthographies are similar (e.g., Spanish and English) (Cisero & Royer, 1995; Cobo-Lewis, Eilers, Pearson, & Umbel, 2002; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993; Hardin, 2001; Lopez & Greenfield, 2004). They explored how L1 has effects on L2 reading comprehension process, how L1 reading influences L2 reading. The cross reading transfer among alphabetic languages is more reliable, whereas a strong and stable language transfer in reading ability between two greatly different orthographic systems (e.g., Mandarin Chinese and English) is less reliable. In general, Mandarin Chinese is orthographically more complicated than English. Wang, Cheng, and Chen (2006) found that cross language transfer in reading ability took place among primary school aged students who learned English in an ESL setting. Although studies by Haynes and Carr (1990), Wakabayashi (2002), and Yamashita (2002a) the reading ability transfer existed in an EFL setting (e.g., Taiwan and Japan), the subjects were focused on college-level and senior-high school students. There are still a few pieces of evidence that show teenaged English learners' transfer of orthographic skills across languages, and the transfer from orthographic skills to reading comprehension across two languages in EFL countries. Thus, this study examined the influence of adolescents' L1 reading ability on their L2 academic performance and explored the reading achievement of ninth-grade Taiwanese students when reading both

Chinese and English texts on the national standardized examination, Basic Competency Test (BCT).

Purpose of the Study

1. To investigate the relationship between L1 and L2 reading comprehension achievement;
2. To examine whether ninth-grade Taiwanese readers' L1 competence is transferred to their L2 academic reading ability;
3. To research whether students' demographic differences such as gender and school district have any influence on L2 reading ability; and
4. To explore the effects of students' demographic differences on the process of cross-language reading transfer from L1 to L2.
5. To examine whether L2 proficiency had an effect on the transfer of L1 reading to L2 reading.

Research Questions

This study proposes to answer five major research questions:

1. What is the degree of association between L2 reading, L1 reading, gender, and school district?
2. To what extent does L1 language reading competence predict L2 reading ability in academic settings?
3. How do students' gender and school district predict L2 reading ability?

4. To what extent does L1 language competence predict L2 language reading comprehension ability when all other predictor variables are considered?
5. Does time in L2 exposure change the effect of L1 reading competence on L2 reading ability?

Significance and Assumption of the Study

This study examined how ninth-grade Taiwanese readers perform in their reading competence in L1 and L2 reading processes. Another significant feature of the study was to inspect whether cross-language transfer between two different languages for reading to provide evidence to support Cummins' linguistic interdependence hypothesis – Whether L1 reading competence is transferred to L2 reading ability in order to further acquire L2 reading ability. The orthographic systems between Chinese and English, as indicated earlier, are very different: One is morphosyllabic and the other is morphophonemic. If L2 readers attempt to use Chinese orthographic skills as a basis of learning to read English, it may cause interference to their development in English reading (Keung & Ho, 2009). Chinese involves a large number of recurring stroke-patterns where English is visually simple and sequential due to the usage of an alphabet. Although all of participants in this study had a certain level of L2 proficiency (at least three years of formal instruction in English) they still lack comprehensive L2 skills (the holistic combination of reading, writing, listening, and speaking in English) compared to their L1 ability. Due to the reasons indicated above, this study predicted that the transfer of L1 and L2 reading would not have statistically significant correlation. However, if the

finding shows better L1 reading results in better L2 reading, the linguistic interdependence hypothesis is supported, in which if learners' L1 reading skills are well-established, they will be easier to acquire L2 reading ability.

Definition of Terms

The key terms are operationally defined in the following order to establish a consistent and general meaning for the terms throughout this study.

First Language: First language is used to indicate a language first learned to read and write. A dialect (e.g., Taiwanese or Hakka) is not considered the first language to participants in this study.

Second Language: Any language that is learned other than first language which is used for some communicative functions among a certain community. It is called L2, foreign language, or auxiliary language as well.

Linguistic Interdependence Hypothesis: A hypothesis developed by Cummins (1979, 1980, 1981) that certain L1 knowledge can be positively transferred to L2. A child's L1 linguistic knowledge and skills can be a basis for the development of corresponding abilities in L2. Thus, L1 and L2 literacy skills are viewed as interdependent - High levels of L1 competence results in better L2 reading acquisition, and high proficiency in L2 positively affects L1 development.

International/Global Language: As explained by McKay (2002), an international or a global language is a language that "is spoken by a large number of native speakers of other languages" (p. 5). Particularly, it provides a function of wider communication.

English as a Second Language (ESL): English is learned as a second language to learners who live in a society where English is the primary language (Brown, 2001; McKay, 2002). The language is used for daily communicative functions among a majority of the population in the community. For example, in a native-English speaking country, such as the US, UK, Canada, or Australia, the learning of English by non-native learners is called ESL.

English as a Foreign Language (EFL): EFL is defined as English that is learned in a non-English-speaking country, such as Taiwan, Japan, or Korea, where English is not the principal medium for daily communication among the majority of population (Brown, 2001; McKay, 2002). Typically, the use of English only occurs in schools during English class and is not for daily communication outside of class.

Junior High School: A certain period of education that serves as a bridge between elementary school education and senior high school education. Junior high schools in Taiwan refer to Grade Seven, Eight, and Nine with students average aged between 13-15 (Ministry of Education of Taiwan, 2000b, 2008b).

Grammar Translation Method (GTM): It is one of the most traditional language-teaching methods developed from the Classical Method. The role of teacher is authoritarian and students are passive. Brown (2001) stated that the teaching methodology focuses on memorization of vocabulary and grammatical regulations, but little attention is given to pronunciation or conversational speech. In addition, classes are taught in the mother tongue and students have little practice using the target language.

Communicative Language Teaching (CLT): It is a student-centered approach in which the components of communicative competence are emphasized. It teaches students how to use the language for a range of different purposes, functions, and settings, how to produce and understand various types of texts (Brown, 2001). In other words, language learning obtains the most benefits from communication.

Orthography: Aaron, Joshi, and Quatroche (2008) stated that orthography refers to “visual representation of language as influenced by phonology, morphology, and semantics” (p. 303). In alphabetic languages, the orthography of writing systems refers to spelling. Nevertheless, spelling does not exist in Mandarin Chinese orthography because each character in the language represents a syllable. Basically, orthography is a comprehensive term to include both alphabetic and non-alphabetic writing systems.

Morphosyllabic Script: In the written character, each character represents a distinct morpheme and each morpheme is a single syllable (e.g., Mandarin Chinese) (Cheung et al., 2006; DeFrancis, 1989; Keung & Ho, 2009; Law, Wong, & Kong, 2006; Leong & Joshi, 1997; Leong, Tan, Cheng, & Hau, 2005; McCarthy, 1995).

Phonetic Radical: It is a unique feature of Chinese phonetic compounds which represents the pronunciation of the character (Chen, 1992; Chen & Weekes, 2004; Cheung et al., 2006; Ho, Ng, & Ng, 2003; Hsiao & Schillcock, 2006; Wang et al, 2005). For instance, the character for “lake” (湖), “coral” (瑚), “glue” (糊), and “butterfly” (蝴) all share the phonetic radical of “reckless (胡)” which is pronounced as /ɥ ɤ' / (hu2).

Semantic Radical: Semantics refers to the meaning of words. Semantic radicals, another particular compound of most Chinese characters, express a clue to the meaning of the character (Chen, 1992; Chen & Weekes, 2004; Cheung et al., 2006; Ho et al., 2003; Hsiao & Schillcock, 2006). For example, the characters 曦 (sunlight), 明 (tomorrow), 曬 (sun-dried), 暇 (leisure) are classified as sharing the semantic radical “日” which means “sun, day, or daytime”; however, they are not pronounced the same as the semantic radical “日” (ㄖㄧˋ / ri4).

Polysemy: In linguistics, the term is defined as having multiple meanings for a single word or phrase (Cheung et al., 2006; Lyons, 1995, Ravin & Leacock, 2000). For example, in English, the word “march” can be the third month of a year, or a body of troops that move forward together on foot. In Chinese, the word (sun) can represent the meaning of sun, daytime, or a day.

Traditional Chinese: The set of Chinese characters that has been consistent with the original form of Chinese ideographic characters since the fifth century is primarily used in Taiwan and Hong Kong (DeFrancis, 1984; Ho, 2003). It was also used in China before the 1960s.

Simplified Chinese: Another set of Chinese characters that was created by decreasing the number of strokes and simplifying some proportions of the traditional Chinese characters which is currently used prevalently in China, Singapore, and Malaysia. It is a simplified version of traditional Chinese characters (DeFrancis, 1984).

School District: It is an area within a community (e.g., urban or rural areas) where all schools accept the same group of people (Wilson & Corbett, 1991). In this study, school district refers to the size of city and is further defined as urban or rural area.

Deep Orthography: According to Frost (1994) and Katz and Frost (1992), deep orthography is also referred to opaque orthography in which the correspondence between graphemes and phonemes in a language is inconsistent and vague.

Shallow Orthography: There is a close correspondence between graphemes and phonemes in a language. It is called transparent orthography as well (Frost, 1994; Katz & Frost, 1992).

Morphology: Morphology expresses the meaningful words. It is the study of the internal structure of words and prefixes (e.g., *uncover*, *preview*) and suffixes (e.g., *books*, *endless*) are comprised (Aaron et al., 2008).

Syntax: The rules of sentence formation which represents the structure of grammatical phrases and sentences from words (Aaron et al., 2008). For instance, a normal sentence in English usually contains at least three elements: Subject (S), Verb (V), and Object (O), and the structure of word order should be S-V-O (e.g., *The girl likes the doll*).

Phonology: Phonology is the study of how sounds and speech patterns of all languages are organized. It includes the inventory of sounds (phonemic and phonetic units) and the regulations for their combinations and pronunciation (Aaron et al., 2008; Katz & Frost, 1992). For example, in English, the spoken word *hit* consists of three phonemes: /h/, /ɪ/, and /t/.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter consists of six sections that present an orderly review of key theories and empirical studies relevant to this specific study. To inspect the differences between L1 and L2 in the study, the review starts with the descriptions of Orthographic Depth Hypothesis (ODH) which has appealed to researchers of language transfer. To investigate how L1 reading competence is related to L2 academic performance in the reading process of EFL students, the review, in the second section probes into the orthographic system in Mandarin Chinese (L1) reading. Orthographic rules and development in Mandarin Chinese is also included in this section. In comparison to L1 orthographic system, orthographic rules and its development process in English (L2) are addressed in the third section. In the fourth section, the Linguistic Interdependence Hypothesis (Cummins, 1979) explains the relationship between L1 reading and L2 reading respectively, that is, cross-language transfer of reading strategies. The fifth section reviews empirical studies on language transfer in reading among L1 and L2 readers. Only empirical studies that are relevant to the purpose are included. The sixth section is my own empirical pilot study which preceded this dissertation.

Orthographic Depth Hypothesis

Writing systems of the world differ and represent spoken language in a great variety of ways regarding grapheme and phoneme correspondence (Caravolas, 2006; Frost, 2005; Frost, Katz, & Bentin, 1987; Sasaki, 2005; Seymour, Aro, & Erskine, 2003). According to Frost and colleagues (1987), the amount of lexical mediation involved in naming depends on the depth of the orthography. Frost (1994) further points out that the depth of orthography in a language determines the types of reading skills used in the language. The degree of correspondence between the pronunciation and spelling of a word is indicated as Orthographic Depth Hypothesis (ODH) (Frost, 1994; Katz & Frost, 1992), which states that languages differ in the depths of their orthographies and the progress of learning to read (e.g., Feldman & Turvey, 1983; Frost et al., 1987; Katz & Feldman, 1983; Landerl, 2006; Turvey, Feldman, & Lukatela, 1984; Wang, Park, & Lee, 2006). Writing systems that have consistent correspondences between symbols and sound (e.g., Finnish, Spanish, and Italian) are called shallow orthographies (also called transparent orthography) - the relationship between written letters and phonemes are close and the pronunciation of a word is predictable based on the phonology seen in print. In other words, the grapheme-phoneme correspondence (GPC) is direct. Unlike the consistent symbol-sound relationship in shallow orthography, there is a weak correspondence between orthographic forms and phonological units in a deep orthography (opaque orthography) and the sounds are unpredictable, ambiguous, and complex based on its spelling (e.g., English). For example, in the English writing

system, *ow* is pronounced /o/ in *low* but /au/ in *owl*; the phoneme /i/ is spelled *ea* in *tea* but *ee* in *peel*.

A study by Frost et al. (1987) measured the degree of orthography among Hebrew, Serbo-Croatian, and English words and found that unvoweled (unpointed) Hebrew has the deepest orthography, whereas Serbo-Croatian has the shallowest orthography. In the study, readers in Hebrew committed the most errors in naming pseudowords and Serbo-Croatian readers had few errors. Apparently, the Hebrew readers could not effectively use the grapheme-phoneme strategy. In contrast, the Serbo-Croatian readers were successful in utilizing the skill due to their simple GPC language system. To clarify, voweled forms of Hebrew that are represented by dashes and dots above and below the consonant letters is a shallow orthography. Nevertheless, the form is replaced by a non-voweled form during elementary school years so vowels no longer appear in texts. Therefore, readers must rely on the context where words are presented because the Hebrew orthography becomes very deep (Benuck & Peeverly, 2004).

Seymour et al. (2003) indicated that English is perhaps the deepest orthographic language among European languages, whereas Finnish is considered as having a highly consistent GPC, that is, one written grapheme stands for one sound phoneme. The reason is that the phonological code plays less of a consistent role in English word recognition due to its complex letter-sound correspondence (Chitiri & Willows, 1994; Landerl, 2006). In other words, readers perform more poorly in reading in English, French, and Danish than in Greek, Spanish, and Finnish. Goswami, Gombert, and de Barrera (1998) described that native-Spanish speaking first graders, who acquired shallow orthography,

were able to make fewer errors in two-syllable pseudowords than English speaking first graders. Aro and Wimmer (2003) reported that English speaking children, up to fourth grade, had more difficulties in reading, particularly decoding skills, than German, Spanish, and Finnish children, who usually achieve high levels of reading accuracy. A study by Patel, Snowling, and de Jong (2004) found that Dutch speaking children, in both word and non-word reading tasks, were able to perform faster and more accurately than English children. In Caravolas' (2004) study, she stated that learners of more consistent writing systems, such as German or Czech, learned spelling skills at a faster rate than learners of less consistent orthographies, such as English or French. In general, children made fewer errors when learning to read in a shallow orthography due to the consistent mapping of orthography-phonology in that language.

Ziegler and Goswami (2005) claimed that the ODH is linked to the dual route model and dual route cascade model (e.g., Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001) of reading which is expressed as two facets, lexical and non-lexical, for processing words. The lexical model is meaning-based operated by a direct mapping of a word's visual characteristics to a stored lexical representation, whereas the non-lexical model is based on phonological cues (Humphreys & Evett, 1985). Readers modify their reliance on the two facets depending on the demands of the particular orthography. In other words, a skilled reader uses the two independent routes in reading words. Due to English's deep orthography, and less systematic mapping between letters and sounds, readers must rely on both the lexical and non-lexical pathways to process the words. On the other hand, because Finnish, Greek, and Spanish are more consistent orthographies,

readers in these languages rely more on the non-lexical facet and are able to decode words quickly and accurately. Accordingly, Caravolas (2004) stated that differences in orthographic depth will affect performance in reading and spelling. Hence, the differences between languages were largely attributed to differences in orthographic complexity.

Orthographic System in Mandarin Chinese Reading

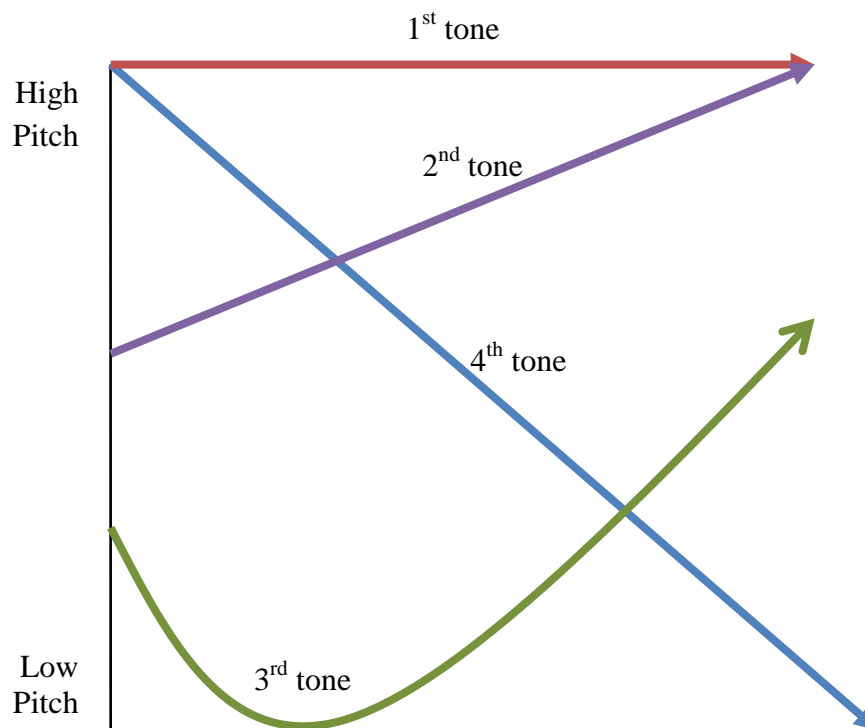
Words in most alphabetic languages are formed by a set of letters. Different words may be composed of different letters or of the same letters contained in different sequential orders. Writing systems have been classified as morphosyllabic, syllabic, and alphabetic based on their representation of the language at the level of the morpheme, syllable, or phoneme (Aro, 2006; Crowder & Wagner, 1992; DeFrancis, 1989; Hung & Tzeng, 1981; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001). Among the varieties of world writing systems, Mandarin Chinese, considered a non-alphabetic language (e.g., logographic language; Aro, 2006; Hoosain, 1991; Rickard Liow & Poon, 1998), is unique in that its relationship between logographs and syllables is rather inconsistent (e.g., opaque orthography) and actually presents the highest contrast to alphabetic systems such as English (Wang, et al., 2005; Wang et al., 2006; Perfetti, 1999; Perfetti, Zhang, & Berent, 1992). For example, a Mandarin syllable can be expressed with different logographs resulting in various meanings. The syllable in the

same tone “ㄔㄨㄤˋ” (chuang) can be represented as the character “莊” (village), “裝” (dress), “妝” (cosmetics), or “樁” (stake) and each has its own meaning.

Each Chinese character represents a syllable and, at the same time, either a full word, or a minimal unit of meaning (e.g., semantic radical). In Chinese, a syllable is constructed of two layers: a segmental layer which includes a phoneme analyzed as a syllable and a tone layer that connects to the syllable which then composes a single unit. The syllable is the basic speech unit of Chinese - each of which is divided into two parts: the onset and the rime. A Mandarin Chinese syllable is comprised of three components interacting with one another: onset, rime, and tone (Tong, Francis, & Gandour, 2008). Ho (2003) and McBride-Chang and Ho (2005) stated the syllable is also the basic unit of Chinese reading. Unlike the English phonetic system, Chinese is not based on consonants and vowels but on syllable initials and finals, and has no initial clusters (Siok & Fletcher, 2001). As a result, Mandarin Chinese onset is only represented by a single initial sound. In a majority of syllables the rime mainly consists of finals (Chen et al., 2004; Siok & Fletcher, 2001; Wang et al., 2005). There are about 21 onsets and 37-38 rimes in Mandarin Chinese in total (Ho, 2003; Li & Thompson, 1981; Siok & Fletcher, 2001; Yin & Weekes, 2003).

There are four main tones in Mandarin Chinese: the first tone is a high level monotone, the second one is a high rising tone, the third is a low dipping tone, and the fourth is a high falling tone (see Figure 1; Chao, 1968; Chen et al., 2004; Chen & Gussenhoven, 2008; Chen & Xu, 2006; Liu, 2004; Shen, 1990; Xu, 1997). Additionally, some Mandarin Chinese syllables lack tone altogether, which is considered a neutral tone or a tone with no emphasis (Chen & Gussenhoven, 2008; Chen & Xu, 2006; Liu, 2004). Like unstressed syllables in English the neutral tones are pronounced weakly. Mandarin Chinese is considered a tonal language, in which every syllable has a particular tone and the meaning of each syllable can change depending on the tone used. In other words, a syllable with a different tone has a different meaning and is also represented by a different character. For instance, “八” *eight* (ㄅㄚˋ / ba1), “拔” *pull out* (ㄅㄚˊ / ba2), “把” *handle* (ㄅㄚˇ / ba3), “爸” *father* (ㄅㄚˋ / ba4), “吧” *imperative particle* (ㄅㄚ • / ba0). Wang et al. (2005) declared that there are approximately 400 different syllables in Mandarin Chinese, whereas DeFrancis (1984) stated that Mandarin Chinese consists of 1,277 syllables formed by phoneme plus tone.

Figure 1. Four Chinese Tones



Note. The neutral tone is toneless; thus, it is unable to be shown on the figure. The tone is usually used in particles, second syllable in some compound words, and second half of a reduplicated word.

The basic units of Chinese orthography are strokes, radicals, characters, and words (DeFrancis, 1984; Hoosain, 1991; Taft & Zhu, 1997). Each Chinese character is constructed from basic strokes (Chen, 1996; Chiang, 2003; Chung & Leung, 2008; DeFrancis, 1984; Law, Ki, Chung, Ko, & Lam, 1998; Zhang, Wang, Zhang, & Zhang, 2002). The order of the strokes, called the character's stroke order, is used when writing a Chinese character. There are eight basic types of strokes normally classified in the language: Dot, vertical line, horizontal line, hook, and four diagonal lines (e.g., curve

and oblique lines) (see Table 1.; Chen, 1996; Chiang, 2003; DeFrancis, 1984; Flores d'Arcais, 1994; Law et al., 1998). Certain component parts of a character, which have the same stroke order, also appear in other characters and enable readers to make more sense of Chinese characters. These component parts (combined strokes) form radicals including semantic radicals and phonetic radicals (Chen, 1992; Chen & Weekes, 2004; Cheung et al., 2006; Ho, 2003; Ho, Ng, & Ng, 2003; Hsiao & Schillcock, 2006; Wang et al, 2005). Phonetic radicals can be read with one of four (or five) different tones which represents four or more corresponding meanings (Rickard Liow & Poon, 1998). Traditionally Chinese scripts were written downwards in columns and from right to left; yet, they can also be written in rows going from left to right in the same way as English (Law et al., 1998).

Mandarin Chinese is polysemous in that one single lexical item has numerous senses of meaning but are etymologically related (Cheung et al., 2006; Lyons, 1995, Ravin & Leacock, 2000). For example, “日” expresses the meaning of “sun”, “day”, and “daytime”. As Chen (1992) explained, Chinese characters are not only distinctive perceptually but also cognitively because they convey semantic and phonetic information (e.g., semantic radicals and phonetic radicals, Cheung et al., 2006). Chinese characters can be divided into simple and complex characters. Chung and Leung (2008) claimed that simple characters are unable to be divided into visually separable components (e.g., “其” *that*, “月” *month*), while complex characters (e.g., “期” *a period of time*) are composed of simple character(s) and subcomponent(s); and that there are

approximately 300 simple characters in the language (Chung & Leung, 2008; Shu, Chen, Anderson, Wu, & Xuan, 2003).

Table 1. Eight Basic Chinese Stroke Forms

| Stroke | Direction | Example (Red highlighting) |
|--------|-----------|-------------------------------|
| 丶 | ↘ | 永 |
| 一 | → | 永 |
| 丨 | ↓ | 永 |
| 丿 | ↙ | 永 |
| ㇇ | ↗ | 永 |
| ㇏ | ↘ | 永 |
| ㇑ | ↙ | 永 |
| ㇒ | ↘ | 永 |

As previously illustrated, the Chinese writing system, in contrast to alphabetic scripts, is morphosyllabic (Cheung et al., 2006; DeFrancis, 1989; Keung & Ho, 2009; Law, Wong, & Kong, 2006; Leong & Joshi, 1997; Leong, Tan, Cheng, & Hau, 2005;

McCarthy, 1995), - each Chinese character represents a morpheme and a syllable and there is no component of the character that is linked to phonemes. The majority of the one-character Chinese words are compound characters, in which there are two radicals, each of which usually has an independent meaning (semantic radicals) and pronunciation (phonetic radicals) that are often different from the meaning and pronunciation of the combined characters (e.g., words). Keung and Ho (2009) pointed out that about 90% of Chinese characters are ideophonetic compounds consisting of a phonetic radical which often provides a clue to the pronunciation of the whole character and a semantic radical that offers a clue associated with meaning of the character (e.g., Ho, Chan, Lee, Tsang, & Luan, 2003). Of the Chinese compound character words, 85% of these are compound characters and have a semantic radical standing on the left and a phonetic radical on the right (Cheung et al., 2006). Pine, Ping'an, & Song (2003) stated that although repetition of character components often occurs, Chinese children are required to memorize hundreds of constructed characters in their Chinese language learning. According to Hudson-Ross and Dong (1990) and Pine et al. (2003), a Chinese sixth-grade child must learn about 2,500 characters to be literate, while a Chinese adult needs 7,000 -9,000 words to be capable of reading books and 3,000 words for formal writing (Pine et al., 2003) though professional literacy may require more.

Due to the lack of grapheme-to-phoneme conversion in Mandarin Chinese, the presence of semantics actually helps in many Chinese characters. Hence, Chen (2002), Cheung et al. (2006), Hoosain (2002), Law et al. (2006), and Wang (1973) indicated that the presence of this particular characteristic leads Chinese orthography to be seen as

meaning-based rather than speech-based and the involvement of phonology plays a less superior role than semantic activation in Chinese reading process. However, some studies have found that Chinese character recognition is dealt with by phonological activation and is not unlike the writing system of alphabetic language (Perfetti & Tan, 1998; Perfetti et al., 1992; Leck, Weekes, & Chen, 1995; Tan & Perfetti, 1997, 1999; Weekes, Chen, & Yu, 1998). The difference between the conception of phonological mediation between Chinese and other alphabetic characters is that Chinese scripts use phonology to select meaning, while alphabetic words apply phonological information to assist semantic activation (Law et al., 2006; Perfetti, Liu, & Tan, 2005; Tan & Perfetti, 1997, 1999). Nonetheless as Leung et al. (2006) clarified that “there is no sign that the debate about the relative prominence of orthographic or phonological information for expert Chinese reading can be easily resolved” (p. 423).

Chinese Phonetic Symbol Systems

In addition to the different forms of Chinese characters in Mandarin Chinese (Traditional Chinese and Simplified Chinese), two phonetic symbol systems are also used: Zhuyin Fuhao (Mandarin phonetic symbols) and Pinyin (Latin letters) which are used in Taiwan and China respectively (Chen & Yuen, 1991). Children learn to read Chinese characters via Zhuyin Fuhao (sub-syllabic phonetic system, each of which has its own sound) in Taiwan and Pinyin (alphabetic phonetic system) in China (DeFrancis, 1950; Ho et al., 2003; McBride-Chang & Ho, 2005). For example, Zhuyin Fuhao “ㄅ” represents Pinyin “B”; Zhuyin Fuhao “ㄆ” is identified as Pinyin “P” (Appendix A). In

total, there are 37 symbols in Zhuyin phonetic system (16 finals and 21 initials). Like Japanese hiragana and katakana, the Zhuyin Fuhao is employed to be closer to the Chinese characters than letters of the English alphabet. Each symbol in Zhuyin Fuhao is a square shape and is unique while Pinyin uses Latin-based letters. Although the form of symbols in the two phonetic systems are sharply different, the influence of learning on reading acquisition is similar because both of them are developed based on the alphabetic principle (Chen & Yuen, 1991).

Studies have shown that L1 background has effects on L2 script recognition (Chen & Yuen, 1991; Chikamatsu, 1996; Holm & Dodd, 1996; Rickard Liow & Poon, 1998; Wang & Abe, 2008; Wang & Koda, 2007). For example, Holm and Dodd (1996) reported that children in China perform better on segmenting English words or naming English pseudowords than Hong Kong children who are not taught to associate letter names with Zhuyin Fuhao or Pinyin. Chen and Yuen (1991) assumed that the instruction of Zhuyin Fuhao or Pinyin assisted children in Taiwan and China with better decoding skills than Hong Kong children due to this difference in learning. However, when the comparison is made to other orthographic systems, Chinese speakers generally perform lower than other alphabetic language speakers in English reading skills. Wang et al. (2003) found that the overall performance of Korean children in naming English words is more accurate than Chinese children. Also, Chinese children have a lower percentage of regularization errors in naming low-frequency exception words because Korean Hangul has a shallow orthography and its syllable structure is more similar to English, whereas Chinese orthography is very different from English (Wang, Anderson, Cheng,

Park, & Thomson, 2008). Rickard Liow and Poon (1998) found that Malay-L1 children (aged 9–10) in Singapore exhibited the highest phonological awareness, followed by English-L1 pupils, and then the Mandarin-L1 pupils who were not taught the Pinyin system. The possible reason is that Malay-L1 students have exposure to a shallow alphabetic script (higher consistent mapping between graphic units and speech sounds), whereas English is a deep alphabetic script (lower consistency between graphs and sounds), and Mandarin Chinese is a logographic script (little relationship between graphs and speech sounds).

Orthographic System in English

The English orthography system consists of 26 letters of alphabet used in combination to represent 44-46 phonemes and approximately 210 graphemes used to spell the 44-46 phonemes in English (Moats, 2000; Port, 2007). For example, *cup* has three letters: *c, u, p*, three phonemes: /k/, /ʌ/, /p/ and three graphemes: *c, u, p*; *rock* has 4 letters: *r, o, c, k*, three phonemes: /r/, /ɑ/, /k/, and three graphemes: *r, o, ck*. English is considered a morphophonemic writing system because its spelling represents both sound (phonemes and syllables) and meaning (morphemes) (Aro, 2006; Chomsky & Halle, 1968; Geva, Wade-Woolley, & Shany, 1993; Gleitman & Rozin, 1977; Moats, 2000; Venezky, 1970). For instance, the plural morpheme *s* has the same expression, such as *cats, dogs, cases*, but different phoneme patterns (e.g., *cats - /s/, dogs - /z/, cases - /ɪ s/*). According to Roman, Kirby, Parrila, Wade-Woolley, and Deacon (2009), phonological awareness, orthographic knowledge, and morphological awareness each has particular

contributions to acquiring English reading proficiency. As Geva et al. (1993) stated: “both phonological and morphological information is encoded in the English writing system” (p. 385). In sum, phonology, orthography, and morphology jointly contribute to learning English reading and these components of the linguistic skills will assist an English reader to read successfully (Wang, Yang, & Chen, 2009).

Phonological Processing

Over the past two decades, the significance of phonological processing has been shown to help young children develop their literacy skills and become skilled readers in alphabetic languages (Adams, 1990; Badian, 1998; Blachman, 2000; Bryant, 1986; de Jong & van der Leij, 2002; Goswami & Bryant, 1990; Kame’enui & Simmons, 2001; Nicholson, 1999; Swanson, Rosston, Gerber, & Solari, 2007; Wagner & Torgesen, 1987). As a result, children have to recognize that the spoken phonemes have a certain degree of representation in written graphemes while learning to read alphabetic languages (Scarborough & Brady, 2002). In acquiring phonological ability such as breaking down words into syllables, identifying individual sounds in words, combining individual sounds to a word, or dividing words into sounds (Anthony & Francis, 2005; Dixon, Chuang, & Quiroz, 2009; Stadler, Watson, & Skahan, 2007), English speaking children are better able to analyze and manipulate units of sound in speech than only focusing on meaning (Castles & Coltheart, 2004; Chen, Ku, Koyama, Anderson, & Li, 2008; Goswami & Bryant, 1990).

Generally, phonological processing is a top-down process which begins at the level of the word as a whole and then gradually moves to smaller parts of the word (Seymour

& Evans, 1994). In other words, it is developed first from a shallow level to a deeper level of phonological awareness (PA). The shallow PA skills deal with larger word parts while the deeper PA skills pertain to smaller parts of words. Numerous research studies have examined the relationship of phonological processing skills and reading proficiency and found that phonological processing skills are highly associated with word reading ability (Badian, 1998; Burgess & Lonigan, 1998; Caravolas, Hulme & Snowling, 2001; Cardoso-Martins, 1995; de Jong & van der Leij, 2002; Hulme, Hatcher, Nation, Brown, Adams, & Stuart, 2002; Stuart, 1995).

In addition to English language, phonological processing skills also have an influence on the reading ability in other alphabetic languages. Patel, Snowling, and de Jong (2004) conducted a study with the comparison of a shallow language (Dutch) and a deep language (English) among PA skills of monolingual children in learning to read. They found that the effects of phonological processing skills, especially phonemic awareness, predicted word reading ability on both Dutch and English children. Studying individuals that speak Spanish provides the second example. Studies also have found that phonological processing skills predict later word reading ability (Atwill, Blanchard, Gorin, & Burstein, 2007; Denton, Hasbrouk, Weaver, & Riccio, 2000; Durgunoğlu et al., 1993). In general, these studies provide support for the notion of the positive relationship between phonological processing skills and reading success in alphabetic languages, whether or not the languages are shallow or deep.

Orthographic Knowledge

The orthographic systems in alphabetic languages rely on the combination of a number of letters, many of which correlate with speech sounds. Orthographic knowledge includes the understanding that words are made up of letters of an alphabet that represent speech sounds. Hence, orthographic knowledge is highly correlated with phonological awareness (Cunningham & Stanovich, 1989, 1993; Roman et al., 2009; Sunseth & Greig Bowers, 2002). When the written letters and sound speech are consistent mappings, the orthography is referred to as shallow, such as Spanish, Finnish, and Italian. In contrast, there are less consistent mappings between written words and speech sounds when the language is considered a deep orthography, such as English, Danish, or French. Generally, children learning deep orthographies acquire decoding skills more slowly than children learning shallow orthographies (Aro, 2006; Aro & Wimmer, 2003; Cunningham, 2006; Katz & Frost, 1992; Seymour et al., 2003; Ziegler & Goswami, 2005). By way of explanation, poor readers in Finnish tend to decode words more accurately but less fluently than poor readers of English. It is because the correspondence between letters and sounds in a shallow orthography are stronger and more stable than in a deep orthography.

In general, orthographic knowledge refers to children's understanding about the conventions of spelling applied in a language writing system (Treiman & Cassar, 1997; Varnhagen, Boechler, & Steffler, 1999). It means that English speaking children need to learn how to spell English through knowledge of spelling rules (Treiman & Cassar, 1997). For example, the medial consonant should be doubled if it is followed by a short

vowel in a two-syllable word (e.g., *tennis*, *button*, *rabbit*); *q* is followed by *u* (e.g., *question*, *quartet*), except *Qatar* and *Iraq* because they are borrowed words from Arabic. It also includes the word patterns and how the patterns have influence on word pronunciation. For example, *c* is pronounced as /s/ when it is followed by *e*, *i*, or *y* (e.g., *cent*, *city*, *cycle*), but is pronounced as /k/ when *a*, *o*, *u*, or a consonant follows (e.g., *cat*, *cotton*, *cup*, *clip*).

Although some see English as an irregular language system due to the complex orthographic system - a single letter expresses numerous sounds (e.g., *c* - /k/, /s/) or a sound is represented by several letters or letter clusters (e.g., /k/ - *c*, *ck*, *k*, *ke*). Some believe that English is not that complex; in fact English speaking children are able to learn to spell English words accurately fairly easily (Kessler & Treiman, 2001).

Morphological Awareness

Of the areas of linguistic awareness, phonological and orthographic knowledge cannot explain all the differences in English reading and spelling ability. Since the English writing system is a combination of phonological and morphological information it is likely that the knowledge of morphemic structure in words significantly affects literacy development as well. Morphological awareness is the ability to combine spoken units of meaning or morpheme to create a new meaning (Kuo & Anderson, 2006). Morphemes include word roots, suffixes, prefixes, and inflections. For instance, the word *beautiful* consists of two morphemes: *beauty*, which expresses the quality of an individual or an object to give pleasure to the senses, and the suffix *ful*, which represents

the word as an adjective (e.g., Kuo & Anderson, 2006). It is “the paring of semantic information with the phonological representation” (Kuo & Anderson, 2006, p. 161).

Studies have shown that the pre-K to Second Grade children learning English begin noticing the morphological features rather than the phonological features of new words (e.g., the stem or suffix, McBride-Chang, Cho, Liu, Wagner, Shu, Zho, Cheuk, & Muse, 2005; Ouellette & Senechal, 2008; Treiman, Cassar, & Zukowski, 1994), while teenagers and adults associate the skill with learning English spelling in more complex words (Deacon & Bryant, 2005; McBride-Chang et al., 2005; Nagy, Berninger, & Abbott, 2006; Ouellette & Senechal, 2008). For example, young English speaking children might realize that the suffix *s* makes a singular noun become plural (e.g., *cats*), whereas teenagers or adults use their understanding that *phono* means “sound” to comprehend the meaning of *phonocardiograph* in context. In other words, morphological awareness facilitates reading development by giving children or language learners the linguistic ability to access sounds of unfamiliar words using morphemic knowledge (Kuo & Anderson, 2006). Another example is provided by Treiman et al. (1994). They found that although the “t” in both words *dirty* and *city* are pronounced more like /d/ instead of /t/, young children are more able to correctly spell *dirty* than *city* because the former one contains the stem *dirt*. In addition, morphological awareness plays a role in recognizing pseudowords that may conceivably have morphemic structure (Deacon & Kirby, 2004; Roman et al., 2009). For example, the pseudoword *mancingful* may be considered a real and meaningful word by children because it is composed of the root *mancing* and the suffix *ful* (e.g., Roman et al., 2009).

Wang, Yang, and Chen (2009) noted that compound, inflection, and derivation are the three major types of morphological structures living in English. Firstly, compound morphology is to combine two or more stem morphemes to a new word (e.g., *chairman*, *popcorn*). Secondly, inflectional morphology represents the grammatical formation of words (e.g., present - past tense: *walk -walked*). Thirdly, the change of the basic meaning of a word by applying one or more morphemes is called derivational morphology (e.g., happy – happiness; aviate – aviator). Wang et al. (2009) further stated that children (e.g., first and second graders; Berko, 1958) are able to acquire inflectional and compound morphology earlier than derivational morphology because the process of acquiring derivational morphology takes much more time and comes later than the fourth grade.

English is morphophonemic because English letters and sounds do not have a one-to-one correspondence and its orthographic system linguistically presents a deeper level of morphology than of phonology. The phonological regularity in English is often lost for the attention of morphology. For instance, although *heal* and *health*, *sign* and *signature* share the same spelling *heal* and *sign* respectively, their pronunciation is very different (e.g., Geva et al., 1993; Katz & Frost, 1992; Landerl, 2006). Thus, English speaking children, because of inconsistent mapping of written symbols and spoken sounds in English are much slower to acquire reading relative to other students (Goswami, 2006).

Linguistic Interdependence Hypothesis

As Goodman and Burke (1973) stated that all languages basically apply similar reading strategies in reading processing: bottom-up and top-down strategies. The bottom-up strategy is a model that proceeds from a part to a whole. It is a reading process driven by a linear fashion from each word letter-by-letter, each sentence word-by-word and each text sentence-by-sentence (Holmes, 2009; Spiro & Myers, 1984; Treiman, 2003). In other words, the approach which begins with written text focuses on learners' understanding of the parts of language, including lexical recognition, parts of speech and structure, and the meaning of phrases and sentences. Top-down reading strategy, on the other hand, proceeds from whole to part - that is, readers can comprehend reading contents with meaning and grammatical cues, even though they do not recognize each word (Goodman, 1967; Goldman & Rakestraw, 2000; Smith, 1971; Treiman, 2003). Basically, this approach employs by the reader's prior knowledge.

The two reading strategies prompt researchers of L2 reading to examine the relationship between L1 and L2 reading, which is called the Linguistic Interdependence Hypothesis. The hypothesis, developed by Cummins (1979), sheds light on the relationship between L1 and L2 reading. It argues that L1 linguistic knowledge plays an influential role in the development of corresponding abilities in L2 with the implication that students with better-developed L1 reading skills will acquire reading abilities in L2 faster than someone with less well-developed L1 reading skills (Bernhardt & Kamil, 1995; Cummins, 1979, 1980, 1981; Yamashita, 2007). Once reading and writing skills are acquired the same operations will be available as needed within L2 contexts; that is,

L2 proficiency must play a role. Simply put, reading skills in L1 is transferable to reading in L2 (Koda, 1993). For example, if a child acquires a high level of proficiency in L1, he/she is likely to develop high levels of L2 competence without negatively affecting the L1 competence. Cummins (1979) reviewed several studies investigating the relationship between L1 cognitive academic language proficiency (CALP) and L2 CALP and found that the correlation was positive and moderate. He further concluded that L2 learning is statistically significantly predictable by L1 performance. Hardin (2001) and Jiménez, Garcia, and Pearson (1996) reported that highly proficient L2 readers apply similar strategies as reading in either L1 or L2.

Transfer of Reading Comprehension Skills between L1 and L2

Chinese is the most contrasted language system to alphabetic languages (Wang et al., 2009). Apart from orthography, Chinese is also different from English in word formation (e.g., morphology) and sentence formation (e.g., syntax). For instance, all Chinese characters are free morphemes which refer to a word that can stand on its own to represent a lexeme (smallest unit of meaning). On other hand, bound morphemes are not present in Chinese, which refer to linguistic forms that must be appended to other lexemes. In contrast, in English, bound morphemes, such as *-ly* signifying adverb formation and *-s* indicating plural nouns, serve informational and grammatical purposes (Aaronson & Ferres, 1986). Because the syllable is the basic unit of phonology in Mandarin Chinese and the phoneme is the basic phonological unit in English, the letter-phoneme mapping system does not apply to Chinese reading (Wang, Cheng, et al.,

2006). Furthermore, graphemes in Mandarin Chinese orthographic systems are represented by syllables that are morphemes instead of phonemes. Thus, learning to read Chinese results in learning the grapheme-morpheme correspondences, which is opposite to GPC in learning to read English (Ho et al., 2003; McBride-Chang & Ho, 2005; Wang, Cheng, et al., 2006). As a result of these sharply distinct orthography systems in Chinese and English, language transfer in reading from Chinese to English may be indirect (Feng & Mokhtari, 1998; Wang, Cheng, & Chen, 2006; Wang, Park, et al., 2006; Wang et al., 2005). Strictly speaking, orthographic, morphological, and syntactic differences between Chinese and English might lead Taiwanese L2 learners who speak Chinese to face some mental constraints and problems while trying to learn English.

Language transfer refers to a situation in which learning knowledge or skills in one language transfers to the acquisition of another language. As noted previously, Cummins (1979; see also Bernhardt & Kamil, 1995; Cummins, 1981, 1991; Yamashita, 2007) offers theoretical support to the important role of L1 ability in cross-language transfer. He hypothesized that the degree of L1 competency will affect the level of L2 proficiency. Carlisle, Beeman, Davis, and Spharim (1999) said that a transfer process still takes place in L2 development if the L2 learners have little L1 competency or schooling in their native countries. Specifically, poor L1 academic language skills often transfer to be poor L2 academic language skills, considering that good L1 skills transfer to good L2 skills. The hypothesis advocated by Cummins actually investigated the relationship between L1 and L2 reading.

The language transfer within a variety of alphabetic languages has been extensively examined. Lopez and Greenfield's (2004) examined 100 Spanish-speaking Head Start children's cross-language transfer abilities. The results showed that the bilingual children with higher reading skills from their L1 have a slightly easier transition from L1 to L2 ($r = .27$); in other words, it was easier to apply their first language knowledge to their second language acquisition. Cobo-Lewis et al. (2002) found a similar result in that Spanish-speaking children with poor reading skills in their L1 would face obstacles in English (L2) comprehension. ($r = .54$). Dufva and Voeten (1999) conducted a two-year longitudinal study testing 160 Finnish-speaking first graders' literacy and phonological memory skills. All participants started learning English (L2) at the third grade. They found that both L1 literacy and phonological memory skills were predictive of 58% of L2 learning. Zwaan and Brown (1996) examined comprehension skills among L2 English-speaking college students who enrolled in a French course. Twelve participants were described as non-fluent French (L2) level. They found that skilled L1 readers were more accurate in their L2 "paraphrases" than less skilled L1 readers. However, because all L2 participants performed much higher in their L1 reading skills than in L2 reading, their high L1 reading skills might not have transferred to L2 reading except the ability to paraphrase. Therefore, the researchers made the additional conclusion that the lack of L2 capacity had effects on L2 reading. Similarly, a study by Sparks and colleagues (2008) also found that L1 word decoding, spelling, reading comprehension, phonological awareness, receptive vocabulary, and listening comprehension affected L2 reading (word decoding

and comprehension) among 54 English speaking high school students who learned Spanish, German, or French as their L2. However, these students had completed two years of L2 learning and had a certain level of L2 ability when they participated in this study.

Unlike Spanish reading which shares the fundamental alphabetic principle as English, Mandarin Chinese is the most distant language from English in terms of similarities. In order to read Mandarin Chinese and English, children have to learn about and deal with the extremely dissimilar orthographic systems. The existence of any relationship in learning to read across different writing systems has been empirically and theoretically examined. Morphological awareness, including compound structure task and a derivational morphology task, across Mandarin Chinese and English reading skill was examined by Wang, Cheng, et al. (2006). Sixty-four Chinese-English bilingual children were recruited in this study. All of them attended an English-only class and a Chinese enrichment after-school program. Thirty-eight students were enrolled in Grade 2 Chinese classes and the remainder attended Grade 4 Chinese classes. The results showed that there was a cross-language morphological transfer in acquisition of two distinct writing systems. The transfer was from L2 to L1, which supports Cummins' Linguistic Interdependence Hypothesis. The transfer was probably this way because participants in that study were ESL learners whose initial literacy instruction was in English (L2). The transferring relationship in morphological awareness did exist in sharp contrast languages and bilingual children were able to apply their knowledge in either L1 or L2 to share morphological structure from one language to reading in another language.

Wang et al. (2005) investigated phonological and orthographic processing in 46 bilingual children who learned to read two different writing systems, Chinese (L1) and English (L2). Results showed that Chinese onset matching skills had significant effects on English onset and rime matching skills. The 46 bilingual students learned to read Chinese characters via Pinyin, an alphabetic phonetic system used to help children learn Chinese character reading. Proficiency in using Pinyin was found to be highly correlated with English pseudoword reading. In addition, Chinese tone processing skills had a moderately significant contribution to predict their English pseudoword reading. In general, this study significantly supports Cummins' Linguistic Interdependence Hypothesis, in which L2 learners will apply their L1 competency to acquire L2 ability.

Another study by Keung and Ho (2009) reported language transfer in Chinese and English. Word reading, phonological, orthographic and rapid naming skills in both Chinese (L1) and English (L2) were examined among 53 Grade 2 students in Hong Kong. The findings offer evidence that there is a significant correlation between Chinese and English phonological awareness and rapid naming rather than orthographic skills. Although Chinese orthographic tactics did not have any influence on L2 word reading, Chinese rhyme awareness aided the development of English phonemic awareness. A similar finding was published by Wang et al. (2005) where both English rapid naming skills and rhyme awareness was a predictor in Chinese word reading; that is, L2 skills were able to predict L1 competence.

A Pilot Study of Taiwanese Ninth Graders' L2 Academic Performance

Apart from the empirical studies conducted by other L2 researchers, a pilot study that preceded this dissertation was conducted in 2008 and examined English (L2) academic performance by using 30,000 Taiwanese ninth-grade students who took a national standardized examination of English (Chuang et al., 2009). All of the participants took the Basic Competency Test (BCT) at ninth grade. The pilot study examined a line of research on L2 academic performance: the amount of time exposed to students using formal instruction in English.

The results found that students with more time of L2 exposure had a significant and positive main effect on the English exam, which emphasized grammar, vocabulary, and reading comprehension, regardless of L2 communication ability. The result was similar to two studies (Allen, Bernhardt, Berry, & Demel, 1988; Barnett, 1986). Working with native readers of English (college aged) reading French, Barnett (1986) conducted a study using reading comprehension as a dependent variable while trying to account for L2 (French) ability level and L1 (English) literacy background. It was reported that English readers with more exposure to French obtained higher comprehension scores, underscoring the importance of L2 knowledge. Similarly, Allen et al. (1988) carried out a study in which English speaking adolescents learned French, German, or Spanish as their foreign language in school. The results revealed a clear increase in comprehension scores based on the language level. In other words, the more knowledge about the foreign language acquired, the higher the foreign language comprehension scores they achieved.

Summary

This chapter reviewed theories related to Orthographic Depth Hypothesis, orthographic system in Mandarin Chinese and English, language transfer in reading skills. Cummins' Linguistic Interdependence Hypothesis was also discussed and as a result made the transfer relationship between L1 and L2 reading much clearer.

In sum, the literature on Mandarin Chinese and English orthographic systems reported that the two languages are highly dissimilar in writing systems in terms of word formation, orthography, morphology, and syntax. Although English is viewed as a deep orthographic writing system in alphabetic languages, it, compared to Chinese, is shallower due to the lack of phoneme element which exists in the Chinese orthographic system. In other words, the GPC in English is highly consistent compared to the grapheme-morpheme system in Chinese (Ho et al., 2003; McBride-Chang & Ho, 2005; Wang, Cheng, et al., 2006). The GPC linguistic factor might affect the transfer of reading across languages more indirectly.

Most research studies concerning language transfer in reading focused on L2 learners in an ESL setting where English is the primary language and is used with daily-communication. To better understand the transfer of reading between L1 and L2, this research study extends beyond the scope of previous language transfer studies and investigates whether transfer will take place in an EFL setting where English is considered a foreign language rather than a second language and is not a communicative tool used in society. Furthermore, personal variables such as gender and school district issues related to the influence in the transfer of language reading among ninth-grade

Taiwanese students are also examined in the study.

CHAPTER III

METHODOLOGY

Introduction

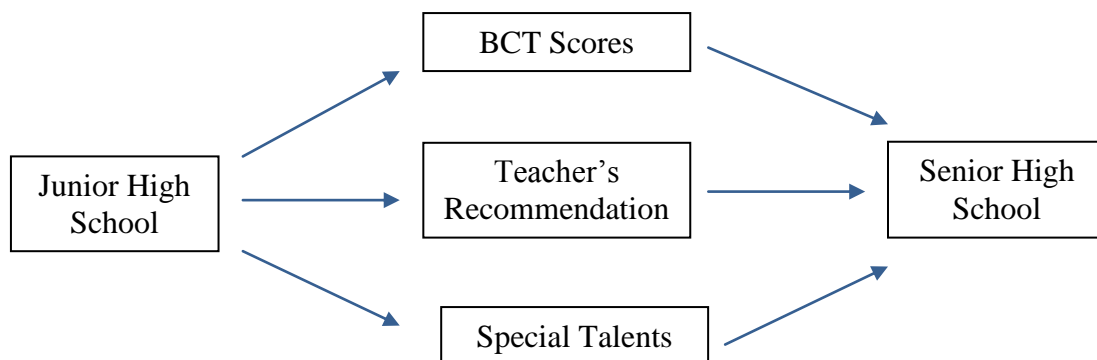
Taiwanese students in the ninth grade - the third year of Junior High School - are administered a national standardized test. The examination was called Joint Public Senior High School (JPSHS) Entrance Examinations or Senior high school united entrance examination before the year 2001. Traditionally, JPSHS was held on the 8th and 9th of July every year. Under the supervision of the MOE, each city and county administered examinations on the same date, however, the districts were able to give their own version of an examination as long as it was supervised by the MOE. Additionally, all primary and secondary education in Taiwan followed the “One Standard, One Textbook policy” (Ministry of Education of Taiwan, 2007). Only the textbooks published by the National Institute for Compilation and Translation (NICT) were allowed to be used in schools (Ministry of Education of Taiwan, 2007, 2008b), so the loophole was that students could do well on their JPSHS test just by memorizing the contents of the textbooks. The question formats on the JPSHS for English mainly consisted of multiple choice, short-answer, and translation questions, with an emphasis on students’ grammatical competence. The testing did not take communicative competence into consideration at all.

Due to the sub-par English skills of students in Taiwan, the government decided to roll out a new educational policy called the 9-year curriculum education reform effective

starting in 2001 (Chang, 2008; Oladejo, 2006). The Basic Competency Test (BCT) was developed to replace the previous conventional high school entrance examination in order to meet the new curriculum objectives of making sure students have English competence in both grammar and communicative skills. The BCT is administered twice a year in May and July, respectively. Cities and counties who used to administer their own exams were no longer permitted to do so; instead, a standardized test created by the Committee of the Basic Competence Test for Junior High School Students was created and distributed as the official exam. The BCT format for English includes multiple-choice questions with the emphasis on students' contextual reading competence. All test questions are multiple choice and the tests are scored by the number of correctly answered questions. To reach the goal of reformed education, the MOE implemented the “One Standard, Multiple Textbooks” policy (Ministry of Education of Taiwan, 2007, 2008b) in 1999. “Multiple Textbooks” indicates that the textbook market will no longer be monopolized by the NICT or by just one book publisher. Each school can decide to organize a committee of teachers to select the textbooks to be used by the students at their school. “One Standard” means the MOE allows students to take entrance exams that test their academic level by the Committee of the Basic Competence Test for Junior High School Students compiling comprehensive questions in accordance with the MOE's standards. Generally, either the JPSHS or the BCT is used as a guide to measure educational achievement in Mandarin Chinese, English, Mathematics, Natural Science, and Social Studies in the context of the junior high school curriculum. It is important to do well on the test in order for a student to continue their education in Taiwan.

Under the new policy, the MOE in Taiwan disseminated various themes for junior high graduates' senior high admission. Figure 2 shows that junior high graduates are currently able to be admitted to senior high schools if one of the three criteria is met: high BCT test scores, teacher recommendation, and/or special selection based on a special talent. In addition to test scores on entrance examination (BCT), the MOE requires two more ways for the admission: One is teacher's recommendation (letters) which is based upon on students' academic achievement in junior high school and the other is special selection which is based on students' special talents for entering secondary school.

Figure 2. Three Options for Senior High School Admission



Note. Adapted from the Ministry of Education of Taiwan (2000b).

The major difference between the JPSHS and the BCT is that the BCT offers more chances for students to succeed in examinations because they have two opportunities each year to take the examinations and produce a better test result in order to apply for their target senior schools. Before, students only had one chance to take the JPSHS and if they didn't score well would have to wait one year before being allowed to take the test again.

The primary intent of this study is to investigate the relationship between Chinese (L1) and English (L2) reading achievement and whether Taiwanese ninth-graders' L1 knowledge is transferable to their L2 academic performance. The second intent is to explore the effects of native-Chinese speaking students' gender and school district on the transfer of L1 and L2 reading ability. Five research questions guide this study:

1. What is the degree of association between L2 reading, L1 reading, gender, and school district?
2. To what extent does L1 language reading competence predict L2 reading ability in academic settings?
3. How do students' gender and school district predict L2 reading ability?
4. To what extent does L1 language competence predict L2 language reading comprehension ability when all other predictor variables are considered?
5. Does time in L2 exposure change the effect of L1 reading competence on L2 reading ability?

Participants

The BCT is held in May and July every year. Almost all of the 300,000 junior high school graduates take the first one and students may choose to take the second in July in an effort to increase their score. Students are also allowed to use the better of the two scores for their senior high school admission application. The scores are only valid for the year in which the test is taken and are not comparable across years. There are 5,000 examination results randomly selected from the entire examinee population by the Taiwanese Government every year. Data, which were obtained after everyone completed their examination, was collected and offered by the study coordinator, The Committee of the Basic Competence Test for Junior High School Students. This study included data from 2002 to 2007; thus a total sample of 30,000 students' test scores in both Mandarin Chinese and English as reported from 18 city districts in Taiwan. The two largest cities in Taiwan are Taipei and Kaohsiung, located in the north and south of Taiwan respectively. Taipei and Kaohsiung are the two municipalities, highest level of classification for cities, in Taiwan – One is the capital and the largest city and the other is the second-largest city and Taiwan's largest trade port. Figure 3 displays the map of Taiwan where the city distributions are illustrated. Any students selected from these two cities are considered urban students and students from the rest of cities are viewed as rural areas (Table 2).

Figure 3. Map of Taiwan



Note. Adapted from the Ministry of Education of Taiwan (2000b).

Table 2. Distributions of Urban and Rural Areas in Taiwan

| Urban Area | Rural Area |
|-------------------|---|
| Taipei, Kaohsiung | Ilan, Keelung, Taoyuan, Hsinchu and Miaoli, Taichung and Nantou, Changhua, Yunlin, Chiayi, Tainan, Pingtung, Hualien, Taitung, Penghu, Chinmen, Lienchiang |

Note. Due to the large examinee population, Taipei is divided into two examination districts – Taipei City and Taipei County. Hsinchu and Miaoli, and Taichung and Nantou are combined to one examination district respectively because of their small population and close geographic region.

The total number of junior high school student enrollment, graduate, and the BCT takers from 2002 to 2007 are listed in Table 3. Although attending senior high school is the most common choice for Taiwanese junior high school graduates to continue their education, some students may consider another way: senior vocational high school or five-year junior college (three years of secondary studies and two years of college work). Unlike normal senior high schools, both vocational high school and five-year junior college place heavily emphasis on practical and vocational skills; that is, they provide students opportunities to acquire entry-level competencies and to become a worker possessing a sound foundation of basic employable skills before leaving school (Ministry of Education of Taiwan, 2000a). Students typically choose a single concentration, such as agriculture, nursing, business, electrical engineering, civil

engineering, or computer science. Vocational school or five-year junior college graduates may also participate in the national university entrance exams. It is not unusual for junior high graduates to select a technical school and proceed to a four year college afterwards. Therefore, students who took entrance exams for vocational school or five-year junior college may not have taken the BCT. The net percentages of junior high school graduates go on advanced educational levels are shown in Table 4.

In Taiwan, students who drop out of school without a junior high school diploma have been an educational concern in the past few years. The reasons might result from students' lower academic self-esteem and social competence, lack of interest in school curricula, drug abuse, peer pressure, and family conflicts (e.g., lax parental discipline, strong parental control, single parent, or financial issues; Chen, 2001; Chen, 2008; Corville-Smith, Ryan, Adams, & Dalicandro, 1998). Missing school is the early symptom and the most potent predictor for students' dropping out of school (Chen, 2001). The total number of dropout and returning students from 2002 to 2007 are listed in the table on p. 58. Due to the lack of a junior high school diploma, some students may not have been qualified to take the BCT. On the other hand, some graduates might have stopped their education and started working after graduating from junior high school due to financial difficulties. Therefore, those reasons indicated above may be why some Taiwanese Grade Nine students who not take the BCT.

Table 3. Total Number of Junior High School Student Enrollment and BCT Takers from 2002 to 2007

| Year | 7 th Grade | 8 th Grade | 9 th Grade | Graduate | BCT Taker | |
|------|-----------------------|-----------------------|-----------------------|----------|-----------|----------|
| | | | | | English | Mandarin |
| 2002 | 316,676 | 316,596 | 302,466 | 300,235 | 296,315 | 296,611 |
| 2003 | 325,943 | 316,072 | 314,808 | 313,549 | 307,601 | 308,249 |
| 2004 | 317,936 | 324,765 | 314,584 | 312,973 | 311,796 | 312,173 |
| 2005 | 316,398 | 317,215 | 323,314 | 321,397 | 319,584 | 320,210 |
| 2006 | 319,666 | 315,538 | 316,032 | 314,528 | 314,126 | 314,657 |
| 2007 | 318,056 | 319,642 | 314,944 | 314,010 | 312,771 | 312,506 |

Note. Resources retrieved from the Ministry of Education of Taiwan (2008a).

Table 4. Percentages of Junior High School Graduates Entering Advanced Educational Levels

| Year | Percentage (%) |
|------|----------------|
| 2002 | 95.48 |
| 2003 | 95.74 |
| 2004 | 96.03 |
| 2005 | 94.88 |
| 2006 | 96.23 |
| 2007 | 95.35 |

Note. Senior high school, senior vocational school, and five-year junior college are considered the advanced level for junior high school graduates in Taiwan. Resources retrieved from the Ministry of Education of Taiwan (2008a).

The participants were chosen for the following reasons: First, the purpose of the study was to examine the relationship between academic examination achievement in L1 and L2. Furthermore, with at least three years formal English training, the students in grade nine should have learned a certain amount of English knowledge, and also would have had many opportunities to read English. Under these conditions, we were able to examine the criterion of Cummins' linguistic interdependence hypothesis. No previous studies had ever examined the education differences and language learning in Taiwanese junior high schools. Thus, Taiwanese Grade Nine students were chosen as the target participants for this study. An analysis of these EFL students' performance provided the researcher with sufficient data to explore their reading ability transfer between L1 and

L2. Among the participants, returning junior high school students listed in Table 5 might also have been included since the data were randomly selected. However, the advanced information was unknown in this study.

Table 5. Total Number of Dropout and Returning Junior High School Students in Taiwan

| Year | Dropout | Returning to School |
|------|---------|---------------------|
| 2002 | 9,464 | 6,254 |
| 2003 | 9,595 | 7,318 |
| 2004 | 8,605 | 5,657 |
| 2005 | 8,168 | 5,786 |
| 2006 | 7,453 | 5,668 |
| 2007 | 6,194 | 4,899 |

Note. Resources retrieved from the Ministry of Education of Taiwan (2008a).

In addition to test scores in L1 and L2, every participant's official length of L2 exposure, gender, and school districts were included and applied in this study analysis. As indicated earlier, the new English educational policy altered the beginning of English learning from the grade five in 2001 and then from the third grade starting in 2005. Therefore, the 30,000 participants were divided into six groups starting in the year where

the BCT was implemented. The amount of time exposed to formal instruction in L2 for each group was distinguishable in Table 6.

In general, the English part of the BCT has 45 multiple questions, including 25 fill-in-the-blank vocabulary and grammatical conceptions, 20 reading comprehension questions, while Chinese part of the BCT exam has 48-50 multiple-choice questions consisting of notions of Chinese characters, grammar, and reading comprehension in both *Baihua* (Vernacular) and *Wenyen* (Classical) Chinese literature. Both Mandarin Chinese and English subjects last approximately 60 minutes, respectively.

Table 6. Descriptions of Participants Formed into Six Groups

| Group | Year of Officially L2 Started Learning | Started Grade | BCT Year | Length of Time in L2 Learning Test Taken (years) |
|-------|--|-----------------|----------|--|
| 1 | 1999 | 7 th | 2002 | 3 |
| 2 | 2000 | 7 th | 2003 | 3 |
| 3 | 2001 | 7 th | 2004 | 3 |
| 4 | 2001 | 6 th | 2005 | 4 |
| 5 | 2001 | 5 th | 2006 | 5 |
| 6 | 2002 | 5 th | 2007 | 5 |

Instruments

English Vocabulary and Grammar

The fill-in-the-blank grammatical conception test consisted of four items on each question. The participants were expected to provide the best answer for the target grammar/word in the blank. A sample question is “Lucy looks _____ in pants than in a dress (pretty, prettily, prettier, or the prettiest).” In this example, the anticipated choice for the question is “prettier.”

English Reading Comprehension

Several short paragraphs are provided and then questions are asked to test reading comprehension of the excerpt. Once participants finished each assigned paragraph, their reading skills are identified based on the responses to those questions. In other words, the test results are considered a measurement of the participants’ reading capacity and vocabulary knowledge.

Vernacular and Classical Chinese

In contrast with Vernacular Chinese, a style of written and spoken Chinese based on Modern Mandarin (Standard Mandarin), Classical Chinese (also called Literary Chinese) is a traditional style of Chinese based upon the vocabulary and grammar used in ancient Chinese which is different from any spoken forms of Modern Chinese (Hung, 1980; Tsao, 1999). Before the 1920’s, Classical Chinese was the style of Chinese widely spoken and written among native-Chinese speakers.

Hsia (1988) stated that the form of Classical Chinese appears to be extremely terse and concise compared to Vernacular Chinese and some uses of vocabulary are different.

In a Classical Chinese article, for instance, few Chinese characters might be used versus Vernacular Chinese, even though the general sense of the writing remains the same. Although Classical Chinese is rarely used now, many historic works of literature in Classical Chinese are culture-oriented. In order to understand Chinese culture and history, the ancient style of Chinese is still taught as part of the junior and senior high school curricula in Chinese class and is part of the BCT and college entrance examinations. According to Tsao's (1999) statement, the ratio of Modern Chinese and Classical Chinese proportion in school textbooks was eight to two at the seventh grade level and the proportion of Classical Chinese increases gradually through the high school education. Classical Chinese is taught primarily by presenting a classical Chinese work and including a glossary in Vernacular Chinese that explains the meaning of the vocabulary and phrases. The questions of Classical Chinese are essentially translation exercises where examinees are asked to choose the correct expression of the meaning of a paragraph in Vernacular Chinese.

Variables

Outcome Variable

English Reading Comprehension: Academic achievement in L2 was measured via the BCT designated by the National Taiwan Normal University. Scores were obtained from the test.

Key Predictor Variable

Mandarin Reading Comprehension: L1 performance was measured via the BCT as well

as scores were obtained from the test.

Control Variables

Amount of Time in L2 Exposure: Group 1, 2, and 3 had three year of official L2 exposure, Group 4 had four years of L2 learning, and Group 5 and 6 had learned the L2 for five years by the time they took the test (see Table 3.2).

Gender: Gender was identified by 1 = male and 2 = female.

School District: School districts were originally collected by 1 = Taipei City, 2 = Taipei County, 3 = Ilan, 4 = Keelung, 5 = Taoyuan, 6 = Hsinchu and Miaoli, 7 = Taichung and Nantou, 9 = Yunlin, 10 = Chiayi, 11 = Tainan, 12 = Pingtung, 13 = Kaohsiung, 14 = Hualien, 15 = Taitung, 16 = Penghu, 17 = Chinmen, and 18 = Lienchiang. Because school district in this study refers to the size of city, two municipalities (No. 1, 2, and 13 on the table on p. 54) are coded as urban areas and the rest of areas are considered to be rural areas (Ministry of Education of Taiwan, 2000b). Thus, the scale form is further described as 1 = urban area and 2 = rural area.

Procedures

The secondary data was obtained via an application process to the Committee of the Basic Competence Test for Junior High School Students, a government unit comprised by the Ministry of Education in Taiwan, Department of Education of Taipei City Government, and Education Bureau of Kaohsiung City Government. The test is administered by the National Taiwan Normal University and they take responsibility of the administration of the BCT and the collection and tabulation of the examination

results. After The Committee of the Basic Competence Test for Junior High School Students approved the application request for data, the researcher received approval from the Internal Review Board (IRB) as well to utilize the data for research purposes. This quantitative study used the nationwide standardized examination. Tests are in two subject areas: Chinese and English. A random sample of 5,000 examinees drawn each year from 2002 to 2007 was employed to carry out this research; thus, overall participants for this study included 30,000 Taiwanese ninth graders who learned English in an EFL setting and whose L1 (Mandarin Chinese) differs greatly from their L2 (English). The purpose was to examine the cross-linguistic relationships and the reading ability transfer between L1 and L2, as well as the ability to predict outcomes in L2 using L1 indicators.

Data Analysis

As noted previously, the five research questions are as follows:

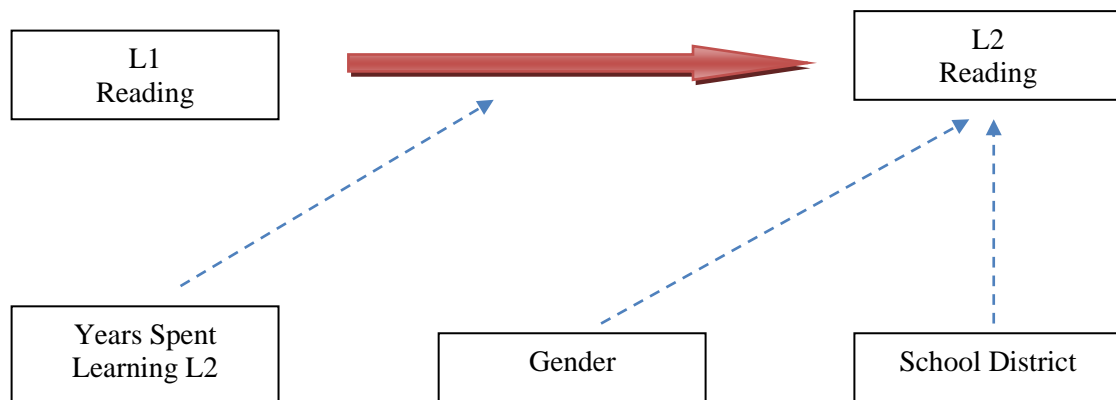
1. What is the degree of association between L2 reading, L1 reading, gender, and school district?
2. To what extent does L1 language reading competence predict L2 reading ability in academic settings?
3. How do students' gender and school district predict L2 reading ability?
4. To what extent does L1 language competence predict L2 language reading comprehension ability when all other predictor variables are considered?

5. Does time in L2 exposure change the effect of L1 reading competence on L2 reading ability?

Measures of central tendency and variance will be calculated for the 9th graders' Chinese and English scores on the BCT. Because the data were across six different years and the examination questions were different every year, all raw scores were transformed to standardized scores. The Pearson Product Moment Correlation (called Pearson's correlation for short), which was used to answer the first research question, was adopted to measure the degree of association between Mandarin Chinese, English reading performance, and other control variables (length of time in English exposure, gender, and school district). A simple linear regression, which was manipulated for the second research question, then was used to model the relationship between two variables by fitting a linear equation to observed data. Mandarin Chinese reading performance was considered to be an explanatory variable and scores in English reading was considered to be a dependent variable. In order to clearly realize the transfer relationship between L1 and L2, a linear regression line was created to examine the function. In general, the goal of a simple linear regression was to find the line that best predicts L2 reading ability from L1 reading competence. Finally, multiple linear regression analyses were applied to find out answers on the third, fourth, and fifth research questions. This calculation allowed the simultaneous testing and modeling of multiple independent variables (L1, gender, school district, and interaction of L2 exposure and L1). Using more than one variable to test hypotheses helped clarify and strengthen the learning capability of L2

(reading ability in L2). Figure 4 displayed the assumptions of relationship among outcome, predictor, and control variables.

Figure 4. Assumptions of Relationship between Individual Variables



Limitation of the Research

The purpose and strength of this research study was to investigate the particular relation of L1 and L2 reading. In addition to providing a huge amounts of data about the ninth graders' BCT results in L1 and L2, the data also provided information regarding whether control variables, length of time in L2 learning, gender, and school district, had significant effects on the cross-language reading transfer. This research had its own boundaries and the study was targeted to understanding the population of junior high school students in Taiwan and their education in L2 learning. Currently in Taiwan, more

and more parents are realizing the importance of English and sending their children to a cram school, where instructors offered additional after-school instruction to enhance students' academic performance. It provided a unique educational context to investigate students' perspectives toward learning and starting learning English at an earlier age (e.g., interview or survey). It was important to note that participants receiving additional English curriculum outside the school, provided students with additional EFL exposure. In other words, every participant in each study group may have had different amounts of actual time in L2 learning, though they have the same amount of L2 exposure in school. Moreover, there have been some examination re-takers were contained each year. However, there was no access to the relevant information; that is, lack of information on bilingual kindergarten or cram school is the major limitation in this study.

CHAPTER IV

RESULTS

Results of the study are presented in this chapter. Language transfer in reading is demonstrated by examining the relationship in reading proficiency, between L1 Mandarin Chinese and L2 English in a study conducted in Taiwan among ninth graders. Analytical results from correlation coefficients, simple linear regression and multiple linear regression analyses are provided to address the research questions stated in the previous chapters. This chapter consists of four parts: (1) Preliminary analyses that include the reliability coefficients of scores on all of examinations used in this study; (2) descriptive statistics of the BCT scores in both English and Mandarin Chinese test subjects and participants' backgrounds related to the BCT; (3) relationships among L1 reading competence, L2 reading ability, and participants' backgrounds related to the BCT; and (4) predictions of L2 reading ability from L1 competence, L2 reading comprehension acquisition from participants' demographic differences, and L2 reading ability in academic settings from L1 competence after controlling for participants' different background information.

Preliminary Analyses

Reliability for each item of the scores in this study was calculated using Cronbach's Alpha (α), considering it showed how well each individual question in a scale correlated with the sum of the remaining questions; that is, it measures

homogeneity among individual items in a scale (Cortina, 1993). Table 7 shows the reliability analyses for the different tests including number of questions in each test.

Table 7. Cronbach's Alpha for English and Mandarin Tests from 2002 to 2007

| BCT Years | English | Mandarin |
|-----------|-----------|-----------|
| 2002 | .944 (45) | .923 (50) |
| 2003 | .964 (45) | .919 (48) |
| 2004 | .965 (45) | .929 (48) |
| 2005 | .964 (45) | .927 (48) |
| 2006 | .965 (45) | .918 (48) |
| 2007 | .967 (45) | .925 (48) |

Note. Number of question items are in parentheses.

Nunnally and Bernstein (1994) declared that reliability scores of .70 is an acceptable reliability coefficient for exploratory purposes and .80 for research purposes. They further stated that a reliability of .90 is the minimum acceptable value in applied settings where important decisions are being made with respect to assessment scores. The reliability analyses for English and Mandarin Chinese reading assessments in this

study are presented from Table B1 to B12 in Appendix B. The Cronbach's alpha for the scores on all assessments were above .90, which was a high satisfactory Cronbach's alpha value. In addition, if alpha-if item deleted values are higher than the Cronbach's alpha for scores on the full scale, the questions (items) are deemed harmful to reliability (Cortina, 1993). No alpha-if-item deleted statistics exceed its alpha level for internal consistency reliability in the study (see Appendix B). Therefore, the reading assessments worked well in all samples of the study, and were considered good scales.

Descriptive Statistics

Before providing the main analytical outcomes related to the research questions, several descriptive analyses were evaluated. All descriptive analyses were conducted using raw scores from a simple sum of questions that students had answered correctly. The descriptive analysis included use of measures of central tendencies and dispersion, which are presented in Table 8, where the results for the test differences between L1 and L2 mean scores in individual groups were also displayed. However, the comparisons of Taiwanese ninth graders' performance on Mandarin Chinese and English examinations in the BCT were not meaningful due to the use of raw scores in this descriptive analysis. In addition, some descriptive statistics were conducted to give a preliminary relationship between other factors, such as gender, school district, and L2 reading scores.

The frequencies and percentages of participants in the three control variables are shown in Table 9. The number of male participants was slightly larger than females in each group and every year there was a smaller participant pool from the urban school districts. Even then the sample is still substantial enough to provide robust statistical measures. Table 10 shows that the means and standard deviations for males and females. In summary, female participants on both English and Mandarin Chinese examinations performed significantly better than males.

School district in this study refers to the size of city, two municipalities (No. 1, 2, and 13 on the table on p. 54) are joined in urban area and the rest of areas are combined to be rural areas (Ministry of Education of Taiwan, 2000b). Thus, the variable is coded as 1 = urban area and 2 = rural area. Means and standard deviations regarding students' English and Mandarin Chinese performance in urban and rural school districts are reported in Table 11. In general, students in urban school districts on both examinations performed significantly better than those in rural school districts.

Table 8. Raw Score Means, Standard Deviations, and the Differences of English and Mandarin Examination Results for All Groups (N = 30,000)

| BCT Year ^a | English | | | Mandarin | | | Corr. ^f |
|-----------------------|--|-------------------|-------------------|--|-------------------|-------------------|--------------------|
| | <i>M^b</i> (<i>SD^c</i>) | Min. ^d | Max. ^e | <i>M^b</i> (<i>SD^c</i>) | Min. ^d | Max. ^e | |
| 2002 | 23.52 (11.59) | 0 | 45 | 32.75 (10.41) | 6 | 50 | .80*** |
| 2003 | 27.63 (13.41) | 0 | 45 | 32.86 (9.78) | 5 | 48 | .78*** |
| 2004 | 27.86 (13.46) | 0 | 45 | 32.61 (10.31) | 0 | 48 | .80*** |
| 2005 | 28.68 (13.25) | 3 | 45 | 32.13 (10.39) | 6 | 48 | .80*** |
| 2006 | 29.39 (13.22) | 0 | 45 | 32.57 (9.7) | 6 | 48 | .78*** |
| 2007 | 29.76 (13.46) | 3 | 45 | 31.25 (10.34) | 3 | 48 | .79*** |

Note. ^an = 5,000 in each year group. ^bMean. ^cStandard deviation. ^dMinimum. ^eMaximum. ^fCorrelation. ****p* < .001, two-tailed.

Table 9. Frequencies and Percentages of Control Variables for All Groups (N = 30,000)

| | Group ^a | | | | | |
|--------------------------------|--------------------|---------------|---------------|---------------|---------------|---------------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Years Spent Learning L2 | 3 | 3 | 3 | 4 | 5 | 5 |
| Gender | | | | | | |
| Male | 2,591 (51.8%) | 2,662 (53.2%) | 2,641 (52.8%) | 2,666 (53.3%) | 2,615 (52.3%) | 2,627 (52.5%) |
| Female | 2,409 (48.2%) | 2,338 (46.8%) | 2,359 (47.2%) | 2,334 (46.7%) | 2,385 (47.7%) | 2,373 (47.5%) |
| School district | | | | | | |
| Urban | 1,990 (39.8%) | 1,988 (39.8%) | 1,989 (39.8%) | 1,905 (38.1%) | 1,968 (39.4%) | 1,978 (39.6%) |
| Rural | 3,010 (60.2%) | 3,012 (60.2%) | 3,011 (60.2%) | 3,095 (61.9%) | 3,032 (60.6%) | 3,022 (60.4%) |
| Total | 5,000 (100%) | 5,000 (100%) | 5,000 (100%) | 5,000 (100%) | 5,000 (100%) | 5,000 (100%) |

Note. Percentages are in parentheses.

^an = 5,000 in each group.

Table 10. Raw Score Means, Standard Deviations, and the Differences between Genders in English and Mandarin

Results for All Groups (N = 30,000)

| Group ^a | English | | | | Mandarin | | | |
|--------------------|---------------|---------------|-----------|-----------------|---------------|---------------|-----------|-----------------|
| | Male | Female | <i>t</i> | ES ^b | Male | Female | <i>t</i> | ES ^b |
| | <i>M (SD)</i> | <i>M (SD)</i> | | | <i>M (SD)</i> | <i>M (SD)</i> | | |
| 1 | 21.9 (11.59) | 25.28 (11.34) | -10.42*** | .30 | 31.64 (10.64) | 33.94 (10.02) | -7.87*** | .23 |
| 2 | 25.47 (13.6) | 30.1 (12.75) | -12.43*** | .36 | 31.6 (10.09) | 34.29 (9.2) | -9.86*** | .29 |
| 3 | 25.89 (13.76) | 30.06 (12.75) | -11.12*** | .33 | 31.13 (10.66) | 34.26 (9.64) | -10.91*** | .32 |
| 4 | 26.3 (13.45) | 31.4 (12.49) | -13.91*** | .41 | 30.8 (10.67) | 33.65 (9.83) | -9.83*** | .29 |
| 5 | 27.33 (13.56) | 31.65 (12.46) | -11.73*** | .35 | 31.4 (9.93) | 33.85 (9.27) | -9.04*** | .26 |
| 6 | 27.63 (13.76) | 32.12 (12.7) | -11.99*** | .35 | 30.13 (10.73) | 32.5 (9.74) | -8.21*** | .24 |

Note. ^an = 5,000 in each group. ^bEffect size.

****p* < .001, two-tailed.

Table 11. Raw Score Means, Standard Deviations, and the Differences between School Districts in English and Mandarin Results for All Groups (N = 30,000)

| Group ^a | English | | | | Mandarin | | | |
|--------------------|---------------|---------------|----------|-----------------|---------------|---------------|----------|-----------------|
| | Urban | Rural | <i>t</i> | ES ^b | Urban | Rural | <i>t</i> | ES ^b |
| | <i>M (SD)</i> | <i>M (SD)</i> | | | <i>M (SD)</i> | <i>M (SD)</i> | | |
| 1 | 28.86 (11.86) | 22.88 (11.02) | 9.51*** | -.54 | 37.22 (9.82) | 32.66 (10.01) | 8.46*** | -.46 |
| 2 | 31.82 (12.61) | 27.31 (13.21) | 6.43*** | -.34 | 35.58 (8.73) | 33.16 (9.43) | 5.12*** | -.26 |
| 3 | 33.72 (12.18) | 26.57 (13.09) | 10.49*** | -.55 | 37.14 (8.51) | 32.45 (10.26) | 9.29*** | -.46 |
| 4 | 34.17 (12.23) | 28.52 (12.89) | 8.11*** | -.44 | 36.51 (9.12) | 32.16 (10.19) | 8.17*** | -.43 |
| 5 | 34.69 (11.8) | 28.42 (13.22) | 9.21*** | -.47 | 36.37 (8.51) | 32.06 (9.57) | 8.81*** | -.45 |
| 6 | 34.83 (12.03) | 29.03 (13.24) | 8.28*** | -.44 | 35.45 (9.26) | 30.71 (10.33) | 8.74*** | -.46 |

Note. ^an = 5,000 in each group. ^bEffect size.
 ****p* < .001, two-tailed.

In this study, the data spanned a six-year time period (2002-2007) and examination questions were different each year. Therefore, it was important to apply standardized scores for analysis, rather than using raw data that were not consistent across the six-year timeframe. According to Thompson (2006), the purpose of using standardized scores is “to integrate results across studies in order to derive a meaningful comparison” (p. 71) and to provide a way to standardize or equalize different metrics (e.g., English and Mandarin Chinese tests). Without standardized scores it is difficult to make comparisons. The most frequently used standardized score is the z -score (Thompson, 2006), which represents both the relative position of an individual score in comparison to the mean and variation of the group scores in the distribution. Each z -score comes from a distribution with the same mean “zero” and the same standard deviation “one”. Therefore, scores of the reading tests in English and Mandarin Chinese were transformed into z -scores for the following statistical analyses.

Bivariate Correlation Analyses

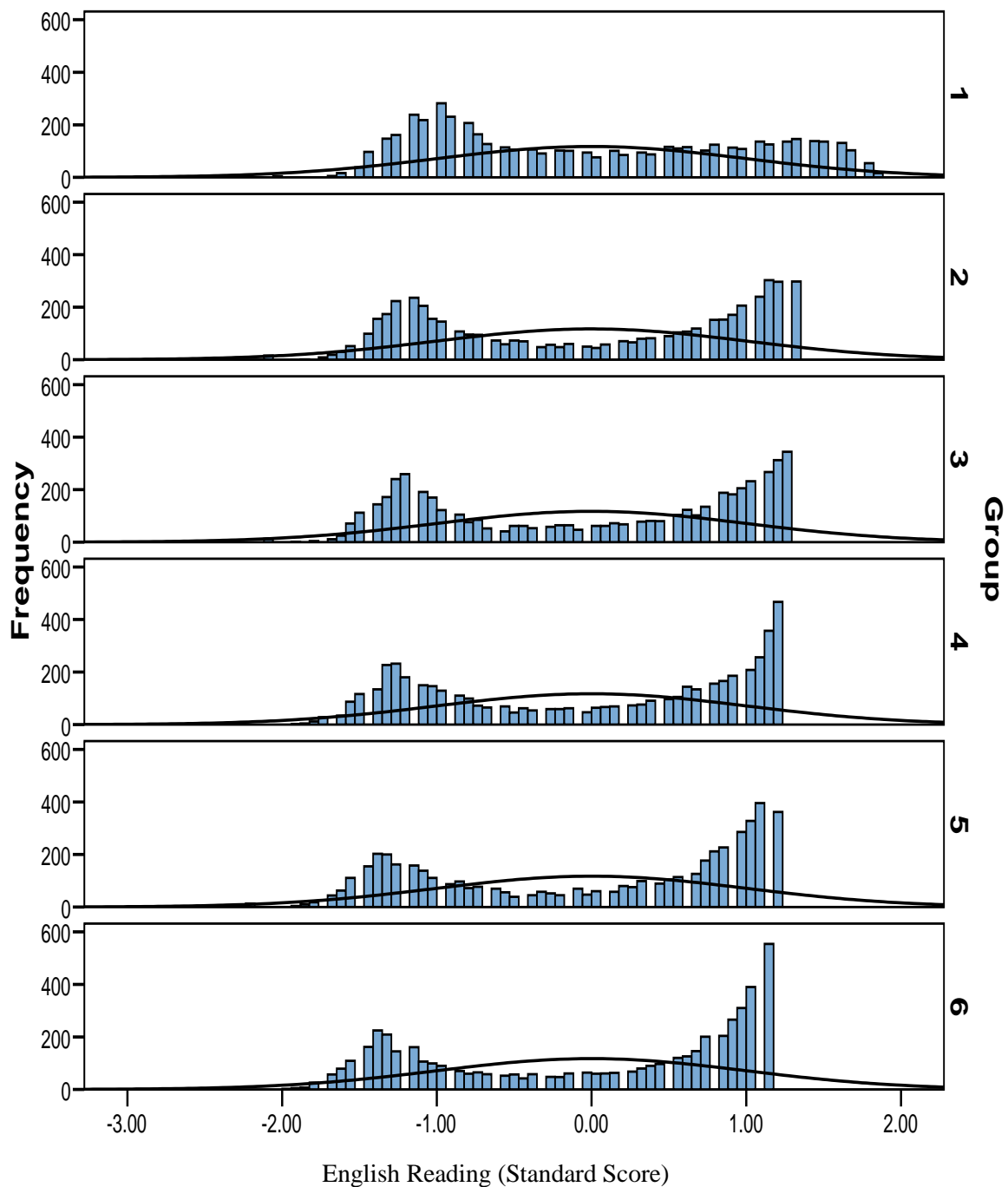
Relationships between Individual Variables

The accuracy of correlations involving two variables requires: (1) the variables are normally distributed; (2) the variables should be linearly related; and (3) the variables are independent. To ensure that none of these assumptions were violated, score distributions for the two reading tests are examined as displayed in Figure 5 and Figure 6. Scores on both English and Mandarin Chinese reading tests in the series of six-year data were shown to be normally distributed. To find the correlations among all variables

in this study, a Pearson's product-moment correlation coefficient was calculated. Table 12 presents the bivariate correlations among three controlled variables (gender, school district, and number of years studying L2) as well as Mandarin Chinese and English reading measures.

The value of the correlation coefficient (r) between overall scores of the Mandarin Chinese reading test and the English reading comprehension test was .793 ($p < .001$). As seen in Table 12 the control variables, except the length of time in L2 learning, were found to significantly correlate with the two language reading measures. For example, gender was significantly and positively correlated with both L1 and L2 reading performance but the correlation coefficient was positive but weak ($r = .130$ and $r = .166$, respectively, $ps < .001$), that is, girls tended to perform better than boys on both reading exams. School district had a significant but negative association with both the L1 reading competence ($r = -.074$, $p < .001$) and L2 reading ability ($r = -.072$, $p < .001$) (the variable codes: 1 = urban; 2 = rural). In other words, rural districts did less well than urban districts on the two examinations. However, the correlation between years spent in learning L2 and English reading ability was unable to be measured due to the use of standard scores and no students within a group varying by years in L2 exposure.

Figure 5. Distribution of BCT English Reading Scores in Six Groups



Note. The distribution of Taiwanese students' English ability is too broad. Some students answered the questions by guessing because they gave up learning the foreign language. In addition, students in urban school districts or high socio-economic status were able to obtain more learning resources and materials. Thus, the bimodal distributions in English reading still should be seen as normal distribution (Chou, 2002; National Taiwan Normal University, 2007).

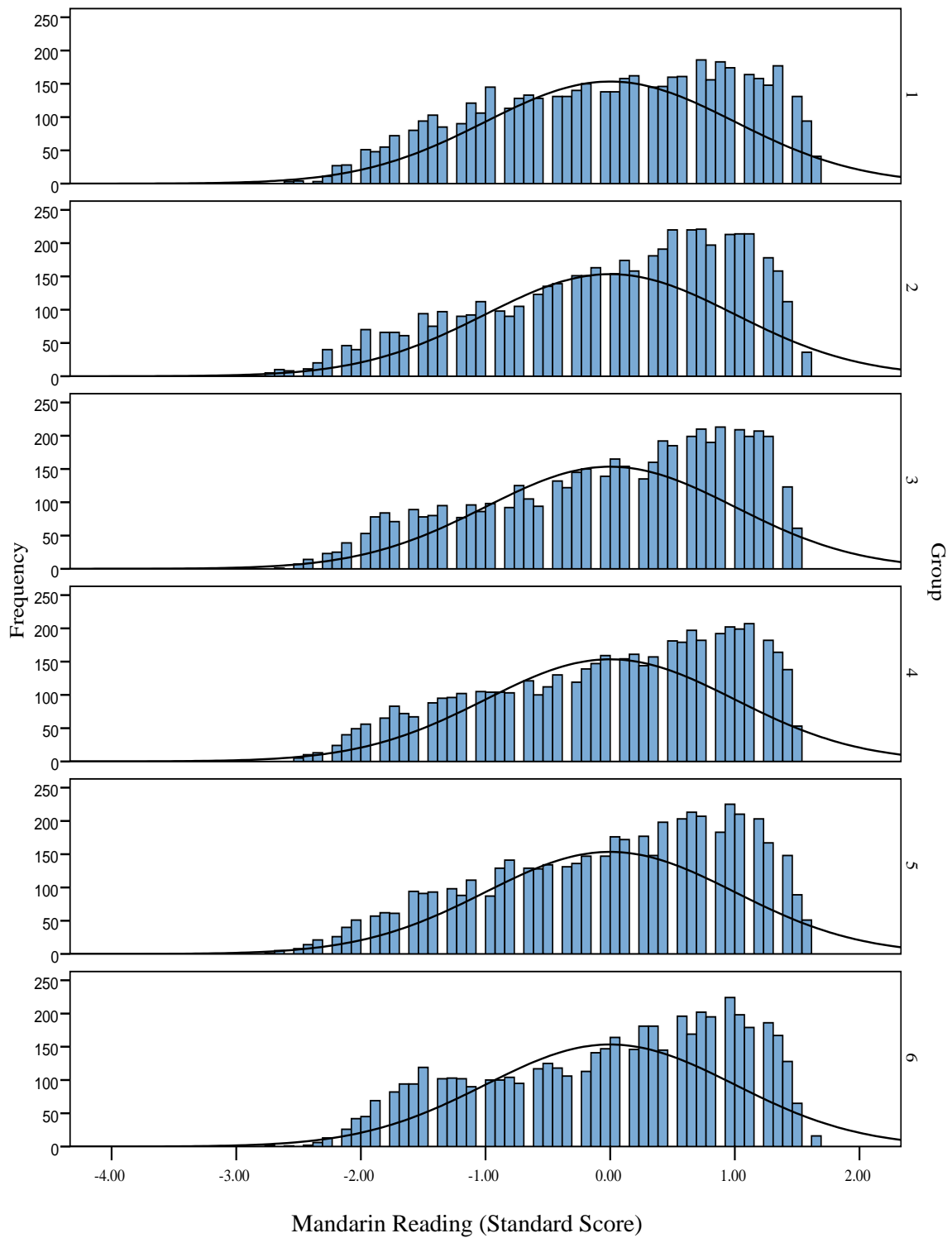
Figure 6. Distribution of BCT Mandarin Reading Scores in Six Groups

Table 12. Correlations among All Variables

| Variable | 1 | 2 | 3 | 4 |
|-------------|----------|----------|------|-----|
| 1. English | --- | | | |
| 2. Mandarin | .793*** | --- | | |
| 3. Gender | .166*** | .130*** | --- | |
| 4. District | -.072*** | -.074*** | .004 | --- |

*** $p < .001$, two-tailed.

Partial Correlation between Mandarin and English Reading

Partial correlation analysis is necessary when considering relationships in a linear form when there are more than two variables (Strauss, 1981). In order to avoid overstating or understating the true relationship between L1 and L2 reading ability, variables such as gender and school district may influence the other two variables under comparison, hence a partial correlation analysis was conducted (Table 13). The correlation coefficient between Mandarin Chinese reading competence and English reading ability was found to be .788. That suggested a significantly strong and positive cross-language transfer relationship between Mandarin Chinese- and English-reading comprehension acquisition when controlling for students' demographic differences.

Table 13. Partial Correlation between English and Mandarin Reading Ability

| Variable | 1 | 2 |
|-------------|---------|-----|
| 1. English | --- | |
| 2. Mandarin | .788*** | --- |

*** $p < .001$, two-tailed.

Linear Regression Analyses

In this part, three sets (models) of regression analyses were performed to identify variables predictive of L2-English reading performance. The unstandardized regression coefficient (b) of the independent variable is the slope of the regression line, which gives the relationship between dependent and independent variables (predictor or regressor variables). On the other hand, because the variance of an independent variable is affected by the magnitude of the unstandardized regression coefficient, the standardized regression coefficient (β) is usually used when the variance is standardized. Standardized coefficients are interpreted as “how many standard deviations the dependent variable changed for an increase of one standard deviation in a particular independent variable” (Allison, 1999, p. 85). As a consequence, all standardized coefficients were in the same metric, and a comparison of coefficients across different variables became more valid. However, standardized regression coefficients were not used in the analyses because both reading test scores had already been transformed into standard scores (z scores)

before conducting regression analyses. Hence, b value for Mandarin Chinese reading scores was the same as β for Mandarin Chinese reading scores. The values of other predictor variables such as gender, school district, and the length of time in English learning were unable to be standardized, due to their dichotomous nominal form.

Simple Linear Regression Analysis of Cross-Language Prediction in Reading

As bivariate correlation results indicated, reading ability was highly correlated across languages from L1 to L2 in Taiwanese Grade-nine students because a significant correlation was observed between Mandarin Chinese and English reading abilities. To evaluate the relationship in cross-language reading proficiency, a simple linear regression analysis was done to explain and predict the value of a dependent variable from a prime independent variable. Muijs (2004) stated that regression modeling is useful when there is a linear relationship between variables of interest. Thus, other predictor variables such as participants' background variables were not included in this analysis.

The table on p. 85 reports the four sets of linear regression conducted for evaluating English reading acquisition. Model 1 demonstrated that, without controlling for other factors, every one standard deviation difference in Mandarin Chinese reading score corresponded to a .793 of a standard deviation difference in English reading score ($R^2 = .628$, $F(1, 29,998) = 50,729.53$, $p < .001$). The high R^2 indicates that scores from Mandarin Chinese reading tests were positively and significantly accounted for 62.8% of the performance in the English reading test (the figure on p. 86). Normally a large F with a small p -value, like the results in this study, referred to strong evidence to state that

there was a general relationship between the outcome and predicting variables (Allison, 1999).

Multiple Linear Regression Analyses Cross-Language Prediction in Reading

Unlike the single independent variable in the simple regression analysis, more than one independent variable was included in the multiple regression analysis (Allison, 1999; Howell, 2009; Shieh, 2006). Two sets of multiple linear regression analyses were performed to explore the relationships between the dependent variable and the predictor variables.

In Model 2 of the table on p. 85, participants' background factors such as gender and school district were included to establish their effects on L2-English reading performance. The relationship between English reading ability and a combination of the independent variables was significant at the .001 level and the F -value was also significant ($R^2 = .033$, $F(3, 29,996) = 338.26$, $p < .001$). Although predictions of the background variables were statistically significant, these two variables accounted for only 3.3% of the variance in English reading ability.

Results in Model 3 showed that the background variables and Mandarin Chinese reading ability together accounted for 63.3% of the variance in English reading scores ($R^2 = .633$, $F(4, 29,995) = 12,914.05$, $p < .001$). The combination of all independent factors contributed an additional 0.5% and 60% of the variance in L2 reading achievement beyond what was accounted for by only L1 reading competence or by participants' background variables, respectively. Overall, the L1-Mandarin Chinese

reading comprehension, participants' gender, and their school district played a small role in L2-English reading acquisition.

By concluding the discussions of regression equation, one important and interesting point should be made. For language transfer to occur, some level of L2 proficiency must be achieved; however, the information with respect to students' L2 proficiency level is unknown in this study. For EFL students who learn the L2-English in a setting have few opportunities for L2 exposure outside of class, length of L2 exposure would be a proxy for L2 proficiency. This study assumed that more time studying English could result in a stronger effect of L1 reading on L2 reading; that is, with more exposure to English, more of a student's reading knowledge and strategies might be able to transfer to L2. Therefore, in the fourth set of regression analyses in this study, an interaction term was created by multiplying L1 reading competence by length of time in L2 exposure to see whether the effect of students' L1 reading competence on L2 reading capacity varied across different length of time in L2 learning. However, the result showed that the amount of time in L2 learning did not change the influence of L1 reading competence on L2 reading ability (Model 4 in Table 14). The reasons may be that either all the students had reached a minimum level of L2 proficiency needed for transfer of L1 skills, or that the relationship between L1 and L2 reading did not vary, even when time studying L2 varied.

On the basis of simple regression analysis (see Model 1 in Table 14), the study provided the formula of their interrelationship as follows:

$$\text{L2 reading} = .793 * (\text{L1 reading})$$

The regression values displayed that L1-Mandarin Chinese reading competence was a strong contributor on L2 reading skill level: A 1% increase in Mandarin Chinese reading ability would result in a .793% increase in L2 reading competence level. However, based on Table 13, 38% of English reading ability could not be explained by the main variable - Mandarin Chinese reading competence alone. To find out other factors which might affect L2 readers' English reading capability, participants' background information were investigated. Analyses found that gender and school district to reading English had some degree of influence on L2 reading ability. Their inter-relationship formula was refined to:

$$\text{L2 reading} = -0.144 + .792*(\text{L1 reading}) + .129*(\text{gender}) - .029*(\text{school district})$$

The final model was displayed in the figure on p. 87. Because the interaction between gender and school district was not statistically significant and the difference in L2-English reading capacity between each group (e.g., males in urban area, males in rural area, females in urban area, and females in rural areas) was extremely small, the four parallel lines were very close. Therefore, only the largest number of group, males participants in rural area, was represented ($n = 9,549$) in this figure. The criterion could also be used in Figure 7.

In general, this result is consistent with Haynes and Carr's (1990) finding, in which the reading proficiency transfer between Mandarin Chinese and English languages existed in EFL setting. However, they focused on college-level EFL students instead of junior high school age adolescents. Thus, the finding of this study has increased the range of age difference in reading ability transfer to younger EFL learners.

Table 14. Coefficients from the Linear Regression of English Reading Ability on Selected Predictor Variables (N = 30,000)

| Independent Variables | Model 1 | Model 2 | Model 3 | Model 4 |
|--|---------------------|---------------------|---------------------|----------------------|
| Intercept | 3.35E-7 (0.00) | -.255 (-7.84) | -.144 (-7.21) | -.144 (-6.61) |
| Mandarin Reading | .793*** (225.23) | | .783*** (221.32) | .792*** (51.54) |
| Gender ^a | | .333*** (29.24) | .129*** (18.23) | .129*** (18.22) |
| School District ^b | | .015*** (-12.75) | -.029*** (-3.99) | -.029*** (-3.99) |
| Length of Time in L2 Learning | | .001 (0.14) | .00001 (0.06) | -3.7E-005 (-.009) |
| Mandarin Reading * Time in L2 Exposure | | | | -.002 (-0.57) |
| R | .793 | .181 | .795 | .795 |
| R ² | .628 | .033 | .633 | .633 |
| Adjusted R ² | .628 | .033 | .633 | .633 |
| σ^c | 0.610 | 0.983 | 0.606 | 0.606 |

Note. Metric coefficients are reported; *t*-values are in parentheses.

^a1 = male, 2 = female. ^b1 = urban school district, 2 = rural school district. ^cStandard error of estimate.

****p* < .001, two-tailed.

Figure 7. Scatter Plot Depicting the Relationship between English Reading and Mandarin Reading Scores

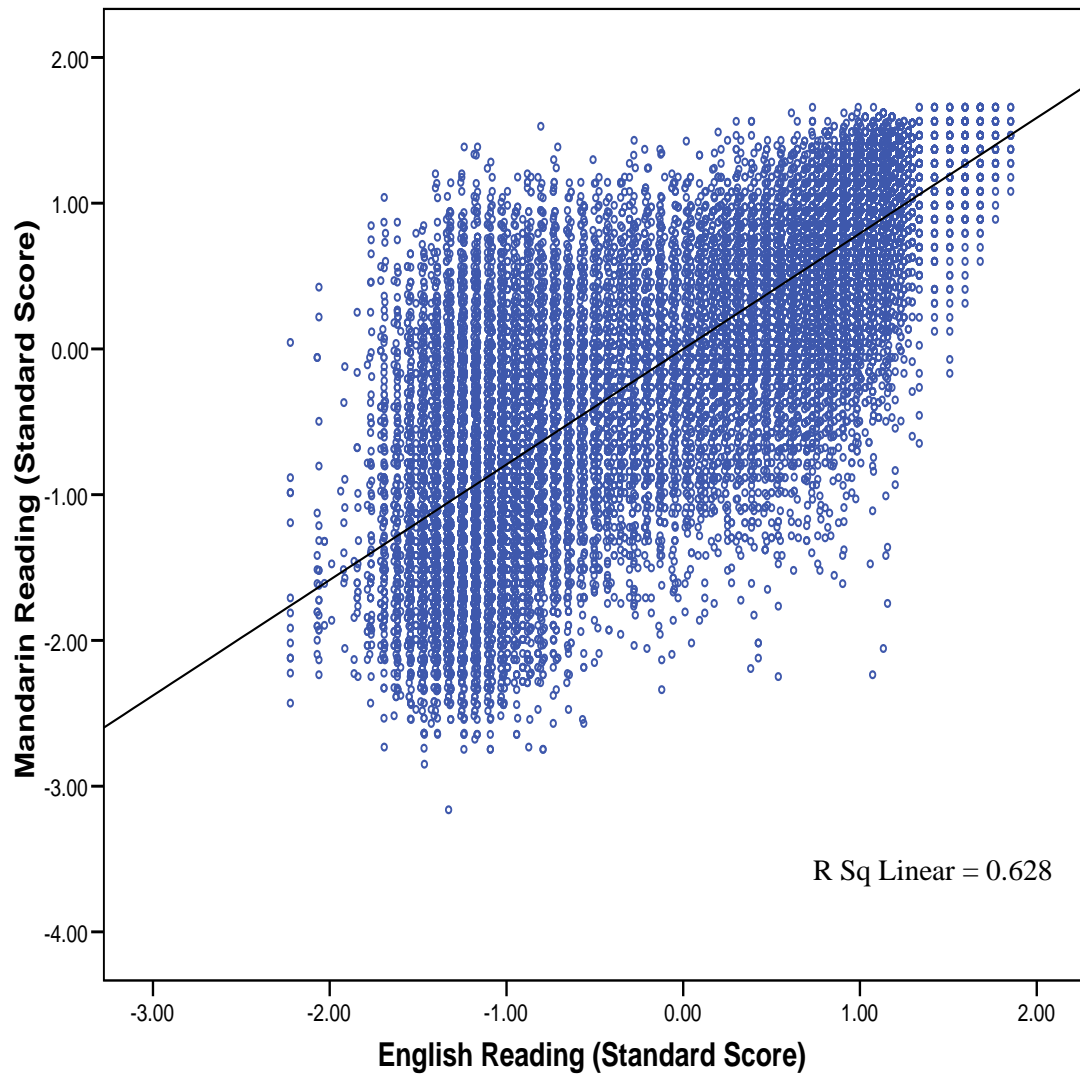
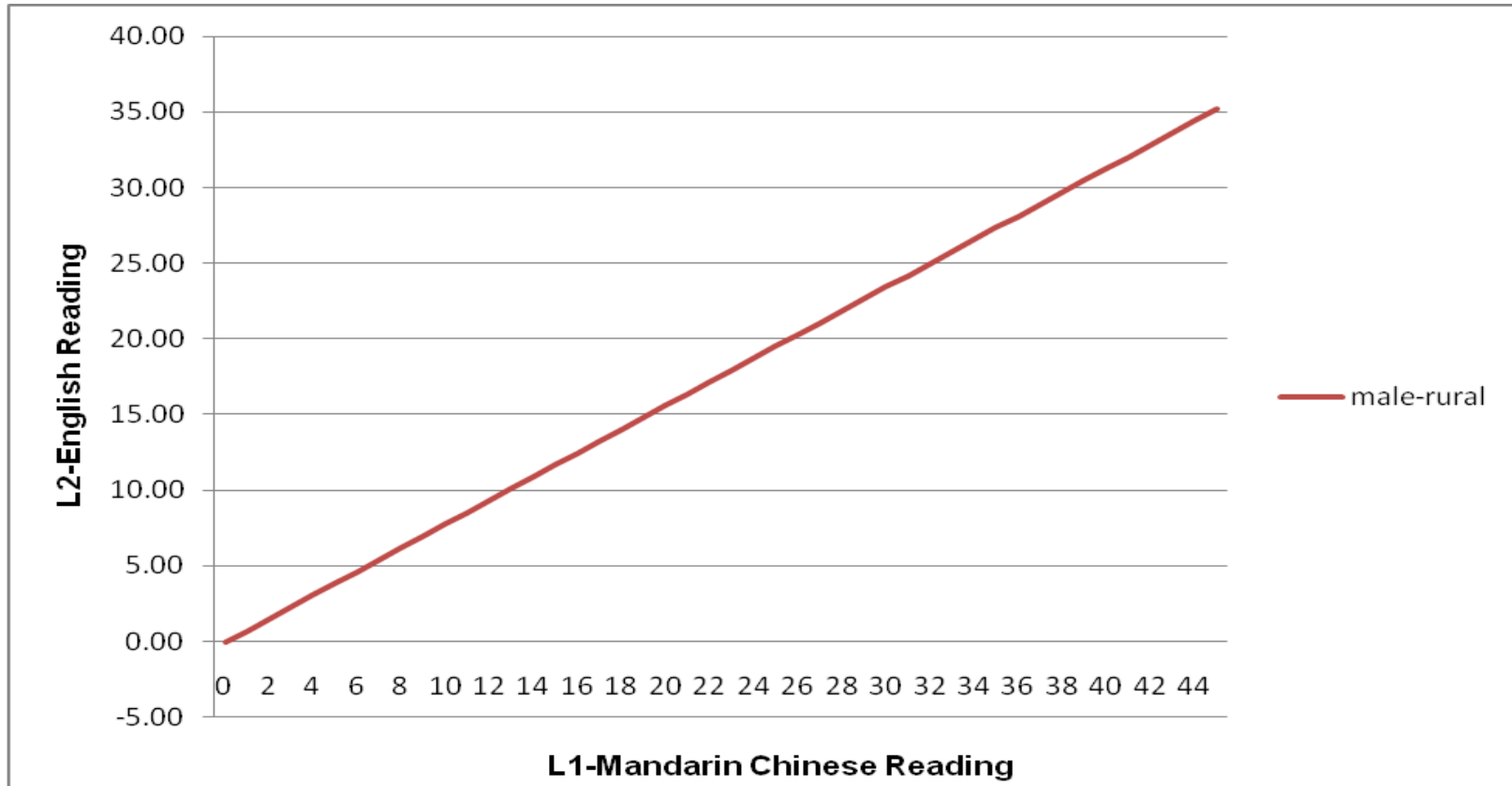


Figure 8. English Reading Score Predicted by Mandarin Chinese Reading Score, Controlling for Gender and School District (n= 9,549)



Note. Equation: Predicted L2-English reading = [-.144 + .792*L1-Mandarin Chinese reading + .129*Gender - .029*School district].

Unlike the correlation coefficient, a coefficient of determination (R^2) can explain how an independent variable predicts a certain proportion of the dependent variable. Adjusted R -Square (Adjusted R^2) is a modification of R^2 that adjusts for the number of predicting factors in a model (Kahane, 2008). The formula for Adjusted $R^2 = 1 - ((1 - R^2) * (N - 1) / (N - k - 1))$. Thus, when the number of observations (N) is large and the number of predictors (k) is small, there will be a smaller or no difference between R^2 and adjusted R^2 because the ratio of $(N - 1) / (N - k - 1)$ will be much closer to or equal to one. Conclusively, due to large number of participants ($N = 30,000$) in this study, the R^2 and Adjusted R^2 were the same (see Model 1-4 in Table 14).

In order to check if the linear regression models were reasonable fits and if possible assumption violations and outliers may have affected the results, residuals and influence statistics were examined. No problems were measured with the assumptions of the regression analyses; that is, the residuals were normally distributed at each level of English reading ability and constant in variance across levels of L2 reading capacity (e.g., Cook's Distance ≈ 0). Thus, the final model was displayed in Figure 8.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Language transfer has been supported by Cummins' linguistic interdependence hypothesis (1979, 1980, 1981). The current study aimed to investigate whether the level of L1 reading competence could impact the acquisition of L2 linguistic reading capability. The hypothesis proposed the transfer of L1 reading competency to L2 reading ability. Since then, the hypothesis remains controversial. Researchers have attempted to determine whether the hypothesis better explains the interdependence between L1 and L2 reading capabilities (Yamashita, 2002c).

In general, the linguistic interdependence hypothesis has been largely supported by research studies (Bernhardt & Kamil, 1995; Bossers, 1991; Taillefer, 1996; van Gelderen, Schoonen, Stoel, de Glopper, & Hulstijn, 2007; Yamashita, 2002a, 2002b) which provided evidence that L1 linguistic knowledge plays an influential role in the development of corresponding abilities in L2 with the implication that students with better-developed L1 reading skills will acquire reading abilities in L2 faster than someone with less well-developed L1 reading skills. Accordingly, higher-level L1 readers demonstrated higher L2 reading skills, whereas lower-level L1 readers showed lower L2 reading skills. Koda (1993) stated that a child's L1 level of competence was the fundamental part in his/her L2 reading. Simply put, if a child acquired a higher level of L1 reading competence, he/she was more likely to develop a higher level of L2 reading ability.

The current study sought to address the role of L1 reading competence in the cross-language transfer to acquire L2 reading ability. Although literatures have reported the cross-language transferring relationship between L1-Mandarin Chinese and L2-English reading processes, it lacked studies with readers at junior-high-school age whose L1 and L2 orthographic systems were sharply different in an expanding-circle country (Crystal, 2003; McKay, 2002) where English was studied as a foreign language.

Students' reading abilities in Taiwanese junior high schools' academic setting were investigated to determine the differences in the reading performance between Mandarin Chinese (L1) and English (L2) languages. Thirty thousand students included in this study were randomly selected from a pool of national standardized examination participants who were involved in a consecutive six-year period. L1 corresponded to Mandarin Chinese reading scores, while L2 referred to English reading scores in the BCT. All the students received literacy instruction in L1-Mandarin Chinese from the first grade level whereas L2-English was officially introduced based on the year of group: English instruction began at the seventh grade level before 2001 and at the fifth grade beginning in 2001.

Summary and Conclusions

This study was conducted to address two main research questions: (1) what is the relationship between L1-Mandarin Chinese reading competence and L2-English reading ability; (2) what is the degree of predictability of L2 reading capability based on L1's reading competence. Many studies demonstrated that L2 reading ability relied on the L1

reading ability which supported Cummins' linguistic interdependence hypothesis (Bernhardt & Kamil, 1995; Carlisle, Beeman, Davis, & Spharim, 1999; Cummins, 1979, 1981, 1991; Hardin, 2001; Haynes & Carr, 1990; Jiménez, Garcia, & Pearson, 1996; Koda, 1993; Wakabayashi, 2002; Wang, Cheng, et al., 2006; Yamashita, 2002a, 2002b). Current study results further supported previous findings on the linguistic interdependence hypothesis. Taiwanese ninth grade students' L1 competence showed a significant association with their L2 reading ability in academic settings whereas some students' background factors might also have partially contributed to L2 learning capacity. In addition, students' L1 reading competence and gender were found positively correlated with L2 reading competence while school district had a negative relevance in L2 learning. It also suggested that students with a higher Mandarin Chinese reading ability would have a higher probability to acquire L2 reading comprehension. Furthermore, female students and those in urban schools were more likely to achieve higher both L1 and L2 reading scores.

Among junior-high-school aged students in Taiwan, their Mandarin Chinese (L1) reading score was a major predictor of the English (L2) reading score in addition to other factors such as gender and school district. Simply put, a Taiwanese student's English reading ability was significantly correlated with his/her Mandarin Chinese reading mastery. Literature review revealed the existence of cross-language transfer (Bernhardt & Kamil, 1995; Carlisle, Beeman, Davis, & Spharim, 1999; Cummins, 1979, 1981, 1991; Yamashita, 2002a, 2002b, 2007). In Yamashita's study (2002a), she compared EFL readers with different reading proficiency levels in their L1-Japanese and L2-

English, and revealed that L2 readers with a higher L1 reading ability were able to achieve a better L2 reading ability. Therefore, poor L1 reading skills led language learners to poorly acquire L2 capabilities.

To investigate the effect of years spent in English learning on the English reading ability, this study divided participants into six groups based on their length of time in English exposure and inspected the differences of relationships between the amount of time in English learning and English reading ability among the different length of time in English learning. Because participants, though participants across groups were varied by studying time in L2, within each group did not have different amount of time in L2 learning, and also the raw scores were standardized, the L2 exposure variable was unable to be considered a predictor of L2 reading ability. In addition, for the occurrence of transfer, time in L2 exposure was substituted for L2 proficiency in this study due to the limited opportunities with L2 exposure outside of English class for EFL participants. The results showed that the influence of L1 reading competence on L2 reading ability was not modified by a variety of time studying L2. Although this L2 exposure variable in this study did not have significant estimation to both transfer process and L2 reading ability, earlier studies by Cummins (2000) and Ramirez, Yuen, and Ramey (1991) found that an increase in exposure to English did not necessarily contribute to the acquisition in English capability. They revealed that children who had been in English-only classes acquired English language skills equivalent to those exposed to the home language and English bilingual classes. The findings are also similar with Chou's (1991), Taiwanese senior-high-school-aged students with earlier English exposure performed better in

listening than those with later English exposure, while the reading ability had no significant difference between the two groups.

Language transfer took place not only among alphabetic languages but also between non-alphabetic and alphabetic languages (Keung & Ho, 2009; Wang et al., 2005; Wang, Cheng, et al., 2006). Because of the significantly positive correlation and prediction between L1 and L2 reading competence, this study concluded that reading transfer across morphosyllabic languages (e.g., Mandarin Chinese) and morphophonemic languages (e.g., English) did occur. Thus, the range of language transfer of reading achievement has expanded by the finding of this study. If two markedly different languages (e.g., Mandarin Chinese and English) have a certain level of language reading ability transfer, there exists highly probable language transfer of reading ability between other minority languages (e.g., African languages) and English.

Limitations and Recommendations

While the results of this study certainly add credence to the existing literature on the influence of L1 knowledge to L2 reading ability, it is important to acknowledge the limitations of the current research, as well as recommendations for future research needs.

The limitations of the current study offer directions for future research needs. As previously indicated, the data were secondary data retrieved from the Committee of the Basic Competence Test for Junior High School Students in which independent variables in this study were limited. Since reading is a complex process, results may be less comprehensive if there is small number of predicting variables considered. Future

research should include more explanatory factors such as participants' socio-economic status, GPA, cognitive skills, number of Mandarin Chinese and English books read at home, hours of TV watching, parental literacy and so on. In addition, there were no students within a group varying by time in L2 exposure, and also there was no way to measure whether different groups with varying years in L2 learning actually performed differently overall since each group took different exams in this study. In order to have more authentic result with respect to whether the amount of time spent in L2 learning had significant influence on L2 reading comprehension acquisition, future research needs to include the time of L2 learning in cram school, a private institute that provides organized lessons instructed after regular school hours and on weekends. Besides, the time in bilingual kindergarten should be considered as well if the information can be obtained. With the English learning time in both cram school and bilingual kindergarten added, the amount of L2 exposure will be more accurate. Moreover, researchers should try to compare groups with differing amounts of time studying the L2 using the same tests.

In addition, students' L1 reading capability plays a significant role during the process of L2 reading comprehension acquisition. Thus, the findings of this study can contribute some pieces of information to Taiwanese educational policy makers to implement more applicable English educational policies to Taiwanese junior high school adolescents. First of all, the Ministry of Education in Taiwan should emphasize on students' L1 reading skills more than their L2. Apparently, if students' L1 reading abilities can be built up more soundly, their L2 reading capacities should be easier to

acquire. Secondly, the Ministry of Education should examine whether English language materials (e.g., textbook) support teaching and learning appropriately; that is, materials that fail to meet the English language content criteria should not be considered satisfactory for adoption. Finally, the government needs to research whether the past and current instructional methods, the Grammar Translation Method and Communicative Language Teaching, were and still are appropriate to Taiwanese teenagers' English reading comprehension capacity, respectively. Simply put, other teaching approaches and techniques should be considered and added to English curriculum in order for learners to have a variety of ways to acquire reading skills. The Ministry of Education in Taiwan also can tailor L2 reading instruction to capitalize on reading knowledge and strategies already familiar to students through L1 learning process.

Finally, there is a need to continue in this line of investigation. This study population was limited to the performance of Taiwanese junior high school students in the BCT. Some of these participants have subsequently attended and/or graduated from college. There were no follow-up or longitudinal studies conducted. Educational researchers are recommended to conduct extensive longitudinal studies on those participants' reading performance in their later educational level. A longitudinal study would help address whether their test scores on the BCT led them to achieve higher L1 and L2 reading capabilities in their subsequent educational level (e.g., senior high school, college). The study should be examined whether the reading ability in L1 and L2 remains stable or changes over time. Due to the longer investigation time, the finding from future research will be more sound and meaningful. Besides, a qualitative method

such as interviews with participants or classroom observation should be included in the longitudinal study in order to elaborate the impact of L1-Mandarin Chinese competence actually on acquiring the L2-English reading capability.

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APPENDIX A

MANDARIN ZHUYIN FUHAO AND PINYIN CONVERSION TABLE

| Zhuyin Fuhao | Pinyin | Zhuyin Fuhao | Pinyin | Zhuyin Fuhao | Pinyin | Zhuyin Fuhao | Pinyin |
|--------------|--------|--------------|--------|--------------|--------|--------------|--------|
| Initials | | | | | | | |
| ㄅ | B | ㄆ | P | ㄇ | M | ㄈ | F |
| ㄉ | D | ㄊ | T | ㄋ | N | ㄌ | L |
| ㄍ | G | ㄎ | K | ㄏ | H | | |
| ㄐ | J | ㄑ | Q | ㄒ | X | | |
| ㄓ | ZH | ㄔ | CH | ㄕ | SH | ㄖ | R |
| ㄗ | Z | ㄘ | C | ㄙ | S | | |
| Finals | | | | | | | |
| ㄨ | I | ㄨˊ | U | ㄨˊ | Ü | ㄦ | ER |
| ㄚ | A | ㄛ | O | ㄜ | E | ㄝ | Ê |
| ㄞ | AI | ㄟ | EI | ㄠ | AO | ㄡ | OU |
| ㄢ | AN | ㄣ | EN | ㄤ | ANG | ㄥ | ENG |

APPENDIX B

RELIABILITY ANALYSIS FOR ENGLISH EXAMINATIONS

Table B1. Reliability Analysis of English Reading Examination in 2002

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 02e_1 | .535 | .942 |
| 02e_2 | .503 | .943 |
| 02e_3 | .359 | .944 |
| 02e_4 | .530 | .942 |
| 02e_5 | .519 | .942 |
| 02e_6 | .467 | .943 |
| 02e_7 | .566 | .942 |
| 02e_8 | .621 | .942 |
| 02e_9 | .631 | .942 |
| 02e_10 | .590 | .942 |
| 02e_11 | .669 | .941 |
| 02e_12 | .493 | .943 |
| 02e_13 | .627 | .942 |
| 02e_14 | .446 | .943 |

Table B1. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 02e_15 | .619 | .942 |
| 02e_16 | .283 | .944 |
| 02e_17 | .001 | .945 |
| 02e_18 | .225 | .944 |
| 02e_19 | .628 | .942 |
| 02e_20 | .315 | .944 |
| 02e_21 | .645 | .942 |
| 02e_22 | .235 | .944 |
| 02e_23 | .638 | .942 |
| 02e_24 | .719 | .941 |
| 02e_25 | .549 | .942 |
| 02e_26 | .627 | .942 |
| 02e_27 | .412 | .943 |
| 02e_28 | .612 | .942 |
| 02e_29 | .559 | .942 |
| 02e_30 | .483 | .943 |
| 02e_31 | .562 | .942 |
| 02e_32 | .623 | .942 |
| 02e_33 | .583 | .942 |

Table B1. (continued)

| Item-Total Statistics | | |
|-----------------------|-------------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 02e_34 | .578 | .942 |
| 02e_35 | .556 | .942 |
| 02e_36 | .485 | .943 |
| 02e_37 | .439 | .943 |
| 02e_38 | .503 | .943 |
| 02e_39 | .553 | .942 |
| 02e_40 | .508 | .943 |
| 02e_41 | .287 | .944 |
| 02e_42 | .472 | .943 |
| 02e_43 | .470 | .943 |
| 02e_44 | .497 | .943 |
| 02e_45 | .458 | .943 |

Table B2. Reliability Analysis of Mandarin Reading Examination in 2002

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 02c_1 | .226 | .923 |
| 02c_2 | .361 | .922 |
| 02c_3 | .414 | .921 |
| 02c_4 | .413 | .921 |
| 02c_5 | .471 | .921 |
| 02c_6 | .450 | .921 |
| 02c_7 | .308 | .922 |
| 02c_8 | .483 | .921 |
| 02c_9 | .334 | .922 |
| 02c_10 | .335 | .922 |
| 02c_11 | .406 | .921 |
| 02c_12 | .436 | .921 |
| 02c_13 | .376 | .922 |
| 02c_14 | .506 | .921 |
| 02c_15 | .355 | .922 |
| 02c_16 | .404 | .921 |
| 02c_17 | .359 | .922 |

Table B2. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 02c_18 | .326 | .922 |
| 02c_19 | .555 | .920 |
| 02c_20 | .581 | .920 |
| 02c_21 | .298 | .922 |
| 02c_22 | .386 | .922 |
| 02c_23 | .415 | .921 |
| 02c_24 | .532 | .920 |
| 02c_25 | .363 | .922 |
| 02c_26 | .367 | .922 |
| 02c_27 | .371 | .922 |
| 02c_28 | .431 | .921 |
| 02c_29 | .529 | .920 |
| 02c_30 | .559 | .920 |
| 02c_31 | .424 | .921 |
| 02c_32 | .359 | .922 |
| 02c_33 | .316 | .922 |
| 02c_34 | .371 | .922 |
| 02c_35 | .472 | .921 |
| 02c_36 | .534 | .920 |

Table B2. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 02c_37 | .523 | .920 |
| 02c_38 | .459 | .921 |
| 02c_39 | .355 | .922 |
| 02c_40 | .452 | .921 |
| 02c_41 | .327 | .922 |
| 02c_42 | .428 | .921 |
| 02c_43 | .425 | .921 |
| 02c_44 | .412 | .921 |
| 02c_45 | .365 | .922 |
| 02c_46 | .488 | .921 |
| 02c_47 | .547 | .920 |
| 02c_48 | .550 | .920 |
| 02c_49 | .456 | .921 |
| 02c_50 | .560 | .920 |

Table B3. Reliability Analysis of English Reading Examination in 2003

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 03e_1 | .783 | .963 |
| 03e_2 | .590 | .963 |
| 03e_3 | .652 | .963 |
| 03e_4 | .654 | .963 |
| 03e_5 | .684 | .963 |
| 03e_6 | .540 | .964 |
| 03e_7 | .719 | .963 |
| 03e_8 | .665 | .963 |
| 03e_9 | .478 | .964 |
| 03e_10 | .547 | .964 |
| 03e_11 | .201 | .965 |
| 03e_12 | .625 | .963 |
| 03e_13 | .630 | .963 |
| 03e_14 | .643 | .963 |
| 03e_15 | .615 | .963 |
| 03e_16 | .703 | .963 |
| 03e_17 | .505 | .964 |

Table B3. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 03e_18 | .643 | .963 |
| 03e_19 | .620 | .963 |
| 03e_20 | .442 | .964 |
| 03e_21 | .573 | .963 |
| 03e_22 | .481 | .964 |
| 03e_23 | .519 | .964 |
| 03e_24 | .510 | .964 |
| 03e_25 | .682 | .963 |
| 03e_26 | .655 | .963 |
| 03e_27 | .619 | .963 |
| 03e_28 | .676 | .963 |
| 03e_29 | .403 | .964 |
| 03e_30 | .687 | .963 |
| 03e_31 | .606 | .963 |
| 03e_32 | .689 | .963 |
| 03e_33 | .631 | .963 |
| 03e_34 | .688 | .963 |
| 03e_35 | .545 | .964 |

Table B3. (continued)

| Item-Total Statistics | | |
|-----------------------|----------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 03e_36 | .708 | .963 |
| 03e_37 | .508 | .964 |
| 03e_38 | .696 | .963 |
| 03e_39 | .588 | .963 |
| 03e_39 | .588 | .963 |
| 03e_40 | .524 | .964 |
| 03e_41 | .639 | .963 |
| 03e_42 | .677 | .963 |
| 03e_43 | .726 | .963 |
| 03e_44 | .572 | .963 |
| 03e_45 | .530 | .964 |

Table B4. Reliability Analysis of Mandarin Reading Examination in 2003

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 03c_1 | .336 | .918 |
| 03c_2 | .422 | .917 |
| 03c_3 | .521 | .916 |
| 03c_4 | .378 | .918 |
| 03c_5 | .501 | .916 |
| 03c_6 | .487 | .917 |
| 03c_7 | .395 | .917 |
| 03c_8 | .439 | .917 |
| 03c_9 | .377 | .918 |
| 03c_10 | .377 | .918 |
| 03c_11 | .516 | .916 |
| 03c_12 | .542 | .916 |
| 03c_13 | .209 | .919 |
| 03c_14 | .492 | .917 |
| 03c_15 | .379 | .918 |
| 03c_16 | .488 | .917 |
| 03c_17 | .508 | .916 |

Table B4. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 03c_18 | .533 | .916 |
| 03c_19 | .398 | .917 |
| 03c_20 | .360 | .918 |
| 03c_21 | .485 | .917 |
| 03c_22 | .505 | .916 |
| 03c_23 | .348 | .918 |
| 03c_24 | .411 | .917 |
| 03c_25 | .267 | .919 |
| 03c_26 | .345 | .918 |
| 03c_27 | .413 | .917 |
| 03c_28 | .429 | .917 |
| 03c_29 | .389 | .918 |
| 03c_30 | .456 | .917 |
| 03c_31 | .343 | .918 |
| 03c_32 | .412 | .917 |
| 03c_33 | .389 | .918 |
| 03c_34 | .445 | .917 |
| 03c_35 | .427 | .917 |

Table B4. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 03c_36 | .505 | .916 |
| 03c_37 | .372 | .918 |
| 03c_38 | .341 | .918 |
| 03c_39 | .428 | .917 |
| 03c_40 | .360 | .918 |
| 03c_41 | .599 | .915 |
| 03c_42 | .418 | .917 |
| 03c_43 | .332 | .918 |
| 03c_44 | .440 | .917 |
| 03c_45 | .567 | .916 |
| 03c_46 | .304 | .918 |
| 03c_47 | .439 | .917 |
| 03c_48 | .528 | .916 |

Table B5. Reliability Analysis of English Reading Examination in 2004

| Item-Total Statistics | | |
|-----------------------|----------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 04e_1 | .637 | .964 |
| 04e_2 | .736 | .964 |
| 04e_3 | .659 | .964 |
| 04e_4 | .723 | .964 |
| 04e_5 | .678 | .964 |
| 04e_6 | .720 | .964 |
| 04e_7 | .540 | .965 |
| 04e_8 | .730 | .964 |
| 04e_9 | .663 | .964 |
| 04e_10 | .356 | .965 |
| 04e_11 | .402 | .965 |
| 04e_12 | .579 | .964 |
| 04e_13 | .412 | .965 |
| 04e_14 | .663 | .964 |
| 04e_15 | .594 | .964 |
| 04e_16 | .539 | .965 |
| 04e_17 | .583 | .964 |

Table B5. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 04e_18 | .642 | .964 |
| 04e_19 | .537 | .965 |
| 04e_20 | .589 | .964 |
| 04e_21 | .419 | .965 |
| 04e_22 | .603 | .964 |
| 04e_23 | .684 | .964 |
| 04e_24 | .648 | .964 |
| 04e_25 | .626 | .964 |
| 04e_26 | .619 | .964 |
| 04e_27 | .589 | .964 |
| 04e_28 | .679 | .964 |
| 04e_29 | .616 | .964 |
| 04e_30 | .732 | .964 |
| 04e_31 | .592 | .964 |
| 04e_32 | .717 | .964 |
| 04e_33 | .718 | .964 |
| 04e_34 | .645 | .964 |
| 04e_35 | .505 | .965 |
| 04e_36 | .611 | .964 |

Table B5. (continued)

| Item-Total Statistics | | |
|-----------------------|-------------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 04e_37 | .673 | .964 |
| 04e_38 | .512 | .965 |
| 04e_39 | .641 | .964 |
| 04e_40 | .676 | .964 |
| 04e_41 | .552 | .965 |
| 04e_42 | .460 | .965 |
| 04e_43 | .696 | .964 |
| 04e_44 | .552 | .964 |
| 04e_45 | .604 | .964 |

Table B6. Reliability Analysis of Mandarin Reading Examination in 2004

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 04c_1 | .419 | .928 |
| 04c_2 | .435 | .928 |
| 04c_3 | .527 | .927 |
| 04c_4 | .432 | .928 |
| 04c_5 | .355 | .929 |
| 04c_6 | .510 | .927 |
| 04c_7 | .562 | .927 |
| 04c_8 | .513 | .927 |
| 04c_9 | .335 | .929 |
| 04c_10 | .331 | .929 |
| 04c_11 | .419 | .928 |
| 04c_12 | .302 | .929 |
| 04c_13 | .591 | .927 |
| 04c_14 | .424 | .928 |
| 04c_15 | .499 | .927 |
| 04c_16 | .488 | .928 |

Table B6. (Continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 04c_17 | .357 | .929 |
| 04c_18 | .484 | .928 |
| 04c_19 | .419 | .928 |
| 04c_20 | .287 | .929 |
| 04c_21 | .364 | .929 |
| 04c_22 | .432 | .928 |
| 04c_23 | .520 | .927 |
| 04c_24 | .458 | .928 |
| 04c_25 | .464 | .928 |
| 04c_26 | .518 | .927 |
| 04c_27 | .432 | .928 |
| 04c_28 | .333 | .929 |
| 04c_29 | .245 | .930 |
| 04c_30 | .413 | .928 |
| 04c_31 | .434 | .928 |
| 04c_32 | .347 | .929 |
| 04c_33 | .464 | .928 |
| 04c_34 | .524 | .927 |
| 04c_35 | .422 | .928 |

Table B6. (Continued)

| Item-Total Statistics | | |
|-----------------------|----------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 04c_36 | .536 | .927 |
| 04c_37 | .541 | .927 |
| 04c_38 | .505 | .928 |
| 04c_39 | .545 | .927 |
| 04c_40 | .455 | .928 |
| 04c_41 | .598 | .927 |
| 04c_42 | .507 | .928 |
| 04c_43 | .431 | .928 |
| 04c_44 | .476 | .928 |
| 04c_45 | .514 | .927 |
| 04c_46 | .560 | .927 |
| 04c_47 | .300 | .929 |
| 04c_48 | .569 | .927 |

Table B7. Reliability Analysis of English Reading Examination in 2005

| Item-Total Statistics | | |
|-----------------------|----------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 05e_1 | .530 | .964 |
| 05e_2 | .638 | .964 |
| 05e_3 | .649 | .963 |
| 05e_4 | .600 | .964 |
| 05e_5 | .705 | .963 |
| 05e_6 | .420 | .964 |
| 05e_7 | .650 | .963 |
| 05e_8 | .609 | .964 |
| 05e_9 | .343 | .965 |
| 05e_10 | .583 | .964 |
| 05e_11 | .358 | .965 |
| 05e_12 | .496 | .964 |
| 05e_13 | .637 | .964 |
| 05e_14 | .553 | .964 |
| 05e_15 | .498 | .964 |
| 05e_16 | .589 | .964 |
| 05e_17 | .715 | .963 |

Table B7. (Continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 05e_18 | .691 | .963 |
| 05e_19 | .426 | .964 |
| 05e_20 | .571 | .964 |
| 05e_21 | .515 | .964 |
| 05e_22 | .555 | .964 |
| 05e_23 | .590 | .964 |
| 05e_24 | .571 | .964 |
| 05e_25 | .668 | .963 |
| 05e_26 | .714 | .963 |
| 05e_27 | .680 | .963 |
| 05e_28 | .681 | .963 |
| 05e_29 | .578 | .964 |
| 05e_30 | .656 | .963 |
| 05e_31 | .612 | .964 |
| 05e_32 | .580 | .964 |
| 05e_33 | .601 | .964 |
| 05e_34 | .670 | .963 |
| 05e_35 | .640 | .963 |
| 05e_36 | .744 | .963 |

Table B7. (Continued)

| Item-Total Statistics | | |
|-----------------------|----------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 05e_37 | .700 | .963 |
| 05e_38 | .720 | .963 |
| 05e_39 | .681 | .963 |
| 05e_40 | .637 | .964 |
| 05e_41 | .583 | .964 |
| 05e_42 | .536 | .964 |
| 05e_43 | .681 | .963 |
| 05e_44 | .716 | .963 |
| 05e_45 | .637 | .964 |

Table B8. Reliability Analysis of Mandarin Reading Examination in 2005

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 05c_1 | .408 | .926 |
| 05c_2 | .461 | .925 |
| 05c_3 | .360 | .926 |
| 05c_4 | .570 | .925 |
| 05c_5 | .388 | .926 |
| 05c_6 | .359 | .926 |
| 05c_7 | .388 | .926 |
| 05c_8 | .466 | .925 |
| 05c_9 | .452 | .925 |
| 05c_10 | .399 | .926 |
| 05c_11 | .567 | .924 |
| 05c_12 | .301 | .927 |
| 05c_13 | .537 | .925 |
| 05c_14 | .427 | .926 |
| 05c_15 | .396 | .926 |
| 05c_16 | .415 | .926 |

Table B8. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 05c_17 | .499 | .925 |
| 05c_18 | .415 | .926 |
| 05c_19 | .449 | .925 |
| 05c_20 | .632 | .924 |
| 05c_21 | .325 | .927 |
| 05c_22 | .533 | .925 |
| 05c_23 | .487 | .925 |
| 05c_24 | .346 | .926 |
| 05c_25 | .465 | .925 |
| 05c_26 | .524 | .925 |
| 05c_27 | .415 | .926 |
| 05c_28 | .500 | .925 |
| 05c_29 | .475 | .925 |
| 05c_30 | .407 | .926 |
| 05c_31 | .445 | .925 |
| 05c_32 | .326 | .927 |
| 05c_33 | .529 | .925 |
| 05c_34 | .464 | .925 |
| 05c_35 | .489 | .925 |

Table B8. (continued)

| Item-Total Statistics | | |
|-----------------------|----------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 05c_36 | .463 | .925 |
| 05c_37 | .514 | .925 |
| 05c_38 | .348 | .926 |
| 05c_39 | .491 | .925 |
| 05c_40 | .298 | .927 |
| 05c_41 | .300 | .927 |
| 05c_42 | .375 | .926 |
| 05c_43 | .480 | .925 |
| 05c_44 | .329 | .926 |
| 05c_45 | .523 | .925 |
| 05c_46 | .454 | .925 |
| 05c_47 | .552 | .924 |
| 05c_48 | .450 | .925 |

Table B9. Reliability Analysis of English Reading Examination in 2006

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 06e_1 | .542 | .965 |
| 06e_2 | .708 | .964 |
| 06e_3 | .517 | .965 |
| 06e_4 | .642 | .964 |
| 06e_5 | .680 | .964 |
| 06e_6 | .726 | .964 |
| 06e_7 | .682 | .964 |
| 06e_8 | .711 | .964 |
| 06e_9 | .638 | .964 |
| 06e_10 | .525 | .965 |
| 06e_11 | .716 | .964 |
| 06e_12 | .583 | .964 |
| 06e_13 | .394 | .965 |
| 06e_14 | .431 | .965 |
| 06e_15 | .725 | .964 |
| 06e_16 | .310 | .966 |
| 06e_17 | .501 | .965 |
| 06e_18 | .623 | .964 |

Table B9. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 06e_19 | .546 | .965 |
| 06e_20 | .617 | .964 |
| 06e_21 | .523 | .965 |
| 06e_22 | .479 | .965 |
| 06e_23 | .587 | .964 |
| 06e_24 | .664 | .964 |
| 06e_25 | .717 | .964 |
| 06e_26 | .618 | .964 |
| 06e_27 | .433 | .965 |
| 06e_28 | .627 | .964 |
| 06e_29 | .658 | .964 |
| 06e_30 | .699 | .964 |
| 06e_31 | .715 | .964 |
| 06e_32 | .585 | .964 |
| 06e_33 | .752 | .964 |
| 06e_34 | .624 | .964 |
| 06e_35 | .668 | .964 |
| 06e_36 | .636 | .964 |
| 06e_37 | .657 | .964 |

Table B9. (continued)

| Item-Total Statistics | | |
|-----------------------|-------------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 06e_38 | .628 | .964 |
| 06e_39 | .719 | .964 |
| 06e_40 | .619 | .964 |
| 06e_41 | .592 | .964 |
| 06e_42 | .401 | .965 |
| 06e_43 | .548 | .965 |
| 06e_44 | .700 | .964 |
| 06e_45 | .729 | .964 |

Table B10. Reliability Analysis of Mandarin Reading Examination in 2006

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 06c_1 | .232 | .918 |
| 06c_2 | .439 | .917 |
| 06c_3 | .478 | .916 |
| 06c_4 | .346 | .917 |
| 06c_5 | .502 | .916 |
| 06c_6 | .463 | .916 |
| 06c_7 | .353 | .917 |
| 06c_8 | .413 | .917 |
| 06c_9 | .349 | .917 |
| 06c_10 | .431 | .917 |
| 06c_11 | .515 | .916 |
| 06c_12 | .487 | .916 |
| 06c_13 | .538 | .915 |
| 06c_14 | .520 | .916 |
| 06c_15 | .258 | .918 |
| 06c_16 | .425 | .917 |
| 06c_17 | .410 | .917 |
| 06c_18 | .591 | .915 |

Table B10. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 06c_19 | .473 | .916 |
| 06c_20 | .310 | .918 |
| 06c_21 | .420 | .917 |
| 06c_22 | .515 | .916 |
| 06c_23 | .435 | .917 |
| 06c_24 | .356 | .917 |
| 06c_25 | .548 | .915 |
| 06c_26 | .400 | .917 |
| 06c_27 | .479 | .916 |
| 06c_28 | .461 | .916 |
| 06c_29 | .421 | .917 |
| 06c_30 | .360 | .917 |
| 06c_31 | .402 | .917 |
| 06c_32 | .386 | .917 |
| 06c_33 | .382 | .917 |
| 06c_34 | .403 | .917 |
| 06c_35 | .253 | .918 |
| 06c_36 | .405 | .917 |
| 06c_37 | .337 | .918 |

Table B10. (continued)

| Item-Total Statistics | | |
|-----------------------|-------------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 06c_38 | .549 | .916 |
| 06c_39 | .431 | .917 |
| 06c_40 | .461 | .916 |
| 06c_41 | .522 | .916 |
| 06c_42 | .492 | .916 |
| 06c_43 | .409 | .917 |
| 06c_44 | .404 | .917 |
| 06c_45 | .378 | .917 |
| 06c_46 | .207 | .919 |
| 06c_47 | .319 | .918 |
| 06c_48 | .526 | .916 |

Table B11. Reliability Analysis of English Reading Examination in 2007

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 07e_1 | .487 | .967 |
| 07e_2 | .727 | .966 |
| 07e_3 | .525 | .967 |
| 07e_4 | .703 | .966 |
| 07e_5 | .695 | .966 |
| 07e_6 | .506 | .967 |
| 07e_7 | .499 | .967 |
| 07e_8 | .728 | .966 |
| 07e_9 | .704 | .966 |
| 07e_10 | .633 | .967 |
| 07e_11 | .614 | .967 |
| 07e_12 | .566 | .967 |
| 07e_13 | .587 | .967 |
| 07e_14 | .438 | .967 |
| 07e_15 | .457 | .967 |
| 07e_16 | .599 | .967 |
| 07e_17 | .612 | .967 |
| 07e_18 | .693 | .966 |

Table B11. (continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 07e_19 | .467 | .967 |
| 07e_20 | .540 | .967 |
| 07e_21 | .563 | .967 |
| 07e_22 | .733 | .966 |
| 07e_23 | .697 | .966 |
| 07e_24 | .539 | .967 |
| 07e_25 | .654 | .967 |
| 07e_26 | .626 | .967 |
| 07e_27 | .646 | .967 |
| 07e_28 | .608 | .967 |
| 07e_29 | .638 | .967 |
| 07e_30 | .752 | .966 |
| 07e_31 | .626 | .967 |
| 07e_32 | .666 | .967 |
| 07e_33 | .714 | .966 |
| 07e_34 | .685 | .966 |
| 07e_35 | .651 | .967 |
| 07e_36 | .761 | .966 |
| 07e_37 | .670 | .967 |

Table B11. (continued)

| Item-Total Statistics | | |
|-----------------------|-------------------------------------|-----------------------|
| Item | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 07e_38 | .541 | .967 |
| 07e_39 | .700 | .966 |
| 07e_40 | .738 | .966 |
| 07e_41 | .694 | .966 |
| 07e_42 | .599 | .967 |
| 07e_43 | .699 | .966 |
| 07e_44 | .655 | .967 |
| 07e_45 | .369 | .968 |

Table B12. Reliability Analysis of Mandarin Reading Examination in 2007

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 07c_1 | .373 | .924 |
| 07c_2 | .435 | .923 |
| 07c_3 | .386 | .924 |
| 07c_4 | .413 | .923 |
| 07c_5 | .606 | .922 |
| 07c_6 | .442 | .923 |
| 07c_7 | .518 | .922 |
| 07c_8 | .423 | .923 |
| 07c_9 | .275 | .924 |
| 07c_10 | .317 | .924 |
| 07c_11 | .358 | .924 |
| 07c_12 | .359 | .924 |
| 07c_13 | .527 | .922 |
| 07c_14 | .553 | .922 |
| 07c_15 | .137 | .926 |
| 07c_16 | .541 | .922 |
| 07c_17 | .475 | .923 |
| 07c_18 | .467 | .923 |

Table B12. (Continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 07c_19 | .522 | .922 |
| 07c_20 | .570 | .922 |
| 07c_21 | .269 | .924 |
| 07c_22 | .442 | .923 |
| 07c_23 | .317 | .924 |
| 07c_24 | .486 | .923 |
| 07c_25 | .554 | .922 |
| 07c_26 | .638 | .921 |
| 07c_27 | .505 | .922 |
| 07c_28 | .476 | .923 |
| 07c_29 | .330 | .924 |
| 07c_30 | .530 | .922 |
| 07c_31 | .409 | .923 |
| 07c_32 | .387 | .924 |
| 07c_33 | .436 | .923 |
| 07c_34 | .405 | .923 |
| 07c_35 | .369 | .924 |
| 07c_36 | .505 | .923 |
| 07c_37 | .548 | .922 |

Table B12. (Continued)

| Item | Item-Total Statistics | |
|--------|----------------------------------|-----------------------|
| | Corrected Item-Total Correlation | Alpha-if Item Deleted |
| 07c_38 | .324 | .924 |
| 07c_39 | .332 | .924 |
| 07c_40 | .470 | .923 |
| 07c_41 | .400 | .923 |
| 07c_42 | .423 | .923 |
| 07c_43 | .539 | .922 |
| 07c_44 | .336 | .924 |
| 07c_45 | .584 | .922 |
| 07c_46 | .443 | .923 |
| 07c_47 | .471 | .923 |
| 07c_48 | .351 | .924 |

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EDUCATION

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|------|--|
| 2010 | Texas A&M University, College Station, TX <ul style="list-style-type: none"> • Doctor of Philosophy, Curriculum & Instruction |
| 2006 | Western Kentucky University, Bowling Green, KY <ul style="list-style-type: none"> • Master of Arts, General Education |
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SELECTED PROFESSIONAL EXPERIENCE

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|-----------|---|
| 2008-2010 | Texas A&M University, Research Assistant, Department of Teaching, Learning, and Culture |
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SELECTED PROFESSIONAL PRESENTATIONS

- Dixon, L. Q., Chuang, H.-K., Quiroz, B. (2009, June). Does Vocabulary Predict Phonological Awareness Among Bilingual Children? Poster Session at Society for the Scientific Study of Reading (SSSR), Boston, Massachusetts.
- Chuang, H.-K., Joshi, R. M., & Quiroz, B. (2009, April). Does the Length of Learning English as a Foreign Language Impact on Reading Comprehension Scores? Poster session at American Educational Research Association (AERA), San Diego, California.
- Chuang, H.-K. (2009, March). Language Learning in a Digital World: Hypermedia and Second Language Reading. Poster Session at Teachers of English to Speakers of Other Languages (TESOL), Denver, Colorado.
- Chuang, H.-K. (2009, February). Is Closed-Captions Exposure Effective for Second Language Learners? Graduate Student Session at Southwest Educational Research Association (SERA), San Antonio, Texas.