ABSTRACT

Title of dissertation: THE RELATIONSHIP BETWEEN PHONOLOGICAL AWARENESS AND READING ABILITY OF THAI STUDENTS IN ENGLISH AND THAI IN PRIMARY SCHOOLS OF THAILAND

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Reading is the most fundamental skill in modern societies and acquiring the ability to read is one of the most important goals of the early school years. In addition, reading English as a foreign language is important not only for academic success but also for professional development. The purpose of the study was to investigate the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students in their native country. Furthermore, I investigated whether there is any transfer of phonological awareness from Thai to English among primary school Thai students.

Participants were 424 Thai primary school students in nine provinces in the

Lower Northern part of Thailand. Measures administered in both English and in Thai included phonological awareness (subtests for Initial Sound Detection, Final Sound Detection, Rhyme Task and Phoneme Deletion) and reading ability (Real Word Reading and Pseudoword Reading). Measures in both English and Thai were administered to all 424 participants with all directions given in the Thai language, in January 2005. The results showed that all four English subtests predicted English Real Word Reading: English Final Sound Detection, English Rhyme Task, English Phoneme Deletion and English Initial Sound Detection. Three English subtests predicted English Pseudoword Reading: English Phoneme Deletion, English Rhyme Task and English Final Sound Detection. The results also showed that three Thai subtests predicted Thai Real Word Reading: Thai Final Sound Detection, Thai Phoneme Deletion and Thai Initial Sound Detection. Three Thai subtests predicted Thai Pseudoword Reading: Thai Phoneme Deletion, Thai Final Sound Detection and Thai Initial Sound Detection.

The transfer test showed that three subtests of Thai phonological awareness predicted English Real Word Reading: Thai Rhyme Task, Thai Phoneme Deletion and Thai Initial Sound Detection. Two subtests of Thai phonological awareness predicted English Pseudoword Reading: Thai Phoneme Deletion and Thai Rhyme Task.

The conclusions are that English phonological awareness is significantly related to English Reading and that Thai phonological awareness is significantly related to Thai Reading. Furthermore, there is strong evidence that there is a transfer of phonological awareness from Thai to English among Thai primary school students.

THE RELATIONSHIP BETWEEN PHONOLOGICAL AWARENESS AND READING ABILITY OF THAI STUDENTS IN ENGLISH AND THAI IN PRIMARY SCHOOLS OF THAILAND

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CHAPTER 1: INTRODUCTION

Overview

This chapter begins with some background on the study that I carried out in this dissertation such as information on Thai language teaching and English as a foreign language (EFL) teaching in Thailand. The background knowledge is necessary to understand this dissertation. I will then lay out the statement of the problem, purpose of the study, significance of the study and research questions. Since this study has quantitative content, I will give operational definitions of terms used in the research questions and my hypotheses. In the section on the theoretical framework, I will introduce two hypotheses – Orthographic Depth Hypothesis and Cognitive Transfer Hypothesis – that this study is built upon. For the sake of convenience, I will provide some additional important terms and definitions that are very useful in reading this dissertation. I will also talk about the limitations of the study. I will conclude this chapter with a summary of Chapter 1.

Background

Reading is the most fundamental skill in modern societies and, as a consequence, acquiring the ability to read is one of the most important goals of the early school years. In our society, reading is essential to success, and to social and economic advancement (Snow, Burns & Griffin, 1998). In addition, as a global phenomenon, reading English as a second or foreign language is important not only for academic success but also increasingly for professional success and personal development (Alderson, 1984). Underlying this claim is the fact that an increasingly large percentage of materials available in every branch of technical, scientific, or professional knowledge are published in English. Thus, the ability to read English fluently is necessary in order for second language (L2) or foreign language (FL) learners to acquire such knowledge from the medium of written text.

According to the U.S. National Reading Panel, reading is a complex system of deriving meaning from print that requires all of the following: a) the skills and knowledge to understand how phonemes, or speech sounds, are connected to print; b) the ability to decode unfamiliar words; c) the ability to read fluently; d) sufficient background information and vocabulary to foster reading comprehension; e) the development of appropriate active strategies to construct meaning from print; and f) the development and maintenance of a motivation to read (retrieved on July 23, 2004, from http://www.nationalreadingpanel.org/).For children learning an alphabetic language, such as English, the cognitive process of phonological awareness is critical to reading development. In the study reported in this dissertation, “reading ability” will include some of these features. See the operational definitions of terms later in this chapter.

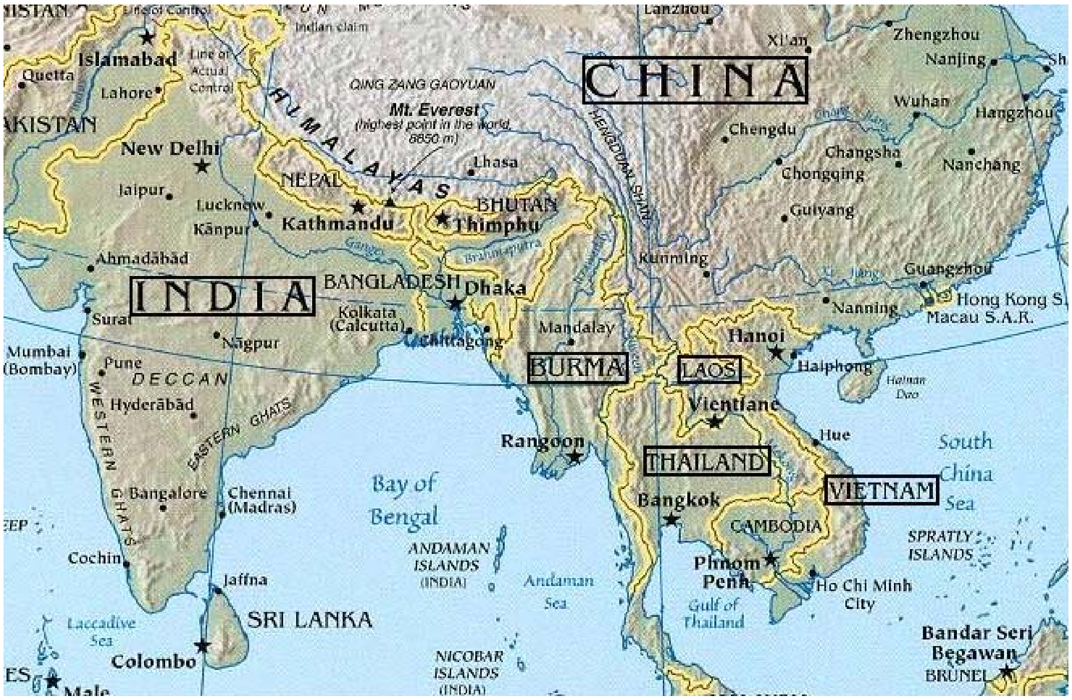
Phonological awareness refers to an awareness of the constituent sounds in spoken words (Goswami, 2000). In other words, phonological awareness is the understanding that sentences are made up of words, words are made up of groups of sounds (syllables), and syllables are made up of individual sounds, or phonemes (Allor, 2002). For the past 20 to 30 years, many studies in L1 (English as a first language) and L2 (English as a second language) have uncovered a strong relationship between phonological awareness and reading ability in English. Phonological awareness, particularly phonemic awareness, is a powerful predictor of success in reading and spelling (Chiappe, Siegel & Gottardo, 2002; Liberman, Shankweiler, Fischer & Cater, 1974; Lundberg, Olofsson & Wall, 1980; Mann & Liberman, 1984; Perfetti, Beck, Bell & Hughes, 1987; Snider, 1997). Phonemic awareness is “an explicit understanding that words are composed of segments of sound smaller than a syllable, as well as knowledge, or awareness, of the distinctive features of individual phonemes themselves” (Torgesen, 1999, p. 129). The above-cited studies strongly suggest a cause-and-effect relationship between phonological awareness and reading ability.

Comparatively speaking, there are fewer studies carried out in the English as a foreign language (EFL) context (for example, Allen-Tamai, 2000) than in the English as a second language (ESL) context, especially when the learners’ native language system is non-alphabetic and hence very different from English.

As this dissertation will in part investigate the relationship between phonological awareness and reading ability in Thai, at this point I would like to present a brief introduction to the Thai language.

Thai language

Figure 1 *The Area where the Thai Language is spoken*



Note:

Source: Modified from

http://www.lib.utexas.edu/maps/middle_east_and_asia/asia_ref04.jpg

Thai is a standard language spoken officially and nationally by almost sixty million people throughout every part of Thailand. It is also spoken from northern India (Assam) through northern Burma, southern China (Yunnan province and

Guangxi Region), Vietnam (in the north), Laos and Thailand (Kullawanit, 1984). Linguists have classified Thai as belonging to a Chinese-Thai branch of the Sino-Tibetan family. It is a tonal language, uninflected and predominantly monosyllabic like Chinese. As was noted by the renowned Thai linguist and writer Phaya Anuman Rajadhon in his 1961 paper, *The Nature and Development of the Thai Language,* there are hundreds of similar words in Thai and Chinese. Many of these words may be cultural borrowings, largely by the Thais, after long and continual contact with the Chinese. On the other hand, there are certain classes of words that obviously were derived from common sources in ancient times. More importantly, beyond the similarities of single words, spoken Thai and spoken Chinese are structured much the same way, though when written the two languages are completely different in appearance (retrieved on August 19, 2004, from www.thaioregon.com/thailanguage.htm). Most polysyllabic words in the Thai lexicon have been borrowed, mainly from Khmer, Pali, and Sanskrit (The National Identity Office under the Office of the Prime Minister, Royal Thai Government, 2002).

The written Thai language, read horizontally from left to right, as is English, consists of 22 consonants and 22 vowels that combine to formulate syllabic sounds. The sounds are combined with five different tones – middle (or called normal or even tone), high, low, rising and falling -- to produce a melodious, lyrical language

(The National Identity Office under the Office of the Prime Minister, Royal Thai Government, 2002). For the purpose of romanizing Thai script, the Royal Institute in Bangkok offered the following tables of vowels and consonants (retrieved on July 20, 2004, from http://www.learningthai.com/romanization.html). I would like to include the aforementioned tables here as I may use them in interpreting the results of the Thai measures.

Table 1 *Thai Vowels*

	Thai Vowels	Examples
a	-ะ -ั -า -1/	สะพาน - saphan ลันตา - lanta บาง - bang สมุทร - samut
am	-ำ	ลำ - lam
I	-ิ -ี	สิงห์ - sing บุรี - buri
ue	-ึ -ื -ือ	สตึก - satuek พืช - phuet บรบือ - borabue
u	-ุ -ู	บุรี - buri ภู - phu
e	เ-ะ เ-็ เ-	ปะนาเระ - panare เพ็ญ - phen เขน - khen
ae	แ-ะ แ-	แซะ - sae สะแก - sakae

o	โ-ะ -[1]/ โ- เ-าะ -อ	พะโต๊ะ - phato ลพ - lop สามโก้ - samko เกาะ - ko บ่อ – bo
oe	เ-อะ เ-อ เ-ิ	เซอะ - soe อำเภอ - amphoe เนิน – noen
ia	เ-ียะ เ-ีย	เผียะ - phia เทียน – thian
uea	เ-ือะ เ-ือ	เกือะ - kuea เมือง – mueang
ua	-ัวะ -ัว -ว-	ผัวะ - phua บัว - bua ควน – khuan
ai	ใ- ไ- -ัย ไ-ย -าย	ใหญ่ - yai ไผ่ - phai ชัย - chai ไทย – thai ปาย – pai
ao	เ-า -าว	เจ้า - chao ข้าว – khao
ui	-ุย	กุย – kui
oi	โ-ย -อย	โดย - doi ดอย – doi
iu	-ิว	งิ้ว – ngiu
eo	เ-็ว เ-ว	เร็ว- reo เลว – leo
oei	เ-ย	เลย – loei

uai	เ-ือย -วย	เดือย - duai ห้วย – huai
aeo	แ-ว	แมว – maeo
ieo	เ-ียว	เขียว – khieo

1 The single hyphen indicates the absence of any associated vowel-sign. Such a consonant is to be transcribed with an *a* or *o* following it, according to pronunciation.

Table 2 *Thai Consonants*

Initial	**Final**	**Thai consonant**
k-	-k	ก
Kh-	-k	ข ค ฆ
Ng-	-ng	ง
Ch-	-t	จ
Ch-	-t	ฉ ช ฌ
y-	-n	ญ
d-	-t	ด ฎ ฑ*
t-	-t	ต ฏ

Th-	-t	ถ ฐ ท ฑ* ธ ฒ
n-	-n	น ณ
b-	-p	บ
p-	-p	ป
ph-	-p	ผ พ ภ
f-	-p	ฝ ฟ
m-	-m	ม
y-	-	ย
r-	-n	ร
l-	-n	ล ฬ
w-	-	ว**
s-	-t	ซ ทร ศ ษ ส
h-	-	ห ฮ
-	-	อ

* This character may be pronounced *th* or *d* when it is in initial position.

** See Table 2, where ว appears in combination with vowels. It serves as the diphthong, *ua*, when placed between two consonants.

The Thai language has been traditionally described as a rigid Subject-Verb-Object (SVO) language (Singnoi, 2000), like Chinese and English. It differs from Japanese, which is Subject-Object-Verb (SOV). In the following section, I would like to present a general overview of English teaching in Thailand.

English as a foreign language (EFL) teaching in Thailand

Although English is not the only foreign language taught in primary and secondary schools in Thailand, it is undoubtedly the most important and most popular one. English is considered a tool for getting a good job and has several other advantages, such as being considered “high-class”, and enabling one to communicate with people from other cultures who are able to speak in English (Wei & Zhou, 2002). English is usually understood in large urban cities.

Globalization has resulted in interconnected, highly complex, and rapid changes in the economics, technology and culture of every country in the world. In the midst of these changes, English is an important medium of communication in Thailand (Prapaisit, 2003). Furthermore, as Thailand becomes more and more popular with tourists and as the country continues to conduct more and more trade in the international marketplace, the number of Thais working in the tourism industry or other industries that require the use of English has increased. In addition, education is highly valued in Thailand, and proficiency in English is viewed as an important element of education, as it is linked to securing a good job and entering the business world. As a result, a large number of Thai students are choosing to study internationally, predominantly in the U.S. and the U.K. According to the governmental Educational Development Plan (1997-2001), the ability to use English is a necessary qualification for Thai people because this knowledge helps them communicate with the world and build a better understanding of the world in the age of globalization (General Education Department, Ministry of Education, 1997). Based on this realization, in 1996 the Ministry of Education encouraged the teaching of EFL starting from the first grade (seven years of age) and recommended the use of a learner-centered approach for teaching and learning all subjects, including English (Department of Academic Research, Ministry of Education, 1996). Since the 1996 curriculum was established, students in grades one through four study English 80 hours a year, while those in grades five through six study English 200 hours a year. In addition to using a learner-centered approach, the general principles of learning and teaching English for primary education are:

1. Provide a variety of authentic and communicative activities, and
2. Focus on listening and speaking skills at the preparatory level (Grade

> one - two); listening, speaking, reading, writing and spelling skills at the literacy level (Grade three - four); and communicating in all four skills at the beginner or fundamental level (Grade 5-6).

(Department of Academic Research, Ministry of Education, 1996, p. 13, quoted in Prapaisit, 2003)

Statement of the Problem

The relationship between phonological awareness and reading ability in English as a first language has been studied for several decades. More and more studies have been carried out regarding that relationship in an ESL context. Few such studies, however, have been conducted in an EFL context. According to a thorough review of the existing literature, the relationship between phonological awareness and reading ability in English and in Thai of Thai primary school students in their native country had never been investigated. Furthermore, investigations of the transfer of phonological awareness from Thai to English have never been carried out. Because of this major gap in the existing research, I wanted to investigate the relationship between phonological awareness and reading ability in English and in Thai of Thai primary school students in their native country, along with investigating whether there is a transfer of phonological awareness from Thai to English among these students.

Purpose of This Study

The purpose of the study was to investigate the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students in their native country. First, I wanted to determine whether the relationship between phonological awareness and reading ability holds in the EFL classroom context in Thailand (an EFL context) just as it does in the U.S., New Zealand, and other ESL contexts. In Thailand English is not used at home or on any other occasions except in English classrooms. Second, I wanted to investigate the relationship between phonological awareness and reading ability in the Thai language. Third, I wanted to investigate whether there is any transfer of phonological awareness from Thai to English at the young age of these Thai students.

Significance of This Study

This dissertation intended to determine whether the relationship between phonological awareness and reading ability holds in English in Thailand and to investigate the relationship and the phonological awareness and reading ability in Thai of Thai students in primary schools of Thailand. It is significant in the following respects:

1. The Thai writing system is a shallow orthography (a writing system that

has consistent or one-to-one correspondence between the phonemes in speech and the written code). Thai script is, quite obviously, entirely different from the Roman alphabet, so that Thai students learning English must master this new alphabet. A study of the relationship between phonological awareness and reading ability of native Thai students in English has never been conducted, but research on that relationship is essential. The results of this study will provide initial insights on this key topic.

2. No study has investigated whether there is a correlational relationship between phonological awareness and reading ability within the Thai language itself, which employs a shallow orthography. Thus, the results of this research can be helpful to Thai teachers teaching the Thai language in primary and secondary schools.
3. No study has investigated whether there is any transfer of phonological awareness from the Thai language to English. If there is any transfer of phonological awareness from Thai to English, we can foster phonological awareness in Thai and this will benefit students' phonological awareness in English.
4. If the relationship between English phonological awareness and English reading ability is confirmed in the EFL context in Thailand, then the

findings might have implications for how English in primary schools in other EFL contexts outside of Thailand might be taught or improved.

Research Questions

1. What are the demographics of the participants in this study?
2. What are the medians, means, and standard deviations for English phonological awareness subtests, English reading ability subtests, Thai phonological awareness subtests, and Thai reading ability subtests of Thai primary students in their native country?
3. What are the intercorrelations among all of the subtests in English and Thai for Thai primary students in their native country?
4. Which phonological awareness subtest(s) in English provide(s) the best prediction of English reading ability among Thai primary school students in their native country?
5. What is the relationship between phonological awareness and reading ability in the English language of Thai primary school students in their native country?
6. Which phonological awareness subtest(s) in Thai provide(s) the best prediction of Thai reading ability among Thai primary school students in their native country?
7. What is the relationship between phonological awareness and reading ability in

the Thai language of Thai primary school students in their native country?

8. To what degree, if at all, is there a transfer of phonological awareness from the Thai language to English among Thai primary school students?

Operational Definitions of Terms in the Research Questions

This study investigates the relationship between phonological awareness and reading ability in English and in Thai. It involves four important variables. They are operationally defined as follows:

Phonological Awareness in English: Scores students received on four phonological awareness subtests in English operate as the measure of phonological awareness in English in the present study. They are initial sound detection, final sound detection, rhyme task and phoneme deletion.

Phonological Awareness in Thai: Scores students received on four phonological awareness subtests in Thai operate as the measure of phonological awareness in Thai. They are initial sound detection, final sound detection, rhyme task and phoneme deletion. Phonological awareness in English and phonological awareness in Thai are separately measured with different trial items and test items. They are not translations of each other.

Initial Sound Detection: Scores students received from detecting the first sound of a word.

Final Sound Detection: Scores students received from detecting the last sound of a word.

Rhyme Task: Scores students received from judging whether two words rhyme or not.

Phoneme Deletion: Scores students received from giving the sound left after one phoneme is deleted.

Reading Ability in English: Scores students received on two subtests in English function as the measure of reading ability in English. They are English Real Word Reading and English Pseudoword Reading. English Letter Identification is a part of reading readiness.

Reading Ability in Thai: Scores students received on two subtests in Thai function as the measure of reading ability in Thai. They are Thai Real Word Reading and Thai Pseudoword Reading. Thai Letter Identification is a part of reading readiness. Reading measures are separately created with different trial and test items. They are not translations of each other.

Hypotheses

Among Thai primary school students in their native country,

1. There is a high correlation between phonological awareness and reading ability in English. Therefore, reading ability in English could be significantly and linearly predicted by phonological awareness in English.
2. There is a high correlation between phonological awareness and reading ability in Thai. Therefore, reading ability in Thai could be significantly and linearly predicted by phonological awareness in Thai.
3. There is a transfer of phonological awareness from Thai to English. Therefore, reading ability in English could be significantly and linearly predicted by phonological awareness in Thai.

Theoretical Framework

Snow, Burns and Griffin (1998) explained that learning to read English poses large challenges, even among native alphabetic-language speakers. Compared with learning English, Snow et al. believed that learning a Japanese syllabic system, either hiragana or katakana, is quite straightforward, since the units represented—syllables—are pronounceable and psychologically real, even to young children. The Japanese hiragana syllables represent spoken Japanese with 46 characters, supplemented with a set of diacritics (Daniels and Bright, 1996). However, English has about 5,000 different syllables (Snow, Burns and Griffin, 1998).

Since the units represented graphically by letters of the English alphabet are referentially meaningless and phonologically abstract (irregularity of spellings), young readers may experience difficulties. For example, there are three sounds represented in the word “sit”, but each sound or letter does not refer to anything, i.e., /s/, /i/ and /t/ don’t refer to any thing or person.

There are many advantages when young readers of written English come to understand the basic idea that letters represent the small sound units within spoken and heard words (phonemes). A much less graphemic symbol-system is needed in either syllabic (like Japanese) or monosyllabic (such as Chinese and Thai) systems. The strategies for how combinations of English letters should be pronounced are learnable, and subsequently prefixes and with enough frequency of encounter suffixes, could be recognized automatically.

Alphabetic systems of writing vary in the degree to which they are designed to represent the surface sounds of words (Snow, Burns, Griffin, 1998). Some languages, like Spanish, spell all words exactly as they sound. This is not the case for English. In English, a particular letter can represent several different sounds. For example, the letter “c” represents different sounds in words like “cat”, “source” and "appreciation". This is a difficult concept to grasp for young readers from other language backgrounds, like Thai, Chinese, and Japanese.

English orthography is even more complicated for young readers because English retains many historical spellings of words that do not correspond to the current pronunciation of those words. For example, "gh" in "night" and "neighborhood" represents a consonant sound that had long ago disappeared from spoken English. Some words, like "does" and "do", do not yield to strategies we might otherwise use to pronounce English words. The phenomenon we are discussing here is accounted for by a theory called the "Orthographic Depth Hypothesis", which I would explain in the following section.

Orthographic Depth Hypothesis

The depth of orthography in different languages has been most widely discussed in studies testing the Orthographic Depth Hypothesis (Frost, 1992, 1994; Frost & Katz, 1987; Katz & Feldman, 1981; Katz & Frost, 1992). These studies suggest that the degree of lexical access during phonological processing is different for deep and shallow orthographies. In shallow orthographies, like Spanish, the phonological codes are recovered from print through grapheme-phoneme correspondences that are direct and consistent. In contrast, the phonological codes of printed words in deep orthographies, like English, are retrieved from the lexicon because of the arbitrary and inconsistent grapheme-phoneme correspondences. Thus, the Orthographic Depth Hypothesis poses that native readers of shallow orthographies will recover phonological codes or pronunciations of the printed words by assembling them from grapheme-phoneme mappings (for example, “ph” in phone is /f/) or by using a pre-lexical or phonological strategy (for example, five is pronounced as /faiv/ because vowel “i” is in an open syllable). Conversely, in deep orthographies, grapheme-phoneme mappings do not allow readers to generate the pronunciations of the printed words pre-lexically. As a result, they must rely on visually orthographic access to the mental lexicon or on the post-lexical or orthographic strategy. For example, the word “knight” does not follow grapheme-phoneme correspondence rules. Students must memorize its pronunciation. This is the orthographic access to the mental lexicon. One more example, if I know “ight” in light is /ait/, I would infer that “night” should be pronounced as /nait/. The strategy that I used was called orthographic strategy. In this study, the participants’ native language is Thai and they study English as a foreign language. According to the Orthographic Depth Hypothesis, the Thai language is a shallow orthography (Dhanesschaiyakupta, 2003), compared with the deep orthography of English (Frost, 1992, 1994; Frost & Katz, 1987; Katz & Feldman, 1981; Katz & Frost, 1992). In this dissertation, I would like to investigate the relationship between phonological awareness and reading ability in these two sharply contrastive orthographies.

Cognitive Transfer Hypothesis

The Cognitive Transfer Hypothesis (Chikamatsu, 1996; Koda, 1988, 1990, Muljani, Koda, & Moates, 1998; Wade-Woolldy, 1999) contends that cognitive strategies developed and utilized in one orthography can be transferred to another orthography with similar or different structural and representational properties. This contention strongly indicates that there is a transfer of the word recognition strategies of readers in deep and shallow orthographies. That is, native language readers of a shallow orthography will transfer the phonological strategy into their second or foreign language reading, while native language readers in deep orthographies will transfer their native language orthographic strategy developed and used in reading in their native language to reading in a second or foreign language. Since the Thai writing system is a shallow orthography, I would predict, according to Cognitive Transfer Hypothesis, that Thai students will transfer their phonological strategies in reading Thai into reading EFL. This dissertation will investigate whether there is any transfer of phonological awareness from Thai to English.

Additional Important Terms and Definitions

The following key terms are used most often in this dissertation and critical in understanding the study. I derived the list from literature that I read or reviewed for this dissertation. They are as follows:

Deep orthography: A writing system that does not have consistent or one-to-one correspondence between the phonemes in speech and the written code. English orthography is an example.

Grapheme: A unit (a letter or letters) of a writing system that represents one phoneme; a single symbol that has one phonemic correspondent within any particular word.

Graphophonemic: Refers to the sound relationship between the orthography (symbols) and phonology (sounds) of a language.

Grapheme-phoneme correspondence: The relationship between a grapheme and the phoneme(s) it represents. Sometimes it is known as letter-sound correspondence, as c representing /k/ in cat and /s/ in cent. Technically, grapheme-phoneme correspondence refers to how letters correspond to sounds, not the other way.

Lexical: Refers to the words or the vocabulary of a language as distinguished from its grammar and construction.

Lexicon: Often called the “mental dictionary”, the lexicon is a representation of all knowledge a person has about individual words.

Naming speed: The speed at which someone can name an array of objects, letters, digits or colors as tested in the rapid automatic naming (RAN) or rapid serial naming test.

Onset and rime: Onset and rime are technical terms used to describe phonological units of a spoken syllable. A syllable can normally be divided into two parts: the onset, which consists of the initial consonant or consonant blend, and the rime that consists of the vowel and any final consonants. For example, in word "bring", "br" is the onset and "ing" is the rime. Words that share the same rime will also rhyme, but the spelling will be constant and not vary as it does with rhyme.

Orthography: A complete writing system for a language or languages.

Orthographic Depth Hypothesis: The Orthographic Depth Hypothesis has been best described in studies by Frost (1992, 1994); Frost and Katz (1987); Katz and Frost (1992). It suggests that the degree of involvement of lexical access during phonological processing is different between deep and shallow orthographies. In shallow orthographies, like Spanish, the phonological codes are directly recovered from print through grapheme-phoneme correspondences that are direct and consistent. In contrast, the phonological codes of the printed words in deep orthographies, like English, are retrieved from the lexicon because of the arbitrary and inconsistent grapheme-phoneme correspondences.

Phoneme: A phoneme is the smallest unit in the sound system of a language.

Phonemic awareness: “An explicit understanding that words are composed of segments of sound smaller than a syllable, as well as knowledge, or awareness, of the distinctive features of individual phonemes themselves” (Torgesen, 1999, p. 129). It involves such task as rhyming, segmenting sounds, blending sounds, and manipulating sounds (deleting and substituting sounds). Phonemic awareness is a necessary skill for learning to read. Research has determined that phonemic awareness is the best predictor of reading success (Chiappe, Siegel, and Gottardo, 2002, Muter and Diethelm, 2001, Quiroga, Lemos-Britton, Mostafapour, Abbott, and Berninger, 2002). Phonemic awareness is included in phonological awareness.

Phonemic segmentation: Phonemic segmentation is to break up and identify the sounds (phonemes) found in words.

Phonological awareness: Phonological awareness is the awareness of the sound structure of language in general (e.g., onsets, and rimes, syllables, or phonemes) (Yopp & Yopp, 2000). In other words, phonological awareness is the understanding that sentences are made up of words, words are made up of groups of sounds (syllables), and syllables are made up of individual sounds, or phonemes (Allor, 2002). Phonological awareness includes phonemic awareness.

Phonological processing: Phonological processing is the process of identifying the sounds and subsequently identifying the words that the sounds combine to make.

Pseudoword: A pronounceable string of letters that has no meaning; also called invented words, nonsense words, nonwords, or made-up words. For example, “mive” can be pronounced but it does not mean anything in English.

Rapid automatic naming (RAN): The ability to state the names of objects, letters, colors, or digits quickly and automatically. It is based on a test devised by Denckla and Rudel (Denckla & Rudel, 1974) in which subjects are asked to name as quickly as possible an array of a limited set of letters, digits, drawings of familiar objects, or blocks of colors arranged in random order.

Rapid serial naming: The ability to name a limited set of items presented in an array. Currently the term rapid serial naming is used more than rapid automatic naming to emphasize the serial processing requirements of the task.

Reading ability: The U.S. National Reading Panel defined this concept as a complex system of deriving meaning from print that requires all of the following: a) the skills and knowledge to understand how phonemes, or speech sounds, are connected to print; b) the ability to decode unfamiliar words; c) the ability to read fluently; d) sufficient background information and vocabulary to foster reading comprehension; e) the development of appropriate active strategies to construct meaning from print; f) the development and maintenance of a motivation to read. (Retrieved from http://www.nifl.gov/partnershipforreading/explore/reading_defined.html on Jan. 19, 2004) NOTE: Only certain aspects of reading, as defined above, are relevant to this study. The relevant aspects are (a) and (b). Reading for meaning is not related to the purpose of this study.

Reading readiness Reading readiness is a term used by both researchers and educators to mean the accomplishment of skills presumed to be prerequisites to benefiting from formal reading instruction. It is measured by comparing the accomplishments of children in kindergarten, where prereading skills are practiced, with their scores on standardized reading tests in the primary grades. Reading readiness has been shown to have a high correlation with reading ability (Snow, Burns and Griffin, 1998)

Shallow orthography: A writing system that has consistent or one-to-one correspondence between the phonemes in speech and the written code. Examples of shallow orthographies include Spanish and Finnish.

Limitations of This Study

One of the limitations of this study stems from the stimulus type that I have used for reading in both English and Thai, which consists of either isolated letters or isolated words. Seidenberg, Waters, Barnes and Tanenhaus (1990) have argued that isolated words, especially if they are low-frequency words, might be mispronounced even by proficient readers, despite the fact that they know the words and their pronunciations. Fewer errors are made if these words are situated in a sentence context. However, Haberlandt (1994) showed ambiguous effects of sentence context and Ferreira (1991) showed that the structure of a sentence, especially a complex one, would delay the pronunciation initiation of the participants (quoted in Haberlandt, 1994). In addition, Stahl and Murray (1998) believe that, in relation to phonological awareness, reading has been defined strictly in terms of word recognition, as phonological awareness has been posited to underlie a person's learning of sound-symbol relations or of orthography, which in turn underlie the larger purpose of reading. Due to the equivocal results of employing sentence context, the stimulus items used in this study are either isolated letters or isolated words.

Summary of Chapter 1

In this chapter, I provided an overview of the relationship between phonological awareness and reading ability in English and gave a brief introduction to Thai (a language whose orthographic system is completely different from that of alphabetic languages) and to the state of EFL teaching in Thailand. In addition I presented a statement of the problem, purpose of the study, significance of the study, research questions, and operational definitions of terms in the research questions. After stating my hypotheses, I provided the theoretical framework of the study, including Orthographic Depth Hypothesis and Cognitive Transfer Hypothesis, two critical hypotheses that underlying this dissertation. Furthermore, some key terms are defined for clarification and ease of reading the dissertation. The limitations of the study are discussed in detail at the conclusion of Chapter 1.

CHAPTER 2: REVIEW OF THE LITERATURE

Overview

This chapter begins with a brief introduction to the literature review and then presents the literature in four major sections: a) the relationship between phonological awareness and reading ability in the first-language or L1 context, b) the relationship between phonological awareness and reading ability in the second language or L2 context, c) the implications for the relationship between phonological awareness and reading ability in the EFL context, and d) cross-language transfer of phonological awareness. The literature that has similar settings or findings is grouped together for the readers' convenience. I will conclude the chapter with a summary.

Introduction

Dozens of studies have reported that there is a causal relationship between phonological awareness and reading ability of young children in the L1 context. In comparison, a minute number of studies about the same relationship have been reported in the L2 context. Very few studies have investigated such a causal link in the context of EFL, as defined in Chapter 1. The main aim of this literature review is to examine studies concerning the relationship between phonological awareness and the English language reading ability of young children in different contexts, proceeding chronologically from the earliest-studied context of L1, to L2, and finally to the least studied context: that of EFL. In addition, I will review not only journal articles related to the relationship between phonological awareness and reading ability in English, but also those concerned with the cross-language transfer of phonological awareness.

The Relationship between Phonological Awareness and Reading Ability in the L1 Context

Many studies on first language (L1) reading have consistently found that phonemic awareness is a powerful predictor of future reading success (Liberman, Shankweiler, Fischer, & Carter, 1974; Lundberg, Wal, & Olofsson, 1980; Mann & Liberman, 1984; Share, Jorm, MacLean, & Mathews, 1984; Stanovich, Cunningham, & Cramer, 1984; Tunmer & Nesdale, 1985). It is a better predictor of early reading skills than onset-rime awareness (Hulme et al, 2002). Some research indicates that explicit training in phonemic tasks improves reading achievement (Ball & Blachman, 1991; Bradley & Bryant, 1985; Cunningham, 1990; Lie, 1991; Lundberg, Frost, & Peterson, 1988). There is considerable evidence that phonological processing is one of the major cognitive determinants of the development of word-level reading skills in the early phases of learning to read (Goswami & Bryant, 1990; Share, 1995; Share & Stanovich, 1995; Wagner & Torgesen, 1987). These findings show that there is a strong correlation between phonemic awareness and reading achievement in the L1 context. We will also see some correlational studies on phonological awareness and reading ability in the L1 context here.

The questions that need to be answered

I will first discuss a chapter in Stahl and Murray (1998). The term *phonological awareness* was first introduced to educators and psycholinguists in *Language by Ear and by Eye* edited by James Kavanaugh and Ignatius Mattingly in 1972. In this volume, several authors - Mattingly, Harris Savin, and Donald Shankweiler and Isabelle Liberman - discussed the relationship between phonological awareness and learning to read. Since then, a lot of research has been done on this specific topic and we have learned much more. However, some questions remain to be answered, as Stahl and Murray suggested, “What kind of ‘phonological awareness’ is related to reading? About what kind of relation are we talking? And how are we defining reading?” (p. 65).

These studies employed several commonly used tasks, such as rhyming, word-to-word matching tasks, sound-to-word matching tasks, full segmentation, partial segmentation, blending, deletion and manipulation. According to Adams (1990), the above named tasks fall into five levels of difficulty: The most primitive consists of having an ear for the sounds of words, as revealed by the ability to remember familiar rhymes. The second level consists of the ability to recognize and sort patterns of rhyme and alliteration in words, as revealed by an oddity task. A third level requires familiarity both with the division of syllables into phonemes and with the sounds of isolated phonemes, as revealed by blending tasks and syllable-splitting tasks. The fourth level covers tasks that require full segmentation of component phonemes. The fifth and most difficult level consists of tasks requiring children to add, delete, or move phonemes and to generate new words or pseudowords. Thus, these tasks can be arranged from the easiest (a) to the hardest (e) as follows:

a. Rhyme (recognize pairs of rhyming words or produce words that rhyme)
b. Sound oddity tasks (identify words that are the same or different in terms of beginning, middle, or ending sounds)
c. Blending tasks (identify a word when each syllable or phoneme is pronounced separately)
d. Phoneme segmentation (pronounce each separate phoneme in a one-syllable word)
e. Phoneme manipulation (identify the word left or created when phonemes are added, deleted, or moved)

There are several ways to define reading. Some people see reading only in terms of decoding and others see reading as responding to and comprehending literature. When doing research on the relationship between phonological awareness and reading, it is important, in whatever context, to state precisely which aspect of reading one is speaking about. Stahl and Murray (1998) believe that, in relation to phonological awareness, reading has been defined strictly in terms of word recognition, as phonological awareness has been posited to underlie a person's learning of sound-symbol relations or of orthography, which in turn underlie the larger purpose of reading. In summary, it is not enough to posit that phonological awareness is related to reading. Stahl and Murray (1998) state that researchers must posit which aspect of phonological awareness is related to a given aspect of reading and in what way this is so.

An experimental study

Vellutino and Scanlon (1987) conducted two experiments on the relationship among phonological coding, phonological awareness and reading ability. In Experiment one, the authors designed a screening battery entitled "Reading Readiness Test" to identify kindergarteners who might have difficulty in acquiring skills in reading. It was comprised of items that evaluated rudimentary reading skills, most of which required facility in phonemic segmentation. Because the authors were also interested in evaluating the predictive validity of other linguistic and cognitive abilities, children were also administered tests of semantic and syntactic competence, along with tests to estimate general intelligence.

The participants were 295 kindergarteners in Albany, New York. All children were administered the Gilmore Oral Reading Test, and a test of pseudoword decoding from Bryant (1963).

The most important finding was that the tests most highly and most reliably correlated with oral reading ability were those which depended heavily on phonemic segmentation ability. The same pattern was evident even after controlling for intelligence. The combined data sets provide rather substantial evidence in support of the idea that facility in phonemic segmentation is a powerful predictor of success in beginning reading.

For Experiment two, the authors had three major purposes. One was to resolve a question as to whether word identification problems in poor readers are caused by difficulty in phonological coding affecting their ability to remember the verbal responses of the counterparts or names of printed words. The second purpose was to examine the relative importance of each in learning to identify printed words. The third purpose was to evaluate the contention that facility in naming and facility in phonemic segmentation are complementary skills that are both necessary for success in learning to identify printed words and, conversely, that deficiencies in one or the other will adversely affect such learning.

The participants in Experiment two were 300 second and sixth graders, dichotomized into poor and normal reader groups on the basis of oral reading ability and criteria used for defining specific reading disability. There were 75 children in the Grade two poor reading group, 75 in the Grade two normal reading group, 75 in the grade 6 poor reading group and 75 in the grade 6 normal reading group. The pre-treatment measures administered were tests of phonemic segmentation and phonetic decoding ability: a) counting phonemes in auditorily presented words, b) counting phonemes in visually presented words, c) detecting phoneme identities and differences in minimally contrasted word pairs, d) vocalizing phoneme identities and differences in similarly constructed word pairs, and e) detecting the location (beginning, middle, and end) of phoneme differences in given word pairs. From the 300 students, 15 students were randomly assigned to each of five treatment conditions. They were: a) phonemic segmentation training; b) response acquisition; c) phonemic segmentation training and response acquisition; d) control condition one; and e) control condition two.

The results of Experiment two provided clear-cut and strong evidence that training in phonemic segmentation has a salutary effect on the acquisition of skill in word identification, for poor readers as well as for normal readers. The data from the reading ability matched groups suggested that a child’s level of ability in phonemic segmentation and phonetic decoding may set upper limits on the child’s ability to learn to identify printed words.

In summary, the two experiments of the Vellutino and Scanlon study provided evidence that facility in phonemic segmentation is causally related to success in reading. It is not simply a by-product of skill in reading.

A comparison study

McBridge-Chang and Kail (2002) tested the extent to which predictors of early reading were similar for Hong Kong Chinese children who were learning to read Chinese and American children who were learning to read English. Also compared were models of Hong Kong Chinese children who were learning to read English as a second language and American children who were learning to read English as their first language.

Participants were 190 Hong Kong kindergarten students and 128 American kindergarten and first grade students. In Hong Kong (similarly in Mainland, China), kindergarten lasts 3 years (K1 to K3), and this sample consisted of 60 K1 (ages 3-4 years), 70 K2 (ages 4-5), and 60 K3 (ages 5-6) Hong Kong children from six schools. The mean ages of the kindergarten children were 4.42, 4.91 and 5.91 years for K1, K2 and K3 respectively. There were 32 boys and 28 girls in the K1 group and an equal number of boys and girls in the other two groups. The American students came from two schools in the Midwestern United States. The kindergarten students (32 boys, 31 girls) had a mean age of 6.10 years, and the first graders (36 boys, 29 girls) had a mean age of 7.10 years.

A battery of tasks was devised to assess children's reading skill, processing speed, phonological awareness, naming, and visual-spatial skill. Because the syllable is the basic language and reading-processing unit of Chinese, phonological awareness was measured in both groups with a syllable deletion task that consisted of 25 compound words or phrases from which children were asked to delete a word or syllable. The first 10 items consisted of two-syllable compound words. From these items, children were asked to delete either the first word or the second word as requested. The remaining 15 items consisted of three-syllable phrases. Children were asked to delete the first, middle or last syllable from each of these. A second measure of phonological awareness for U.S. children consisted of a task of letter sound knowledge. Children were asked to name all 26 letters of the alphabet from a sheet on which the capital letters were arranged in a fixed order that did not confirm to the actual ordering of the alphabet.

This study showed remarkable similarities in the early phases of reading Chinese and English. The two models that predicted reading in a child's native language revealed identical results. Phonological awareness was strongly associated with character/word recognition, speeded naming was weakly associated with reading, and visual processing was unrelated to reading ability. The model that predicted English word recognition for Chinese children was similar to the ones that predicted native reading acquisition. The results also indicated that phonological awareness was strongly related to reading acquisition across English and Chinese. Similar results had been found in the learning to read English as a Second Language context (Durgunoglu et al., 1993). Despite the fact that phonological awareness was measured using syllable deletion tasks in both Chinese and English for the Hong Kong students and English letter sound (phonemic) and syllable deletion tasks for the American students, results of all models that predicted reading were remarkably similar, both qualitatively and in the size of the path coefficients. The importance of phonological awareness for reading acquisition across orthographies was that it involved mapping an oral referent to a written symbol, whether the symbol represents a morpheme/syllable, as in Chinese, or a phoneme, as in English. Thus, at least in the very earliest states of reading acquisition, some level of phonological awareness, depending on orthography/language, was probably a universal aspect of learning to read.

Reciprocal relationship between phonemic knowledge and learning to read

Explicit knowledge of the phonemic structure of spoken words, or phonemic awareness, has sometimes been seen as necessary for learning to read. However, it is suggested that although some phonemic knowledge is important for beginning reading, the relationship between phonemic knowledge and learning to read is reciprocal.

Perfetti, Beck, Bell, and Hughes (1987) conducted a longitudinal study on the relationship between phonemic awareness and reading ability. The authors' purpose was to examine three closely related questions by testing children, at several points in time during their first year in school, on different phonemic knowledge tasks and tests of reading skill. The questions were: a) can evidence be brought to bear on the contribution of phonemic knowledge to reading in relation to the contribution of reading to phonemic knowledge; b) can we model some component phonemic tasks; and c) are children who are taught by a direct code method more dependent on phonemic knowledge than children taught by indirect code methods and commercial basal readers?

Three tasks were used to assess phonemic knowledge, each motivated by theoretical and empirical considerations. The research strategy was to examine the performance of children learning to read on tasks that tap abilities of phoneme synthesis and analysis. Three tasks were designed: one for synthesis, and two for analysis (the tapping task and the deletion task). The synthesis task required the child to produce a word or pseudoword in response to segments spoken in isolation by the experimenter. There were eight real words, followed by four pronounceable nonwords (pseudowords). The tapping task required the child to tap a pencil once for each sound in a word and the deletion task required the child to produce a transformation of a word spoken by the experimenter. There were two tests for each word: one requiring deletion of the initial segment, and one requiring deletion of the final segment.

The participants were 82 first graders who were native English speakers divided into three beginning reader groups: two taught by a commercial basal reader series and one by systematic direct code instruction. Because some of the students were instructed by a direct code teaching method (the New Reading System or NRS) (Beck & Mitroff, 1972) in which children are taught explicitly to “blend”, interesting instructional questions could be examined. It might be imagined that an ability for phoneme synthesis strongly determined performance at blending. More generally, it might be supposed that children directly taught decoding had to know more about phonemic segments to have success. A group taught by a commercial basal reader system that used indirect decoding instruction might be expected to be less dependent on phonemic knowledge and more dependent on reading components concerned with letter and word forms. However, there was another possibility: in the absence of explicit teaching of decoding, basal students might be more dependent on discovering the phonemic constituent principle. If so, then phonemic awareness would predict the reading success of basal students more than that of students taught by direct code.

The results showed both that phonemic knowledge allowed reading and that reading allowed phonemic knowledge. In other words, phonemic awareness was strongly related to reading ability. The best predictor of word reading, in general, was deletion. Synthesis was as good a predictor at first, but the correlation with synthesis decreased as children's abilities on this task increased. Deletion, because it remained a difficult task, was a good predictor throughout. One way to see the predictive value of deletion was through a multiple regression analysis, in which each phonemic test was entered as a predictor variable along with the reading readiness scores. In that analysis, the last three together accounted for 77% of the variance in word reading. This further indicated that phonemic awareness is strongly related to reading ability.

Longitudinal studies

Maclean, Bryant and Bradley (1987) conducted a 15-month longitudinal study on the relationship among rhymes, nursery rhymes and reading in early childhood in Great Britain. The participants were 66 children (32 boys and 34 girls), whose average age was 3 years and 3 months. Data were reported from five sessions with these children in their homes. The average ages of the children in the five sessions were: Session one: 3 years and 4 months; Session two: 3 years and 8 months; Session three: 4 years and 0 month; Session four: 4 years and 5 months; and session five: 4 years and 7 months. The children were given two standardized tests: the British Picture Vocabulary Scale during the first session and the Wechsler Preschool and Primary Scale of Intelligence, between session three and four.

The first aim of Session one was to discover what each child knew about nursery rhymes. The second goal was to establish each child's skill in detecting whether words rhyme or not. This session included a knowledge of nursery rhymes task, and a detection of rhyme-I task. The main aim in Session two was to introduce other measures of phonological awareness. This session included a detection of alliteration-I task, an alliteration production task, a rhyme production task, a forced-choice rhyme task, and segmenting. Session three included a detection of rhyme-II task. Session four included a reading words task and a recognizing letters task. Session five included rhyme detection-III and alliteration detection-II tasks.

The correlation matrix showed that there were strong relationships between the children's knowledge of nursery rhymes and their scores on various tests of phonological awareness. The results showed that, as the authors claimed, for the first time, a degree of phonological awareness in children as young as three was established. Many of these children did well in the rhyme and alliteration detection tasks and in rhyme and alliteration production tasks as well.

The most important finding, as related to this literature review, was that the early rhyme and alliteration detection scores are related to the beginnings of reading words, and that this longitudinal relationship is specific because it exists even after the effect of IQ has been ruled out. This result considerably extends the evidence for a connection between phonological skills and learning to read. It is already known that measures of school children's phonological skills are related to their reading (e.g. Stanovich, Cunningham, & Cramer, 1984) and that preschool measures of phonological skills predict progress in reading at school (e.g. Bradley & Bryant, 1985; Lundberg, Olofsson, & Wall, 1980). The Maclean, Bryant and Bradley study has established that preschool phonological skills predict the beginning of preschool reading as well.

Wagner, Torgesen and Rashotte (1994) conducted a longitudinal correlational study on the relationship between phonological processing abilities and reading acquisition. In the context of L1 beginning reading, phonological processing refers to making use of the phonological or sound structure of oral language when learning how to decode written language (Adams, 1990; Brady & Shankweiler, 1991; Crowder & Wagner, 1991). Developmental and individual differences in phonological processing are believed to be causally related to the normal acquisition of beginning reading skills. The goals of the Wagner, Torgesen and Rashotte study were to examine the nature and development of young children's phonological processing abilities and to compare alternative views of causal relations between phonological processing abilities and the acquisition of reading for alphabetic languages.

To examine the nature and development of young children’s phonological processing abilities and their causal relations with word decoding, the authors carried out a longitudinal study of children from the time they were in kindergarten through second grade. Participants included 244 children (53% were girls) randomly sampled from kindergarten classrooms in six elementary schools in Tallahassee, Florida. Three-quarters of the children were white and nearly all of the remaining 25% were African Americans. The average age when first tested in kindergarten was 5 years and 8 months, with a range from 5 years and 0 months to 6 years and 9 months.

The tasks administered to the sample each year included a battery of phonological and word-level reading tasks and a verbal ability measure. The phonological tasks were further subdivided into tasks that assessed: a) phonological analysis, b) phonological synthesis, c) phonological coding in working memory, d) isolated naming, and e) serial naming. The four phonological analysis tasks were: a) phoneme elision, b) sound categorization, c) first sound comparison, and d) phoneme segmentation. The three phonological synthesis tasks were a) blending onset and rime, b) blending phonemes into words, and c) blending phonemes into nonwords. The two standardized measures of word decoding were word identification and word analysis. The two measures of pre-reading knowledge were letter-name knowledge and letter-sound knowledge.

The results indicated that phonological processing abilities at kindergarten had a causal influence on first-grade decoding (phonological analysis and phonological synthesis). The pattern of causal influences from first-grade phonological processing abilities to second-grade decoding was similar. The Wagner, Torgesen and Rashotte study not only indicated a causal relation between the development of phonological processing abilities and the acquisition of reading skills, but also supported the view that the causal relations were bi-directional. When considering abilities individually, the authors found support for causal influences from each of the phonological processing abilities to subsequent decoding.

Hulme, Hatcher, Nation, Brown, Adams and Stuart (2002) reported a short-term longitudinal study that was carried out in Great Britain. The study was about which one is a better predictor of early reading skill, small phonological unit (phonemes) or large phonological unit (onset-rime). The purpose of the study was to clarify the relative importance of onset-rime versus phonemic awareness as predictors of reading skill in young children. Seventy-two first graders participated in the study. They were recruited from two schools in the City of York and two rural schools in Cambridgeshire. The children's age ranged from 5.14 to 6.34 years with a mean age of 5.6 years. 39 boys and 33 girls participated in the study. All the children spoke English as their first language and none had any reported speech, hearing, or visual impairments.

These children were administered three different tasks (deletion, oddity, and detection) tapping awareness of four phonological units (initial phoneme, final phoneme, onset, and rime). In order to compare awareness of different phonological units with the same stimuli it was necessary to use nonwords. The stimuli consisted of 10 CCVC non-words, each beginning with a different cluster; all contained a tense vowel. These 10 nonwords were used as base items for all 12 subtests. For the oddity and detection tasks, distracter items contained the same phonemes and structures across tasks and phonological units.

The results showed that there were significant correlations (.31 to .54) between the different phonological awareness measures, and each of these measures was significantly correlated with reading (.33 to .53). However, the measures of initial and final phoneme awareness appear to be better predictors of reading then the measures of onset and rime awareness. It was also evident that onset (13%), rime (6%), initial phoneme (26%), and final phoneme (12%) awareness each account for significant variance in reading after effects of age and vocabulary scores have been controlled. However, after the effects of onset-rime awareness have been controlled, phoneme awareness is a powerful predictor (13%) of reading ability whereas onset-rime awareness accounts for some significant additional variance in reading scores (1%) after phoneme awareness has been controlled.

Hulme et al’s analyses showed clearly that phoneme awareness was a better predictor of individual differences in reading ability than was onset-rime awareness. The study concluded that measures of phoneme awareness were excellent predictors of early reading skills. Conversely, measures of onset-rime awareness were weaker predictors of reading skill. The most practical implication of the findings was that assessments of children’s phonological skills should pay particular attention to phoneme level skills.

Snider (1997) conducted two longitudinal studies to examine the relationship between phonemic awareness and reading achievement in the primary grades. In the first study, the author explored the relationship between phonemic awareness skills in kindergarten and reading achievement at the end of second grade. Additionally, the author examined the following specific questions: a) what is the relative predictive power of different types of phonemic awareness tasks; and b) is the statistical correlation between phonemic awareness and reading achievement also of practical significance.

The 73 participants were all of the kindergarteners in a small rural community. The mean age of students at the initial testing was 6 years 6 months, with a range of 5 years 8 months to 7 years 4 months. Thirty-six boys and 37 girls participated. Posttest data were obtained from standardized tests that were given to all students at the end of second grade. Only 50 out of the original 73 students participated in the final tests due to the fact that 14 students moving to a new place, four students were retained and five were placed in special eduction.

A test of phonemic awareness and an achievement test were administered, at kindergarten and at the end of the second grade respectively, to each student individually. The test of phonemic awareness consisted of 5 subtests with 10 items each, for a total of 50 items. The subtests were chosen to represent a mixture of phonemic awareness tasks varying in level of difficulty. A word analysis subtest and a reading comprehension subtest were also administered to the students. The word analysis subtest required students to select a word that had the same sound as a target word. The reading comprehension subtest assessed comprehension by asking students to answer literal and inferential questions based on short messages.

A series of stepwise regressions were performed to determine how well the total score and each subtest predicted reading achievement in second grade as measured by both the word analysis subtest and the reading comprehension subtest. Rhyme supply and the sound oddity tasks were not highly predictive of performance on either the word analysis or reading comprehension subtests. Performance on the strip initial consonant subtests was as good a predictor of reading achievement as the total score. The results of this investigation replicated previous research by confirming the predictive value of phonemic awareness to later reading achievement. The results also indicated that three subtests--phonemic segmentation, strip initial consonant, and substitute initial consonant--and the total score were highly predictive of later reading achievement.

In study two, 3 years later, 12 of the original 18 students in the lower quartile participated. Boys outnumbered girls by a ratio of 6:1. All 12 students were retested using the test of phonemic awareness. They also read a third-grade passage from the Gray Oral Reading Inventory (Wiederholt & Bryant, 1992). Individual structured interviews were conducted with the students. The following questions were asked:

1. Do you like school?
2. How smart are you compared with other kids?
3. Do you think you’re a good reader?
4. What’s your favorite subject?
5. What’s your least favorite subject?
6. Do you like to read in school?
7. Do you like to read at home?
8. Do you think reading is hard or easy?
9. Do you like school better or worse than when you were in kindergarten?

The qualitative results showed that students completed the tasks more easily than they had in kindergarten. They understood what to do and answered without hesitation. Although performance on the phonemic segmentation and manipulation tasks showed remarkable improvement, performance on the easier rhyming task remained inconsistent. Additionally, some interesting findings that were directly related to this literature review emerged from the interviews: a) the students with the most negative attitudes were, in general, not special education students; b) the only student to name reading as his favorite subject was the lowest of the low performers; and c) in general, the students who had been placed in special education had positive attitudes toward school.

In summary, the combination of quantitative and qualitative data in this article supported a powerful and predictable relationship between phonemic awareness and future reading achievement. However, educators should not infer that children who perform poorly on phonemic awareness tasks in kindergarten are developmentally delayed or have an intrinsic processing or language disorder. Kindergarteners who could not complete phonemic segmentation and manipulation tasks were at risk for learning and reading disabilities, but 25% of the students in the lowest quartile were average readers by the end of third grade.

Thus, educators should be skeptical of making important educational decisions about placement based on children's performance on phonemic awareness tasks. Instead, poor performance on tests of phonemic awareness should be used as a mandate to provide explicit instruction in phonemic awareness as part of beginning reading instruction. Furthermore, the qualitative data provided in the second study of this article would be interesting to teachers who want to know more about students' attitudes towards reading.

Muter, Hulme, Snowling and Taylor (1998) presented a longitudinal study of children in the first two years of learning to read in Britain. The authors believed that early phonological skills were causally related to later success in learning to read. They considered the nature of the phonological skills that are important: which phonological skill plays the most important role in the process of learning to read? This question about the structure of phonological skills is of great theoretical and practical importance, but so far lacks a clear answer.

Participants were thirty-eight children from four north London nursery schools. They ranged in age from 3 years and 10 months to 4 years and 9 months, with a mean age of 4 years and 3 months. To ensure that the children were nonreaders at the outset of the study, they were all screened on the British Ability Scales Word Reading Test. The screening was very strict. Any child reading even one word correctly was excluded from the study. All 38 children received a large battery of tests at three equidistant points in time over a two-year period. At Time one in the study, they were attending local nursery schools. At Time two and three they were attending State primary schools.

The following four tests of phonological awareness were administered:

a. Rhyme Detection. This test was presented in picture format, with three demonstration items followed by 10 test items. The children had to indicate which of three words (e.g., fish, gun or hat) rhymed with or "sounded like" the target word (e.g., cat). All words were depicted by a drawing.

b. Rhyme Production. In this test, the children were asked to produce words that rhymed with each of two target words (day and bell). Both words and nonwords were considered permissible responses.

c. Phoneme Identification. This was based on a test devised by Stuart (Stuart & Coltheart, 1988). The children were shown a series of pictures depicting common objects that had one-syllable names. The examiner supplied the first two phonemes of the word that the children were requested to "finish off" with the final phoneme, e.g., this is a picture of a "ca-" for which the correct response was /t/ to complete the word "cat".

d. Phoneme deletion. The children were shown a picture of a common object, e.g., a bus, and then requested to say the word after deleting its initial phoneme.

Principal components analyses with Varimax (orthogonal) Rotation were carried out on the phonological awareness raw scores for each time of the study. The two factors identified at times one and two seem to reflect relatively distinct rhyming and segmentation factors. A very similar pattern emerged at Time two and three.

To investigate the role of different predictors in accounting for progress in reading and spelling, regression analyses were conducted in order to estimate weights for a series of path diagrams. Each hypothesized path was represented by a structural equation for which a simultaneous regression analysis was conducted in a cumulative fashion, working from left to right, and dropping nonsignificant variables. The analysis was also carried out using the individual phonological awareness scores. The findings were essentially the same as those obtained for the factor scores, thus reassuring us that the results are robust across different analytic procedures. The results indicated that segmentation ability was a significant predictor of reading in that year. However, rhyming ability was not a significant predictor of individual differences in learning to read. Meanwhile, segmentation skill was a significantly better predictor of reading than rhyming.

Other studies in U.S., Great Britain, Canada and Australia

In an attempt to understand the development of phonological awareness, Mann and Foy (2003) examined the interrelations of speech skills and letter knowledge to phonological awareness and early reading skills. The primary objective of the study was to examine how speech perception and production, vocabulary, letter name, and letter sound knowledge may be interrelated with each other and with rhyme awareness, phoneme awareness, and reading ability. The hypotheses that the authors tested were that a) phonological awareness will be related to reading, and there would be separable relations for rhyme awareness and phoneme awareness; b) speech measures and vocabulary would be related to reading measures and to measures of phonological awareness by virtue of common demands on phonological representation; and c) letter knowledge would bear special relations to reading and phonological awareness.

The participants were 99 children aged 4-6 years old (50 girls and 49 boys) attending preschool or daycare programs in southern California. The final sample included 51 four-year-olds, 43 five-year-olds, and five six-year-olds. The children were from low to upper middle-class families. None of the preschools explicitly taught “reading” and none taught phonological awareness. The measures included Woodcock Reading Mastery Test-Revised (Woodcock, 1987), WISC-R Verbal Working Memory (Wechsler, 1992), Letter Knowledge, Phoneme Awareness (Foy & Mann, 2001), Rhyming Awareness (Foy & Mann, 2001), Speech Production, Naming Speed, Nonword Repetition, and Speech Perception. The battery of phonological tests resulted in eight different scores (initial vs. final position for phoneme judgment deletion and substitution; rhyme production and rhyme identification).

For hypothesis a), the results showed that both phoneme judgment and phoneme manipulation added significant additional variance to the prediction of reading after the other measures had been entered. Taken together, all of the other variables accounted for 41% of the variance in reading. For hypothesis b), only vocabulary was a significant predictor of rhyme awareness. For hypothesis c), Spearman rank correlations showed that letter sound knowledge also accounted for a significant proportion of the variance in phoneme manipulation, phoneme judgment, rhyme awareness, letter name knowledge, speech production, word reading, naming speed and discrimination of speech.

In summary, as the authors and others (Hulme, 2002; Hulme at al., 2002; Marshall et al., 2001) had previously found, rhyme awareness in a preschool sample might not be linked with reading. It is phoneme awareness that is consistently the stronger predictor of emerging reading skill in children on the brink of kindergarten entry. Next to phonological awareness, letter knowledge is one of the best predictors of children’s reading ability. The findings of Mann and Foy study supported this result.

In Bryant, Maclean, Bradley and Crossland (1990), three views (models) of the relation between various forms of phonological awareness (detection of rhyme and alliteration and detection of phoneme) and children’s reading were tested. These views (models) were: a) that the experience of learning to read leads to phoneme awareness and that neither of these is connected to awareness of rhyme, b) that sensitivity to rhyme leads to awareness of phonemes, which in turn affects reading, and c) that rhyme makes a direct contribution to reading that is independent of the connection between reading and phoneme awareness.

The participants were 64 children (33 girls and 31 boys). All children were native English speakers. The average age was 4 years and 7 months (ranged from 4 years 2 months to 5 years 3 months). The data were collected over a period of two years. The children were tested with two sets of predictive measures and one set of outcome measures. The predictive measures were tests of rhyme and alliteration detection (given at mean age of 4 years and 7 months and 5 years and 7 months), and phoneme detection (given at mean age of 5 years and 7 month and 5 years and 11 months). The outcome measures were reading, spelling, and arithmetic (at mean age of 6 years and 7 months).

The results produced evidence for Model two (rhyme/alliteration scores are related to phoneme detection measures, to reading and spelling but not to arithmetic) and Model three (rhyme/alliteration scores predict reading even after controls for differences in the ability to detect phonemes), but not for Model one. The measures used in the Bryant et al study proved to be powerful predictors of reading and spelling. The multiple regression, which included both a measure of rhyme or alliteration detection and one of phoneme detection, regularly accounted for above

65%, and in some cases for as much as 71%, of the variance in reading. So there was certainly a connection between early phonological skills and the child's progress in reading later on. This study confirmed the existence of a strong, consistent, and specific relation between children's phonological skills and reading. It also showed that rhyme and alliteration contributed to reading in at least two ways: sensitivity to rhyme and alliteration were developmental precursors of phoneme detection, which, in turn, played a considerable role in learning to read.

Kirby, Parrila and Pfeiffer (2003) investigated how well kindergarten phonological awareness (PA) and naming speed (NS), measured before formal reading instruction had begun, accounted for reading development from kindergarten to Grade five in Canada. The purpose was to see whether children who later developed serious reading difficulties could be identified at the beginning of compulsory schooling. The participants were 161 children who began the study in senior kindergarten when they were about 5 years of age (the mean age was 66.7 months). These participants were retested annually until they were in Grade 5. Over the 6 years of the study, attrition reduced the sample to 122, 106, 99, 86 and 79, but T tests indicated that attrition did not pose a threat to the study. The participants were drawn from a broad range of schools in Kingston, Ontario, Canada, representing a range of socioeconomic backgrounds. Each year approximately half of the children were female.

In the kindergarten, four measures of PA were administered (all taken from Wagner et al, 1993): Sound Isolation, Phoneme Elision, Blending Onset and Rime, and Blending Phonemes. Two measures of NS were developed, based on tasks described by Wolf, Bally, and Morris (1986): Color Naming and Picture Naming. Two tests of measuring mental ability were used: Figure Memory and Verbal-Spatial Relations (Naglieri & Das, 1997). Woodcock Reading Mastery Tests-Revised (different forms) (Woodcock, 1987) was used to assess reading development in kindergarten to Grade 5.

The authors reported the results in two studies. In study one, the scores on the six predictor variables were entered into a principal-axis factor analysis. The first factor was identified as PA, and the second as NS. An orthogonal factor analysis yielded similar results. A series of hierarchical regression analyses was conducted for each of the dependent variables at each age level. The results for the three reading outcomes were consistent. The three covariates accounted for a substantial amount of variance, about 20% to 50%, the amount increasing with grade levels. At each grade level, the PA and NS factor scores added significant amounts of predicted variance.

In general, kindergarten PA and NS predicted subsequent reading development quite well. Even though the two factors correlated moderately, they made independent contributions to the various reading measures. Kindergarten PA had the most impact in the early grades, whereas NS influence was weaker in the early grades and stronger in the later grades. Results were similar regardless of whether letter recognition or initial reading scores, or neither were included as covariates.

The purpose of the second study was to examine the reading development of four groups of children who fit the criteria of the double-deficit theory (Wolf & Bowers, 1999). The four groups were: a) those with low PA and slow NS, b) those with low PA and adequate NS, and c) those with adequate PA and slow NS, and d) those with adequate PA and NS. These four groups were selected from the data set used in study one. The results showed that it was possible to identify children who were at risk for later reading difficulties. Children with both PA and NS deficits performed the worst on subsequent reading achievement. Low PA by itself in kindergarten was associated with lower achievement for the next two years. Children with slow NS in kindergarten performed poorly on reading throughout the 6 years of this study.

In summary, PA and NS, measured in kindergarten, made independent contributions to the prediction of reading. PA was the more powerful predictor in kindergarten and Grade one. Children who had low PA and slow NS in kindergarten made slower progress in reading development and were more likely to suffer from reading difficulties by Grade five.

Tunmer and Nesdale (1985) carried out a study in Australia the aim of which was to determine more precisely the nature of the relationship between phonological awareness and learning to read. The authors had four predictions. First, because the beginning reader must figure out which phonemes and graphemes correspond to acquire phonological recoding ability, a nonlinear relation of phonological awareness and the ability to recognize phonemic segments to phonological recoding ability would be expected. Second, in view of the research that has linked phonological awareness to early success in reading acquisition, a prediction that follows from this suggestion is that tests of phonological awareness comprising nondigraph words should be more strongly associated with reading achievement than should those comprising digraph words.

Their third prediction was that poor decoders (defined as those beginning readers who have yet to master the grapheme-phoneme correspondence rules, as reflected in their performance on a pseudoword naming task) should perform better on familiar nondigraph real words than on nondigraph pseudowords. Fourth, if the effects of phonological awareness on reading acquisition are mediated by phonological recoding skill, the relation of phonemic segmentation to pseudoword naming should be stronger than that of phonemic segmentation to reading comprehension because pseudoword naming requires both phonemic segmentation ability and knowledge of the grapheme-phoneme correspondence rules, whereas reading comprehension involves, in addition, text level processes such as comprehension monitoring.

Sixty-three first-grade children participated in the Tunmer and Nesdale study (35 male subjects and 28 female subjects) with a mean age of 6 years and 2 months at the first testing. All children were native English speakers and were recruited from six classes, two in each of three state primary schools located in average socioeconomic status areas within the same school region of Perth, West Australia. It should be noted that these children entered school in the year during which they turned 6 years of age and that formal reading instruction did not begin until well into the year. Therefore, these children were younger and had been exposed to less reading instruction than the average American child.

The students were administered tests of verbal intelligence, phonemic segmentation ability, and reading achievement. Form A of the Peabody Picture Vocabulary Test (Dunn, 1965) was used to provide an estimate of each child's verbal intelligence.

The first prediction of this study was supported by two findings. First, there were errors of 60.4% and 56% on the real and pseudo digraph words, respectively, compared with 21.5% and 34.8% errors on the real and pseudo nondigraph words, respectively. Second, performance on the two digraph vowels (M = 0.95) was much lower than on the two nondigraph vowels (M = 1.83). The second prediction was also supported by the finding that the poor decoders performed better on the nondigraph real words than on nondigraph pseudowords, whereas the good decoders were able to segment both types of word. The third and fourth predictions were also supported by the findings.

In general, there were four major findings from this study. They were a) that the relation of phonological awareness to decoding skills is nonlinear: that is, phonological awareness is a necessary, but not sufficient, condition for the acquisition of phonological recoding ability; b) that phonemic segmentation tests that include digraph words may provide inaccurate estimates of phonological awareness; c) that phonological awareness affects comprehension proficiency indirectly through phonological recoding; and d) that the development of phonological awareness is not greatly affected by the method of reading instruction, unless specific phonemic analysis training is included as an important component.

From all articles reviewed at this point, it seems beyond doubt that there is a causal relationship between children's phonological skills and their success in reading (Bryant & Bradley, 1985; Wagner & Torgeson, 1987). The better children are at detecting syllables (Mann & Liberman, 1984), rhymes (Bradley, 1988c; Bradley & Bryant, 1983; Ellis & Large, 1987; Lundberg, Olofsson, & Wall, 1980), or phonemes (Lundberg at al., 1980; Stanovich, Cunningham, & Cramer, 1984; Tunmer & Nesdale, 1985), the quicker and more successful will be their progress with reading. This relationship holds even when extraneous variables such as IQ, social class, and memory (Bradley & Bryant, 1985; MacLean et al., 1987) are controlled.

In summary, all studies reviewed here are studies conducted in the English as Native Language context (L1) and all of the studies supported that there is a strong relationship between phonological awareness and reading ability of young children in the L1 context. Phonological awareness (either onset, rime or phoneme) is also the most powerful predictor of reading ability of young children.

The Relationship between Phonological Awareness and Reading Ability in the L2 Context

The relationship between phonological skills and reading development has been extensively documented in a wide range of correlational, longitudinal, and training studies (see Adams, 1990, for a review, and Wagner, Torgeson, & Rashotte, 1994, and Hatcher, Hulme, & Ellis, 1994, for examples of a longitudinal and training study, respectively). Most studies have addressed the phonology-reading connection in English monolingual children.

One question that might be asked is whether these findings can also be extended to children whose L1 is not English but who are nonetheless being educated in English. This issue is of theoretical importance because it speaks to the universality of the phonology-reading connection. It also has pedagogical implication for the use of phonological measures as “screening” instruments to identify children at risk for reading problems among those who may come from different linguistic backgrounds. More and more correlational studies on phonological awareness and reading ability in the L2 context have been conducted and require our close attention. We shall review some of these here.

A study in Sweden

Lundberg, Olofsson and Wall (1980) reported a study in Sweden on the relationship between phonemic awareness and reading and spelling skills. The purpose of the study was to further elucidate the relation between certain metalinguistic skills in kindergarten and later achievement in reading and spelling. The initial participants were 200 kindergarteners. No socio-economic bias could be discerned in any place. One year later, when students were in Grade one, data from 143 children (73 girls and 70 boys) from the original sample were obtained. Some six months later, in the first semester of Grade two, 133 children remained for the last measurement reported in this study.

A series of metalinguistic tasks, including segmentation and synthesis of words, were given to children in kindergarten: the synthesis task included synthesis of syllables, synthesis of phonemes, direct auditory synthesis of syllables and direct auditory synthesis of phonemes. The analysis task included segmentation into syllables, segmentation into phonemes, analysis of phoneme position, and reversal of phonemes and rhyme production. PREAD (The Preschool Reading Test) was used to assess kindergarteners' reading ability. The children were followed up on in school where reading and writing achievement was assessed with several tests and ratings. The first grade data included silent word reading, spelling, raven's progressive matrices, teachers' ratings of reading ability, teachers' ratings of spelling and writing ability, teachers' ratings of language comprehension and teachers' ratings of language production. Second grade data included silent word reading test (the same as in Grade one), Spelling II, and RAVEN II.

The results indicated that the most powerful determinant of reading achievement in Grade one was the ability in kindergarten to analyze phonemes and reverse their order. This strongly suggested that the achievement levels in children's reading and spelling in the first school years could be validly predicted from an assessment of their phonemic awareness skills at a time well before formal reading instruction had commenced. One possible use of the results was to identify high-risk children in kindergarten and pay attention to their specific needs in the hope of preventing later failures in school. However, great caution is advisable, since the prediction is after all not perfect; a few children will be mistakenly identified as having problem and a few real problems will be missed. This was the same advice given by Snider (1997), reviewed above.

In contrast to many prediction studies, the detection procedure of the present Lundberg et al investigation is based on a theoretical effort to identify some particular skills of fundamental significance in learning to read. This strategy in combination with the application of path analysis, has probably yielded more than predictive power. It has also provided some straightforward guidelines for intervention. The high predictive accuracy was largely accounted for by a small number of tasks that consistently yielded high path coefficients. The most powerful determinants of reading and writing skills turned out to be the analytic ability to manipulate phonemes.

An experimental study

Torneus (1984) conducted two experiments on the causal relationship between metaphonological skills (sound blending and segmentation) and reading/spelling in Sweden. The first purpose of the article was to elucidate further the issue of the causal relationship discussed above by means of two different approaches: statistical testing of causal models and experimentally designed training. The second purpose of the article was to investigate the effects of metaphonological training on segmentation, sound blending, reading, and spelling.

Experiment one was a part of a large-scale Nordic research project in which 723 children were studied during their first 6 years at school. At the end of Grade one and again at the beginning of Grade two, reading and spelling skills were assessed. Forty-six children (8 girls and 38 boys) were selected to dyslexic group based on their results on two cognitive tests, reading tests, and spelling tests in the following procedures. The first and second results from the reading and spelling tests were plotted against the corresponding results from the progressive matrices, and thus, four regression lines were obtained. A 90% confidence interval associated with each regression line was set up. For each child in the dyslexic group, a matched control child with a reading and spelling performance close to the regression line was selected. Finally, a control group had 44 children (8 girls and 36 boys).

Reading skill was assessed by means of a silent reading test, OS 400 (Soegard & Bording Petersen, 1974). Spelling skill was assessed at the end of Grade one by means of a dictation test consisting of 30 phonetically spelled common words. Four different metaphonological tests were used: sound segmentation, sound blending, position analysis, and segment deletion.

The results showed, through LISREL analysis (the method of structural equation modeling), that metaphonological abilities seemed to be dependent on cognitive, as well as on linguistic, development. Metaphonological abilities were of critical importance for the development of spelling and reading skills. Although the method of LISREL analysis was a powerful tool, causality could not be proved in a strict sense. Since perfect fit was theoretically impossible, there was always room left for arbitrariness in the final interpretation.

In order to investigate further the causal relationship between metaphonological ability and reading/spelling skills, experiment two was conducted. The author's question was, "Does metaphonological training improve segmentation and sound blending skills?"

The participants for experiment two were 38 children attending three different classes that participated in the study, which started when the children had attended Grade one for about 7 months (in Sweden, children enter school in August of their 7th year). All students were given a pretest battery including a segmentation test, sound blending test, spelling test, and OS400. After the pretest the experimental groups were given metaphonological training for 8 sessions, each lasting about 20 minutes. There was about one training session per week. Each training session included activities like rhymes, alliterations, sound verses, and games and tasks that trained segmentation and/or blending with morphemes, syllables, or sounds.

The results indicated that some children had not fully developed their segmentation and sound blending ability at the end of Grade one. These metaphonological skills could, however, be improved by training tasks specially designed for this purpose.

In general, the results from the testing of several causal models supported the hypothesis that metaphonological abilities had a causal influence on reading and spelling. The experimental results also supported the causal effect of metaphonological abilities on spelling.

Studies on Spanish-speaking children

It is necessary to take a look at the linguistic characteristics of Spanish since several studies here were conducted on bilingual and/or monolingual Spanish-speaking children. According to Cuetos & Labos (2001), the Spanish writing system is considered a shallow or transparent orthography with a consistent mapping between Spanish graphemes and phonemes. According to Jimenez-Gonzalez (1997), the vowels in Spanish only have one grapheme-phoneme correspondence. The majority of the consonants in Spanish also only have one pronunciation for reading purposes. The few consonants that have more than one pronunciation are regular within the context of the syllabic structure in which they appear.

Carlisle, Beeman, Davis, and Spharim (1999) investigated the developing metalinguistic capabilities of Hispanic primary school children who were becoming bilingual but whose English reading achievement was below average. The purpose of this study was to try to explain their difficulty in acquiring reading skills by examining the relationship of native and second language development to metalinguistic development and also to skill in English reading comprehension, for Hispanic primary school children learning a second language.

The participants were 57 children attending first, second, and third grade in a parochial school in Chicago. The school was located in a predominantly Mexican, low-income neighborhood. Over 80% of the students qualified for the school free-lunch program under the federal guidelines. There were 19 first graders (8 boys and 11 girls), 19 second graders (12 boys and 7 girls), and 19 third graders (7 boys and 12 girls).

In the fall, three standardized tests were administered to the children: the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981), the listening comprehension subtest and the letter-word identification subtest from Woodcock-Johnson Psychoeducational Battery-Revised (Woodcock & Johnson, 1989). Two experimental tasks were also administered in the fall. The Test of Auditory Analysis Skills (TAAS), a measure of children’s phonological awareness developed by Rosner (1975), required the students to analyze the sound structure of words, delete one sound, and then synthesize the remaining sounds to form a new word. The reading comprehension subtest from the California Achievement Test (CAT) was used as a measure of English reading comprehension.

Performance on the English phonological awareness task accounted for a significant 6% of the variance in English reading comprehension after the effects of Spanish and English vocabulary were accounted for. The extent of the contribution of formal definition quality might have been affected by the overlap between definitions and vocabulary knowledge; the correlation of English formal definition quality and reading comprehension was significant ($r = .33$, $p < .05$). Together, the language and metalinguistic measures accounted for 40% of the variance in reading comprehension. Thus, it might be fair to conclude that both metalinguistic measures were directly or indirectly related to English reading comprehension for the children in this study. Furthermore, the results indicated that both word meanings and sensitivity to the sound structure of words (phonological awareness) contributed to second language reading comprehension for these young (and not very skilled) readers.

Lindsey, Manis, and Bailey (2003) conducted a longitudinal study in Texas with 249 Spanish-speaking English language learners (mean age 67.8 months at the time of first test, 47.5% boys and 52.5% girls) who participated in an early transition bilingual Spanish-English program at three time points in kindergarten through Grade one. The main purpose of that study was to explore relations between: (a) cognitive skills assessed in the first language at the outset and at the end of kindergarten, and (b) reading competence in both the first and second language at the end of first grade. The second major purpose of the study was to determine how well Spanish-speaking children at risk for reading difficulties in English at the end of first grade could be identified from a small battery of cognitive measures administered in Spanish during their kindergarten year. The study addressed two questions. First, what was the extent of cross-linguistic transfer of certain cognitive skills involved in early reading acquisition? Second, how accurately could a battery of cognitive measures in the L1 be used to predict progress in the L2?

The study included a broad range of predictive measures: phonological awareness, rapid serial naming, sentence memory, letter knowledge, print awareness, and oral-language skill. Predictive measures were obtained only in Spanish for kindergarten (at two test points) because of the children's limited English skills. The same predictor variables were administered in English in the first grade. Outcome measures in first grade included phonological decoding in English and word identification and reading comprehension in both languages.

Three hypotheses pertaining to cross-language transfer were tested. The first hypothesis was that cross-language transfer would be observed for phonological awareness and word-identification skill, in keeping with past studies. Second, the authors predicted that additional variables that had been strong predictors of later word reading for monolingual children would show cross-language transfer (e.g., letter knowledge, print awareness, rapid serial naming). Third, a hypothesis derived from research on German and Dutch was that the predictive relationship between rapid serial naming and word reading would be stronger for Spanish to Spanish than for Spanish to

English, owing to the greater orthographic regularity of Spanish.

For the first hypothesis, the results indicated that phonological awareness was a general and not a language-specific cognitive process involved in early reading. For the second hypothesis, the results showed that cross-linguistic transfer was not unique to phonological skills but also occurred for measures of print awareness, letter knowledge, and rapid serial naming. For the third hypothesis, the study provided no support, although it is possible that different results would be obtained in later grades, particularly with fluency measures. In summary, this study found that phonological awareness had a high degree of transfer from Spanish to English and was predictive of word-identification skills.

Gottardo (2002) conducted a study to determine the relationship between L1 and L2 oral language proficiency and reading skills in bilingual Spanish-English speakers. For phonological processing, the study consisted of two tasks: one was a phonemic detection task and the other was a phoneme deletion task. Phonemic detection skill was measured in English and in Spanish whereas phoneme deletion performance was measured only in English. The participants were 85 Latino first graders in west Michigan who had immigrated to the United States during the last decade. The sample consisted of 42 girls and 43 boys, with a mean age of 80.1 months. All of the children spoke Spanish to their parents at home and only a small portion of them reported having older siblings who spoke some English at home.

The results indicated that language and reading measures were significantly correlated within languages as well as between the English and Spanish languages. In particular, reading and phonological processing were related within languages and across languages. More specifically, the English phonological processing variables, English oral language variables, and English rapid naming variables all correlated with English reading performance. In addition, phonological processing skill in Spanish, the child's L1, was related to L2 reading acquisition performance.

The strong relationship between phonological variables and reading was consistent with the findings of previous research. Phonological processing in English and Spanish was related to English reading and explained the highest proportion of variance on English reading. Multiple regression analysis revealed that the strongest predictors of English word reading ability were L1 and L2 phonological processing, L1 reading and L2 vocabulary.

The participants in the preceding studies were bilingual students of Spanish and English. What about participants in an ESL context?

Quiroga, Lemos-Britton, Mostafapour, Abbott, and Berninger (2002) conducted two studies to examine the relationship between phonological awareness and beginning reading in Spanish-speaking ESL first graders. There were four research questions. First, was phonological awareness important in the beginning stages of learning to read English when the student's first language was Spanish? Second, could cross-language transfer from phonological awareness in the first language to reading or phonological awareness in the second language be replicated in another sample of Spanish-speaking ESL students? If so, what were the instructional applications of these findings? Third, in the case of children whose first language was Spanish and second language was English, did language skills other than phonological awareness in Spanish or English influence learning to read in English? Specifically, was oral language proficiency such as vocabulary and syntax in oral expression and listening in either Spanish or English critical in learning to read English? Fourth, might an early intervention based on all these necessary instructional components help Spanish-speaking ESL students learn to read in English?

The participants for the first study were 30 Spanish-speaking ESL first graders (14 females and 16 males) from 10 urban, suburban, or semi-rural schools. These children received their instructions for either ESOL pullout or mainstream class only in English. No instruction in Spanish was provided.

Regarding the first research question, the findings were that phonological awareness was related to learning to read English when one’s first language was Spanish and reading instruction was conducted in English. Both Spanish and English phonological awareness predicted English word reading. This finding was of interest because a) Spanish has a more transparent phonology than spoken English, and b) Spanish has more regular spelling-phoneme correspondences than does English for decoding. For the second research question, the findings were that phonological awareness in Spanish, the first language, predicted reading in English, the second language, and that phonological awareness correlated across the first and second language. For the third research question, oral language proficiency in the second language predicted reading achievement in the second language.

The participants for the second study were four lowest achieving males and four lowest achieving females who participated in one-to-one tutorials. Each child received twelve 30-minute lessons. The tutorials occurred twice a week over a six-week period. They all received phonological awareness training in both Spanish and English, explicit instruction in alphabetic principles, practice reading and rereading text, and comprehension monitoring.

The second study answered the fourth research question. The results showed that the reading achievement of these Spanish-speaking ESL students was raised by 0.8 standard deviation in real-word reading and nearly 0.5 standard deviation in pseudoword reading in less than 2 months.

Comparison studies

Huang and Hanley (1994) examined the performance on tests of phonological awareness, visual skills, and reading abilities of children in Britain, Hong Kong, and Taiwan. The participants were 130 children from three primary schools in Great

Britain, Hong Kong, and Taiwan. They were all aged between 8 and 9 years. Because of the relative complexity of some of the tests (e.g. phonological awareness tests in an unfamiliar or second language), the participants were introduced to the tests separately.

Forty five 8 year-old children (20 boys and 25 girls) from a primary school in Liverpool were selected. None of them were of Chinese origin, and none of them had ever studied Chinese. All were native English speakers; those for whom English was a second language and those experiencing learning difficulties according to their teachers were not included in the study. The ages of the participants ranged from 8.0 to 8.9 with a mean age of 8.43 years at the time of testing. Fifty children (25 boys, 25 girls) from the third grade in a primary school located in Chang-Hua City, Taiwan, participated in this research. Ages ranged from 8.3 years to 9.3 years with a mean of 8.9 years. The sample excluded children who were suspected of mental retardation and those with sensory handicap according to the judgment of class teachers. All children were native Chinese and spoke Mandarin. These children had little or no exposure to English. Forty-two 8 year-old children (21 boys, 21 girls) from the third grade in a primary school in Hong Kong participated in the study. Their average age was 8.9 years. They were all native Cantonese speakers. These children studied English as a second language for seven hours per week at school.

Measures included the Schonell reading test (Britain and Hong Kong), a

Chinese Character Recognition test (Hong Kong and Taiwan), the Visual Form Discrimination (Benton et al, 1983), the Non-verbal IQ Test (Raven, 1956), British Picture Vocabulary Scale (BPVS) (Dunn, Dunn, and Whetton, 1982), and phonological awareness tests. The phonological awareness tests included odd man out tests (Bryant and Bradley, 1985) and phoneme deletion tests.

The results showed that phoneme deletion scores were significantly correlated with reading scores in both the Hong Kong and the Taiwan groups. All phonological tests were highly correlated with English reading in the UK subjects, ranging from .37 ($p<.05$) to .59 ($p<.001$). The phoneme deletion test, in particular, was highly related to English reading in the U.K. group. Using stepwise regression analysis, the results showed that the phonological test score was the most powerful predictor of English reading for English children. Vocabulary and IQ were also significant factors in predicting English reading in the U.K. group.

Some researchers have argued that the oddity task and phoneme deletion test might require different cognitive procedures (Yopp, 1992). Therefore, a separate analysis was performed in which the odd man out tests were combined as a single oddity score and entered separately from the phoneme deletion scores. The predictors comprised IQ, BPVS, visual skill, oddity score and phoneme deletion. The results showed that the phoneme deletion test performance was the most powerful predictor of English reading. Finally, a fixed order stepwise regression was performed in which the order of the steps was determined by the experimenter. Regardless of whether a phonological test score was entered into the regression equation before visual skills or after visual skills, phoneme deletion still accounted for a large proportion of the variance in reading scores.

The study found that the Taiwanese children who have learned Zhu-Yin-Fu-Hao (an alphabetic script similar to Pinyin which is the alphabetic system used in mainland China, in which each phoneme is represented by a unique visual symbol) performed very much better than the Hong Kong children on the Chinese phoneme deletion test. This was reminiscent of Read et al's (1986) finding that phoneme deletion was superior in Chinese adults who had been taught the alphabetic script Pinyin and with Mann's (1986) finding that 6-year-old Japanese children performed less well than American children on a test of phoneme deletion. In short, performance on phoneme deletion tests seemed to be dependent on one's experience of learning an alphabetic script in the language in which one was being tested.

Chiappe and Siegel (1999) examined whether the same component processes are involved in reading acquisition for native and nonnative speakers of English in the first grade. The participants were 175 first grade children recruited from three schools in metropolitan Toronto, Canada, including 93 native English speakers and 82 children who spoke a language other than English with their parents. A subset of 50 children who were native English speakers was randomly selected to be included in this study, whereas all 38 children who spoke Punjabi at home with both parents were included. Children predominantly came from the middle class. All the children had been enrolled in school since junior kindergarten (age 4), so the Punjabi-speaking children had been exposed to English for 2 years. Most of the Punjabi-speaking children's parents had a high-school education in India. Seventeen children (11 native English speakers and 6 Punjabi-speaking children) were classified as poor readers based on their performance on the reading subtest of the Wide Range Achievement Test—3 (WRAT3; Wilkinson, 1995). These children had reading scores below the 26th percentile. Seventy-one children (39 native English speakers and 32 Punjabi-speaking children) whose WRAT3 reading scores were above the 29th percentile were classified as average readers. The mean age of the total sample was 78.4 months.

The word reading measures included, in addition to WRAT3, a set of 40 experimental words, and a second set of words drawn from the Bridge reading program (Dewsbury, Jennings, & Boyle, 1983). Syntactic awareness was assessed using an oral cloze task developed by Willows and Ryan (1981). There were five sets of phonological measures. First, children's skill at recognizing and reproducing sounds in oral language was assessed using the sound mimicry subtest of the Goldman, Fristoe, and Woodcock (1974) Sound Symbol Test. In this task, children repeated pseudowords of increasing difficulty that had been read to them by the experimenter. Pseudowords ranged in difficulty from vowel-consonant syllables (e.g., ab and id) to polysyllabic pseudowords (e.g., depnoniel and bafmothem).

The second task was the phoneme recognition task used by Vandervelden and Siegel (1995). In this task, children indicated whether a target phoneme was presented in a test word. For example, the examiner said: “Listen for /s/, /fat/. Does /fat/ have a /s/?” The target phoneme was contained in 20 target words and was not contained in the other 20 items. When presented, the target phoneme was always in the initial position.

The third measure of phonological processing was the phoneme recognition/location identification task used by Vandervelden and Siegel (1995). In this task, the child was required to indicate whether the target phoneme was in the initial position, the final position, or not present in the target word. The fourth task assessed the children’s ability to delete and substitute phonemes within words. Items selected from Levels F, G, and H of the Auditory-Motor Skills Training (Rosner, 1973) were administered to the children. The fifth task was a variation of the rapid automatized naming task (Denckla & Rudel, 1974). Finally, a pseudoword reading task assessed children’s skill at phonological recoding.

The results showed that the performance profiles of Punjabi-speaking children in English were very similar to those of native English speakers. Similarly, children from Punjabi-speaking families did not differ significantly from native English speakers on measures of word recognition or phonological processing. In addition, phonological processing shared an important relationship with reading skill for both native and non-native speakers of English. Phonological awareness (as measured by the phoneme recognition and phoneme location identification tasks, and phoneme deletion and substitution) and phonological recoding (as measured by pseudoword reading) discriminated between groups of children based on reading skill, not on their first language. The majority of the children from Punjabi-speaking families were able to develop strong skills at phonological processing in English and read as well as average readers who were native English speakers.

In short, several implications for education might be drawn from the study. Although it was conducted with students speaking only one language other than English, the results can be viewed as encouraging for instruction in multicultural classrooms. Most of the children from Punjabi-speaking families had levels of reading and phonological processing similar to those of monolingual English-speaking children. The bilingual children who did experience difficulties in reading had a similar pattern of difficulties as the monolingual English-speaking children because the performance profile of poor readers was the same for both native and non-native speakers of English. Thus, phonological processing played a critical role in reading acquisition for both native and non-native speakers.

Although a great deal is known about the prereading skills necessary for early reading acquisition in English, the question remains as to whether the same patterns exist for children learning English as a second language. Lesaux and Siegel (2003) conducted their study of patterns of reading development on English-speaking L1 children and children who spoke English as a second language. This study was an investigation of the development of reading in a program designed for children who entered kindergarten with little or no proficiency in the language of instruction. For this group of children, it was critical to examine the development of reading and to examine those skills that were predictors of reading development in kindergarten. The focus in this study was on those ESL speaking children who were immersed in mainstream English classrooms in kindergarten.

The sample consisted of 978 kindergarteners (790 L1 speakers and 188 ESL speakers; mean age: 64.39 months) when the study began. There were 469 girls and 509 boys. The sample spoke a total of 33 languages, with the predominant ones being Cantonese, Mandarin, Korean, Spanish, Persian, Polish and Farsi. None of the ESL children received ESL instruction due to the district policy that ESL instruction was mainly reserved for higher elementary graders (grade 4-6). They could not read in their native language when they entered kindergarten.

The measures included kindergarten measures and Grade two measures. For the kindergarten part, literacy measures included WRAT3 (Wilkinson, 1993) and letter identification. Phonological processing included sound mimicry, rhyme detection, phoneme deletion, syllable identification and phoneme identification. The rest were lexical access, syntactic awareness, memory and spelling. For the Grade two part, reading measures included WRAT3, Woodcock Reading Mastery Tests-Revised, Form G (Woodcock, 1987), WRMT-R, Form G (Woodcock, 1987) word attack subtest, Standford Diagnostic Reading Test (Karlsen & Gardner, 1994), a reading comprehension subtest, one-minute word reading (WRAT3 reading subtest, tan form; Wilkson, 1993), and one-minute pseudoword reading (WRMT-R word attack subtest, Form H; Woodcock, 1987). Memory measures included working memory for words (Siegel & Ryan, 1989) and working memory for numbers (Siegel & Ryan, 1989). Spelling measures included WRAT3 spelling subtest (Wilkson, 1993), real word spelling and nonword spelling. The other measures included phonological processing, lexical access, syntactic awareness, and arithmetic.

The results showed that in kindergarten, the L1 children performed significantly better than the ESL children on tasks of rhyme detection, pseudoword repetition, memory for sentences, syntactic awareness, rapid naming, and spelling. On all other tasks, there were no significant differences between the two language groups. There were no significant differences between the ESL at-risk and ESL not-at-risk groups on tasks of language and memory. On all other tasks, the ESL not-at-risk group performed significantly better than the ESL at-risk group. The L1 at-risk group performed significantly more poorly than the L1 not-at-risk group on all tasks.

In Grade two, the performance of the ESL children was significantly better than that of the L1 children on the WRMT-R word identification subtest, the rapid naming task, the WRAT3 spelling subtest, real word spelling, nonword spelling, the one-minute pseudoword reading task, the one-minute word reading task, and the WRAT3 arithmetic subtest. On the oral cloze task, the performance of the ESL children was significantly lower than that of the L1 children. On all other tasks, there was no difference between the language groups.

Among the ESL children, there was no significant difference between the disabled readers and the average readers on the working memory for words task. On all other tasks, the ESL average readers performed significantly better than the ESL disabled readers. Similarly, among the L1 children, there was no significant difference between disabled readers and average readers on the working memory for words task. On all other tasks, the L1 average readers performed significantly better than the L1 disabled readers.

In summary, the results supported previous research that had found that even if a young child was still developing phonological awareness skills in his or her native language, these skills from the children's first language helped reading acquisition in a second language and could be a stronger predictor of reading ability than was oral proficiency in either the child's native or second language. The same variables in kindergarten identified the children at risk in the ESL and L1 groups. These results suggested that the research had identified kindergarten phonological awareness as one of the single best predictors of reading development in native English speakers. Multiple regression analysis showed that phonological processing was the single best predictor of Grade two word reading ability.

Chiappe, Siegel, and Gottardo (2002) examined reading-related skills of kindergartners from diverse linguistic backgrounds. The authors believed that screening for the cognitive and linguistic skills that were considered prerequisite to reading acquisition was a first step toward intervention. According to Siegel (1993), there were five basic cognitive processes involved in reading. These processes included phonological processing, syntactic awareness, working memory, semantic processing, and orthographic processing. Although these processes had proven to be robust predictors of subsequent reading ability within one's native language, it was less clear whether these measures were also appropriate for children from linguistically diverse backgrounds.

Therefore, in their study, the authors examined the nature and development of phonological processing, orthographic awareness, and naming speed in both native English-speaking prereaders and children from diverse linguistic backgrounds.

Literacy measures included WRAT3 (Wilkinson, 1995), a letter identification task, and a spelling task. Measures of phonological processing included sound mimicry, rhyme detection, syllable and phoneme identification, phoneme deletion, and Ran tasks (Denckla & Rudel, 1976). Other measures included syntactic awareness and verbal memory.

The participants were 659 kindergartners enrolled in 32 schools in the North Vancouver school district. Among them, 540 children were native English speakers (NS), 59 bilingual (BL) students, and 60 ESL students. The main languages spoken were Chinese (both Mandarin and Cantonese, 21 children), Farsi (12 children) and Korean (6 children). The mean age of the participants was 64.2 months.

In this study, the acquisition of basic literacy skills for children with different language backgrounds developed in a similar manner. In fact, the ESL and BL children showed performance and growth in English comparable to native English speakers on measures of letter identification, spelling, and word recognition, as measured by the WRAT3 and the environmental print task. Although the NS and BL children were more successful than the ESL children at identifying logos from the environment, children from the three language groups performed equally well when the logos were removed and the environmental print task became a decoding task.

The Chiappe, Siegel and Gottardo study also examined whether the relations between literacy measures and measures of phonological awareness, alphabetic knowledge, naming speed, syntactic awareness, and verbal working memory were the same for native and nonnative speakers of English. For children from the three language groups, the results indicated that phonemic awareness was correlated with literacy skill by the end of kindergarten. In fact, phonemic awareness tended to be more highly related to literacy skill than were rhyme detection and syllable identification for children from all three language groups. Thus, the view that metalinguistic processing at the phonemic level may be more highly related to reading acquisition may be extended to children learning to read in a foreign language.

In summary, although measures of phonological awareness, syntactic awareness and verbal working memory were more difficult for children learning English, their limited exposure to English did not inhibit their acquisition of basic English literacy skills. More specifically, alphabetic knowledge, spelling and phonological processing, were strongly related to literacy acquisition in English for children from the three language groups.

Muter and Diethelm (2001) conducted a longitudinal study on the relationship between phonological awareness and reading ability in children from diverse linguistic backgrounds. The main aims of their study were to determine the structure of phonological skills in a sample of children from multilingual backgrounds and to determine their validity as predictors of reading ability. The authors planned to address the following questions:

a. Can the multifactorial nature of phonological awareness in monolingual

English speakers be extended to a linguistically heterogeneous sample?

b. Do phonological awareness tests, in particular measures of segmentation, predict early progress in learning to read, irrespective of the language to which the child was initially exposed?

c. Do English-mother tongue children show a similar or different pattern of phonological skill from those who have a different native language, and if so, how might this relate to subsequent English reading development?

d. What is the relative importance of vocabulary, letter knowledge and phonological skill in predicting early reading development?

The participants were 55 children (27 girls and 28 boys) from two kindergarten classes at the International School of Geneva, Switzerland. Their ages ranged from 4 years and 9 months to 5 years and 7 months, with a mean age of 5 years and 2 months at the beginning of the study. The children were from multilingual backgrounds: 22 were English L1, 28 were non-English L1 and 5 were of mixed L1. One year later, 46 students remained in the sample, of whom 17 were English L1, 24 were non-English L1 (all had been exposed to English as a language of instruction for at least 18 months), and five children were of mixed L1, but where one of the languages spoken at home was English. The children were of middle class social background.

At both Time one and Time two (separated by one calendar year), the children were administered all six subtests from the Phonological Abilities Test (PAT, Muter, Hulme, & Snowling, 1997). The PAT comprises four phonological awareness tasks: rhyme detection, rhyme production, word completion (syllables and phonemes), and phoneme deletion (beginning and end sound), together with a measure of speech rate and a test of alphabet letter knowledge. In addition, at both Time one and two, the children were given the British Picture Vocabulary Scale (BPVS, Dunn, Dunn, & Whetton, 1982), a measure of receptive vocabulary derived from the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981). At Time one, the children were given the Ravens Progressive Matrices Test (1965), and at Time two, a test of single-word reading was administered.

The relationships between the phonological measures, letter knowledge, vocabulary, and general cognitive skill at age 6 were investigated in a series of hierarchical multiple regression analyses. The Time two measures having the highest correlations with reading in the same year were beginning phoneme deletion ($r=.38$, $p<.01$), end phoneme deletion ($r=.36$, $p<.01$), BPVS Vocabulary ($r=.41$, $p<.01$), and letter knowledge ($r=.61$, $p<.001$). The factor scores were retained for the two factors derived from the Time two Principal Components Analysis, i.e. rhyming and segmentation. The correlations of the Time two factor scores with reading in the same year were .20, ns, for rhyming and .44, $p<.01$, for segmentation.

The first analysis examined the relative contribution of the Time two segmentation and of rhyming skill to concurrent reading ability. Segmentation ability was a significant contributor to children's concurrent reading ability (Beta = .39, $p<.01$). Both letter knowledge and segmentation significantly predicted reading skills at age 6 after controlling for the effects of general cognitive ability and vocabulary. The Time one measures having the highest correlation with reading one year later were end phoneme deletion ($r=.31$, $p<.05$), phoneme completion ($r=.47$, $p<.01$, and letter knowledge ($r=.50$, $p<.001$). The factor scores were retained for the three factors derived from the Principal Components Analysis of the phonological measures conducted at Time one, i.e. rhyming, implicit segmentation, and explicit segmentation. The correlations of these factor scores with reading one year later were .36, $p<.01$ for implicit segmentation, and .26, $p<.05$ for explicit segmentation.

The multiple regression analysis investigating the relative salience of rhyming and segmentation to reading pointed to segmentation measures being stronger predictors of reading skill than rhyming measures.

In summary, this finding extended Muter and Diethelm's previous work on monolingual children to a multilingual sample. It confirmed that, first, phonological abilities were good predictors of both concurrent and later reading achievement and, second, segmentation measures were better predictors that rhyming measures. The study findings demonstrated clear and consistent relationships between phonological skills and learning to read among children from multilingual backgrounds.

In conclusion, all journal articles reviewed here support the contention that there is a strong relationship between phonological awareness and reading ability in the ESL or bilingual context that we referred to as the L2 context.

Implications for the Relationship between Phonological Awareness and Reading Ability in the EFL Context

Correlational studies on phonological awareness and reading ability in EFL contexts are very limited. After searching all possible sources, to the best of my knowledge, I found only the following study that is directly related to the relationship between phonological awareness and reading ability of young children in the EFL context.

Allen-Tamai (2000) reported her studies related to phonological awareness and reading development of young Japanese learners of English. The dissertation consisted of three sub-studies. The first study investigated the effect of nursery songs on the development of English rhyme awareness among 62 five-year-old Japanese children. It found that it was possible to measure the rhyme awareness of preschool learners and that the children could learn rhymes and develop their rhyme skill in class.

The second study was a cross-sectional correlational study involving 700 Japanese elementary school children from the first to sixth grades who learned

English at school. This study investigated the relationship between English phonological awareness and English development. Path analysis showed that only rhyme ability was a significant predictor of success in word recognition and reading ability.

The last study investigated the effect of English phonological training on the development of English phonological and/or reading skills among 357 Japanese elementary school children from the first to sixth grades who learned English at school. The participants in the experimental group showed more gain from the treatment, although there was no significant difference between the groups, probably because of the limited training time. In summary, in the EFL context in Japan, only rhyme ability was a significant predictor of word recognition and reading ability of young Japanese children.

After reviewing all these studies in the L1, L2 and English as a Foreign Language contexts, it seems that the findings have some implications for the relationship between the phonological awareness and reading ability of young children in the EFL context.

The strong relationship between phonological awareness and reading ability of young children in L1 and L2 contexts can be seen as encouraging for a strong relationship between phonological awareness and reading ability in the English as Foreign Language context. Allen-Tamai (2000) reported that rhyme ability was a significant predictor of word recognition and reading ability of young Japanese learners of English. More studies are needed to determine the relationship between other components of phonological awareness and reading ability of young children in the EFL context.

Cross-language Transfer of Phonological Awareness

Studies on transfer of phonological awareness from Spanish to English

Durgunoglu, Nagy and Hancin-Bhatt (1993) investigated the factors influencing the English word identification performance of Spanish-speaking beginning readers. The subjects were 27 Spanish-speaking, first-grade students from two school districts. They were identified by their teachers as beginning and nonfluent readers. The mean age of the subjects was 85.3 months at the time of testing, and there were 11 girls and 16 boys. All subjects were in transitional bilingual education programs because they were considered to have limited English listening and speaking proficiency as determined by State Board of Education guidelines. In the first grade, students were mostly instructed in Spanish, with English taught as a second language.

All tests were individually administered to the students by experimenters fluent in both Spanish and English. Each child was tested on two occasions separated by an interval of one or 2 weeks. During the first testing session, the experimenters gave instructions in Spanish and gave all of the Spanish tests and an English word recognition test. The order of testing was as follows: letter naming, Spanish word recognition, English word recognition, Spanish phonological awareness, and Spanish oral proficiency. During the second testing session, the experimenters gave instructions in English but translated them to Spanish if necessary and an English oral proficiency and transfer test were given. The order of testing was as follows: English-like pseudoword training and reading, English word reading, and English oral proficiency test.

The results indicated that Spanish word recognition and Spanish phonological awareness were better predictors of performance on English pseudoword and word reading tests than were English or Spanish oral proficiency or English word recognition. To determine whether Spanish word recognition and phonological awareness have overlapping influences on transfer test performance, the authors performed hierarchical regression analysis and entered the two variables in different orders to determine whether one variable explained a unique amount of variance when the other one was accounted for in the regression equation. The results showed that the best predictors of performance on English pseudoword and word recognition tests were Spanish phonological awareness and Spanish word recognition. Interestingly, neither English nor Spanish oral proficiency was a good predictor.

Research with monolingual beginning readers had demonstrated the strong relationship between phonemic awareness and reading acquisition. Durgunoglu, Nacy and Hancin-Batt replicated this finding with Spanish-speaking children and showed that phonemic awareness in Spanish was closely related to Spanish word recognition. Children who could perform well on Spanish phonological awareness tests were more likely to be able to read English words and English-like pseudowords than were children who performed poorly on phonological awareness tests. In short, phonological awareness was a significant predictor of performance on word recognition tests both within and across languages.

The cross-language transfer summarized in this article indicates that it is possible to build on the strengths that a child already has in his or her first language. A child who already knew how to read in Spanish and who had a high level of phonological awareness in Spanish was more likely to perform well on English word and pseudoword recognition tests. In contrast, a child who had some Spanish word recognition skills but low phonological awareness tended to perform poorly on English transfer tests. Developing phonological awareness and word recognition skills in the first language was likely to help in second-language word recognition.

Cisero and Royer (1995) examined whether phonological awareness skills develop in a specific pattern and, once developed, whether they transfer to another language. There were two experiments in this study. The subjects for the first experiment were first grade students from mainstream and Transitional Bilingual Education (TBE) classes in a western Massachusetts school system. Twenty-one students were from a TBE classroom and 14 were from a mainstream classroom. TBE students were native Spanish-speaking children and mainstream students were native English speakers. The subjects for experiment two were first grade and kindergarten students from the same state. There were a total of 10 kindergarten and 11 first grade TBE students and 49 kindergarten and 29 first grade mainstream students.

The measures consist of rhyme detection, initial phoneme detection, and final phoneme detection tasks. Tasks were developed in English and Spanish.

The results showed that evidence for cross-language transfer was found, but finding it depended on looking at the right skill at the right time in a student's developmental history. The regression analyses indicated that native language accuracy performance on the initial phoneme task was a significant predictor of L2 performance on the task after the variance associated with L2 performance on experiment one was accounted for. This result indicates that native language performance was a significant predictor of the gain in second language performance from experiment one to experiment two. The authors believed that it was not accidental that the only significant evidence they found in the regression analyses for cross-language transfer came from the initial phoneme task.

Phonological awareness is not only related to learning to read in English, but also an important factor in learning to read in other languages such as French, Italian, Serbo-Croatian, Spanish, and Swedish (e.g., Alegria, Pignot, & Morais, 1982; Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; de Manrique & Gramigna, 1984; Lundberg, Oloffson, & Wall, 1980; Ognjenovie, Lukatela, Feldman, & Turvey, 1983). The above-reviewed Cisero and Royer (1995) study also stated that, with respect to the transfer of phonological awareness from the native language to another language, the language needed to be alphabetic with similar phonological structure.

Lopez and Greenfield (2004) focused on cross-language transfer of phonological awareness. The main objective of their study was to determine the interlanguage relationships of Spanish and English for both oral language skills and phonological awareness with Spanish-speaking preschool children.

The sample consisted of 100 children (49 males and 51females) with a mean age of 56 months. All of the children in the study were participants in a Head Start program in Miami, and were identified as Hispanic based on the Head Start registration form filled out by parents at the beginning of the year.

The study used two measures. Oral language proficiency was measured using the pre-Language Assessment Scale 2000 edition (preLAS 2000) (Duncan & DeAvila, 1998), which utilizes a convergent approach to measure receptive and expressive language. The assessment consists of both oral language and preliteracy components. The authors developed the Phonological Sensitivity Test to measure three types of phonological skills in preschool children: rhyming, alliteration, and sentence segmenting.

A hierarchical multiple regression was conducted using English phonological awareness as the dependent variable. English oral proficiency, Spanish oral proficiency, and Spanish phonological awareness were entered respectively as independent variables in a stepwise multiple regression to control for the variance attributable to proficiency when comparing phonological awareness across languages.

The results showed that all three independent variables were significant predictors of English phonological awareness. The first variable entered into the equation, English oral proficiency, significantly accounted for the most variance (27%). Spanish oral proficiency accounted for 8% of the variance associated with English phonological awareness. Spanish phonological awareness uniquely and significantly accounted for 6% of the variance associated with English phonological awareness. It should be noted that once Spanish phonological awareness was included in the equation, the effect of Spanish proficiency on English phonological awareness, although still significant, dropped to 3%, indicating that most of the variance attributed to Spanish proficiency was shared with Spanish phonological awareness.

In summary, the Lopez and Greenfield study extended prior research on the cross-language transfer of phonological skills to the critical preschool age. The findings from the study revealed that phonological awareness in English was directly related to phonological awareness in Spanish in Hispanic Head Start children, which supports prior research with older children that found phonological awareness skills in one language are related to phonological skills in a second language. English phonological awareness, beyond its unique relationship with Spanish phonological awareness, was also related to both English and Spanish language proficiency.

A study on transfer of phonological awareness from Chinese to English

However, another study on the transfer of phonological awareness from Chinese -- a language that does not meet the requirements—to English still found a transfer of phonological awareness.

Gottardo, Yan, Siegel and Wade-Woolley (2001) examined factors associated with English-reading skill in one group of 65 children learning English as an L2 who were native speakers of Cantonese. These children were living in Canada and attending schools where English was the primary language of instruction. The children had a wide range of English experience. Some children were recent immigrants to Canada, having lived in the country for less than 2 years, whereas others were born in Canada and had received all their primary academic schooling in English.

Parallel measures of phonological processing, orthographic processing, and oral language skill were administered in English and Cantonese. They assessed whether measures related to English reading performance in this group were the same as well-known predictors of reading in monolingual English speakers, and whether performance on any of the Chinese measures was associated with English word reading. The methodology used in this study allowed the authors to examine the question of cross-language transfer of reading-related skills from Chinese to English, two languages with very different phonological and orthographic systems. Finally, the authors examined the impact of participants' native language phonological awareness on their second language reading skill.

The results of the correlational analyses revealed that performance on the English phoneme deletion task was significantly related to English reading performance. In addition, Chinese rhyme detection was significantly related to English reading performance. Hierarchical regression analysis was conducted using the residual scores for the Chinese rhyme detection task and the English phoneme deletion task that accounted for age and amount of education in the respective language. The results showed that performance on the English phoneme deletion task contributed unique variance (10.2%), $F(1, 62) = 9.83$, $p < .01$, to reading performance when it was entered after the Chinese rhyme detection measure. In the meantime, performance on the Chinese rhyme detection task also contributed unique variance (6.2%), $F(1, 62) = 5.99$, $p < .01$, to English word reading when it was entered after the

English phoneme deletion task.

In summary, the study demonstrated that the same relationship exists among English tasks that measured phonological processing and reading in children who are native Chinese speakers. The finding is in accordance with those from other studies reviewed in this section. In addition, rhyme detection in Chinese, the only phonological measure administered in the children's native language, was associated with English-reading skill. Other measures of Chinese oral language proficiency and reading performance were not strongly related to English-reading performance in the analyses that were conducted.

Chinese rhyme detection performance was also significantly correlated with the English phonological processing measures. This cross-language transfer of phonological processing skill is consistent with previous research conducted with other groups of ESL learners who spoke European languages and who learned to read alphabetic writing systems in their native languages (Cisero & Royer, 1995; Durgunoglu et al., 1993).

Finally, when the participants' native language and second language phonological measures were measured together to determine unique relationships to English reading, Chinese phonological processing as measured by a rhyme detection task was also a unique statistical predictor of English reading, even when other English phonological processing variables were statistically controlled. English phonological processing as measured by a phoneme deletion task was a unique statistical predictor of English reading, even when Chinese phonological processing was statistically controlled. Therefore, both English and Chinese phonological processing contributed unique variance to English reading.

The finding in the Gottardo et al. (2001) study that Chinese rhyme detection was predictive of English reading points to the importance of phonological processing skill in the child's native language for learning to decode an alphabetic orthography, even if the orthography of the child's native language is not alphabetic.

Summary of Chapter 2

All L1 studies reviewed here support the idea that phonological awareness is strongly related to reading acquisition in monolingual English speakers. Evidence from L1 studies that investigated the training of phonological analysis skills in young readers also suggests a causal link between phonological awareness and reading. In an L2 context, more and more studies report that there is a strong relationship between phonological awareness and reading acquisition in young children. L2 here includes both ESL and bilingual contexts. One study has compared ESL learners from a variety of different first language backgrounds (Chiappe & Siegel, 1999). Most of the children from Punjabi-speaking children families had levels of reading and phonological processing similar to those of monolingual

English-speaking children. More interestingly, the performance profile of poor readers was the same for both native and non-native speakers of English.

Although only one study on the relationship between phonological awareness and reading ability of young children was available (Allen-Tamai, 2000), its findings indicated that there was a strong relationship between the phonological awareness and reading ability of young Japanese children learning English. Rhyme skill was also found to be a significant predictor of reading ability for these children. The findings from L1, L2 and EFL contexts all point in the same direction--that there is a strong relationship between the phonological awareness and reading ability of young children in all three contexts.

All journal articles related to the cross-language transfer of phonological awareness that were reviewed here have supported the notion that phonological awareness transfers from participants' native languages (though the participants' native language in most studies was Spanish and, in just one, a Chinese dialect, Cantonese) to their second language, which was English.

CHAPTER 3: METHOD

Overview

This chapter begins with the settings of the research, including how I selected participants, the locations of the participants and the number of participants that were selected. Independent and dependent variables are laid out in this chapter. I will introduce measures in English and in Thai including how they were created. I will also give a brief introduction of data collection, procedures and data analysis of this study. This chapter ends with a summary.

Settings

The participants in this study came from ten primary schools in nine provinces of the lower northern part of Thailand. Traditionally, Thailand is divided into four regions: North, Northeast, Central and South (see Figure 2). The following figure would give us a general idea of those four regions in Thailand.

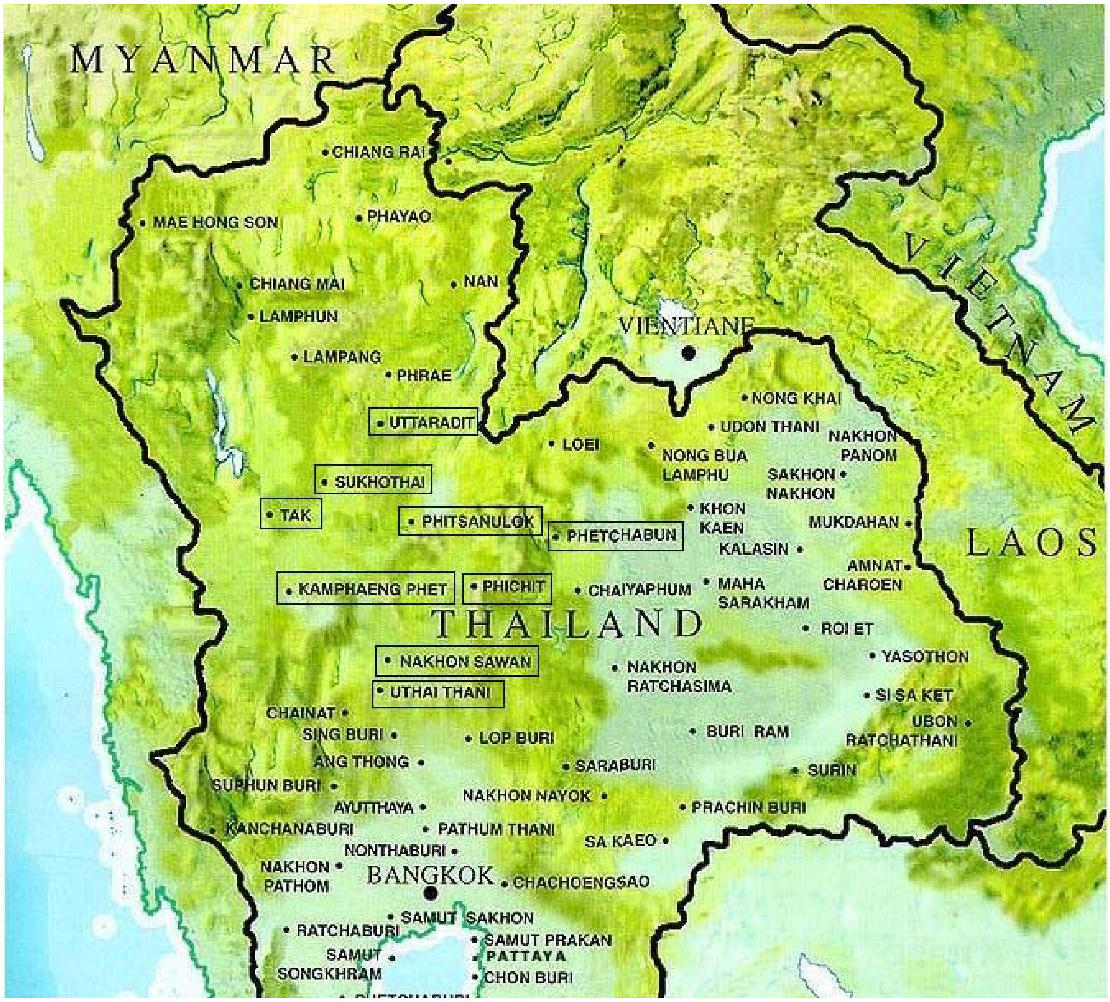
Figure 2 *The Four Regions of Thailand*

Note:

Source: http://www.thaiembdc.org/aboutthai/map_home.jpg

The North is further divided into two parts: the Higher North and the Lower North. Participants were chosen from the Lower Northern part of Thailand since the people living in this area speak standard Thai and the annual income per capita is medium. In addition, currently there are a total of 76 provinces in Thailand. Nine provinces were selected in the Lower Northern part of Thailand. They were Tak, Kamphaeng Phet, Nakhon Sawan, Phichit, Phitsanulok, Uttaradit, Phetchabun, Sukhothai and Uthai Thani (see Figure 3). These nine provinces are very close to each other and share similar social economic development.

Figure 3 *Nine Sample Provinces*



Notes:

1. Source: http://www.asiatravel.com/thaimap.html

2. Provinces inside a rectangle are sample provinces.

I planned to select about 400 students. The number of participants was determined according to a table for determining sample size produced by Krejcie and Morgan (1970) in response to an article called "Small Sample Techniques" issued by the research division of the National Education Association. In this article a formula was provided for the purpose of determining sample size however, as Krejcie and Morgan noted an easy reference table had not been provided. Consequently, they produced a table based on the formula:

$$s = X^2 NP(1-P) \div d^2(N-1) + X^2 P(1-P).$$

s = required sample size.

X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05).

No calculations are required to use the table which is reproduced in Appendix A. According to Krejcie and Morgan, if one wishes to know the sample size required to be representative of the opinions of 9,000 specified electronic users, then one enters the table at N = 9,000. The sample size in this example is 368. The table is applicable to any population of a defined (finite) size. It should be noted that as the population increases the sample size increases at a diminishing rate and remains relatively constant at slightly more than 380 cases.

Participants

Based on the table from Krejcie and Morgan (1970) (see Appendix A), a few more than the required number of student participants (424 students) were selected from the third grade student population in the aforementioned provinces. All students were Thai nationals. All students spoke Thai as their primary language. Any child who had a history of hearing, oral language and cognitive disabilities was not selected into the sample. Starting from 2001, all students began to learn English no later than Grade one. Thus when the measures were administered to the students, they had been studying English for at least three years. Grade three was chosen because students have a background in English by then but are not studying it as intensively as they would be in grade four and beyond. Third grade students were deemed the ideal population from which to draw for this study.

The table below shows the third grade student population in nine provinces in Lower Northern part of Thailand, the planned sample sizes according to Krejcie and Morgan (1970) and the actual sample sizes.

Table 3 *Total third grade population in nine provinces, planned and actual sample sizes*

Thai province	*Total third grade population*	*Planned sample*	*Actual sample*
Tak	7,814	45	50
Kamphaeng Phet	9,035	52	53
Nakhon Sawan	10,482	60	63
Phichit	5,738	33	35
Phitsanulok	9,685	56	59
Uttaradit	4,710	27	28
Phetchabun	10,849	62	65
Sukhothai	6,925	40	44
Uthai Thani	4,235	25	27
Total	69,473	400	424

Note:

Sources for total third grade population were the Provincial Education Commissions of all the sample provinces in Thailand (2005).

Research Design: Independent and Dependent Variables

The purpose of the study was to investigate the relationship between phonological awareness and reading ability in English and in the Thai language of Thai students in primary schools in Thailand. I also wanted to investigate whether there is any transfer of phonological awareness from Thai to English among Thai primary school students.

When investigating the relationship between phonological awareness and reading ability in English, four independent variables and two dependent variables were involved. The four independent variables were English Initial Sound Detection, English Final Sound Detection, English Rhyme Task and English Phoneme Deletion. The dependent variables were two subtests of reading ability in English. They were English Real Word Reading and English Pseudoword Reading.

When investigating whether English Letter Identification is a powerful predictor, six independent variables and two dependent variables were involved. The six independent variables were English Initial Sound Detection, English Final Sound Detection, English Rhyme Task, English Phoneme Deletion, English Letter Identification Upper Case and English Letter Identification Lower Case. The dependent variables were two subtests of reading ability in English. They were English Real Word Reading and English Pseudoword Reading.

When investigating the relationship between phonological awareness and reading ability in Thai, there were four independent variables and two dependent variables involved. The four independent variables were Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion. The dependent variables were two subtests of reading ability in Thai. They were Thai Real Word Reading and Thai Pseudoword Reading.

When investigating whether Thai Letter Identification is a powerful predictor, there were five independent variables and two dependent variables involved. The five independent variables were Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task, Thai Phoneme Deletion and Thai Letter Identification. The dependent variables were two subtests of reading ability in Thai. They were Thai Real Word Reading and Thai Pseudoword Reading.

When investigating whether there is any transfer of phonological awareness from Thai to English, there were two steps. The first step was to check the intercorrelations between phonological awareness in English and phonological awareness in Thai. The second step was to use Thai phonological awareness to predict English reading ability. There were four independent variables and two dependent variables were involved. The four independent variables were Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion. The dependent variables were two subtests of reading ability in English. They were English Real Word Reading and English Pseudoword Reading. If the intercorrelations between English phonological awareness and Thai phonological awareness were significant, and Thai phonological awareness could predict English reading ability, then the results would suggest that there was a transfer of phonological awareness from Thai to English among Thai primary school students. Here is a table to show independent variables and dependent variables in each investigation.

Table 4 *Independent and dependent variables*

Investigating	*Independent variables*	*Dependent variables*
Relationship between phonological awareness and reading ability in English	English Initial Sound Detection, English Final Sound Detection, English Rhyme Task and English Phoneme Deletion	English Real Word Reading and English Pseudoword Reading
Whether English Letter Identification is a powerful predictor	English Initial Sound Detection, English Final Sound Detection, English Rhyme Task, English Phoneme Deletion, English Letter Identification Upper Case and English Letter Identification Lower Case	English Real Word Reading and English Pseudoword Reading
Relationship between phonological awareness and reading ability in Thai	Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion	Thai Real Word Reading and Thai Pseudoword Reading
Whether Thai Letter Identification is a powerful predictor	Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task, Thai Phoneme Deletion and Thai Letter Identification	Thai Real Word Reading and Thai Pseudoword Reading
Transfer of phonological awareness from Thai to English (second step)	Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion	English Real Word Reading and English Pseudoword Reading

Instruments

This study used two types of instruments: a background questionnaire (see APPENDIX G) and measures in English and in Thai. In this section, I give detailed information about these two types of instruments.

Background questionnaire

The background questionnaire asked participants to provide information such as name, gender, and when they started learning English. The name was not used in any analysis or reporting; it was immediately coded by number from 1 to 424.

Measures

Measures were the most important instruments in this dissertation, and their creation was time consuming and laborious. The measures consist of two parts: those in English and those in Thai. These two parts were not translated from one language to the other and, in fact, but, were created separately. The two measures of phonological awareness, in English and in Thai, consisted of Initial Sound Detection, Final Sound Detection, Rhyme Task, and Phoneme Deletion. Both measures of reading in English and in Thai include Letter Identification, Real Word Reading, and Pseudoword Reading. The following table shows the components of measures used in this study.

Table 5 Components of measures in this study

Measures in English	*Measures in Thai*
English Phonological Awareness • English Initial Sound Detection • English Final Sound Detection • English Rhyme Task • English Phoneme Deletion	Thai Phonological Awareness • Thai Initial Sound Detection • Thai Final Sound Detection • Thai Rhyme Task • Thai Phoneme Deletion
English Reading Ability • English Letter Identification • English Real Word Reading • English Pseudoword Reading	Thai Reading Ability • Thai Letter Identification • Thai Real Word Reading • Thai Pseudoword Reading

A pilot study was conducted to check the reliability and construct validity of all measures and necessary adjustments were made according to the results of the pilot study.

Three rules were applied to all students. First, measures in English and Thai were used for children in grade three who could understand the directions in Thai (for both measures in English and in Thai) and were able to formulate appropriate responses. Second, to avoid needless delay, examiners encouraged participants to progress fairly rapidly through the test and not spend too much time on any specific item. If an examinee could not respond to an item within 10 seconds, the examiner proceeded to the next one. Third, each test contained trial items to give examinees an opportunity to familiarize themselves with the tasks before the actual testing began. All subtests required examiners to give feedback to examinees during the administration of sample items: to affirm correct answers and, in the case of errors, to ask participants to try again. I will now introduce the measures in English and in Thai individually.

Measures in English

In Thailand, there are no mandated English textbooks for each grade. Classroom teachers choose the textbooks, which must, however, meet requirements published in curriculum guidelines issued by the Ministry of Education. These requirements stipulate which vocabulary items must be taught to each grade. Therefore, all words in the phonological awareness and real word reading in English language measures were chosen from the Grade three English curriculum guidelines. Pseudowords were created on the basis of those real words. All words were written in lower case when they were shown to students; no proper nouns were included, so capital letters were not needed. All English language measures are included in APPENDIX B.

The creation of measures in English involved third grade teachers, experts in instrument creation and students. Five third grade English teachers were contacted for their help in selecting 20 easy words, 20 rather difficult word and 20 difficult words from their third grade curriculum guideline. After their selections, three third grade English teachers from other schools were invited to check the appropriateness of the selections and choose the final 20 easy words, 20 rather difficult word and 20 difficult words. All three teachers highly agreed with each other on the final selections. I then created four subtests including English Initial Sound Detection, English Final Sound Detection, English Rhyme Task and English Phoneme Deletion for phonological awareness in English. They are as follows:

Phonological awareness subtests in English

1. *English Initial Sound Detection.* Students were asked to name the first sound in a word read to them. These words were selected from the third grade English curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all words read to them.

2. English Final Sound Detection. Students were asked to name the ending sound in a word read to them. These words were selected from the third grade English curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all words read to them.

3. *English Rhyme Task.* Muter, Hulme, Snowling and Taylor (1998), Maclean, Bryant and Bradley (1987), and Mann and Foy (2003) all found that the rhyme

detection task is related to reading ability. In this subtest, two words were read to students and they were asked to say whether they rhyme with each other. All these words were also selected from the third grade English curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all words read to them.

4. *English Phoneme Deletion.* In Chapter 2 of this dissertation, many studies found that phoneme deletion is strong related to reading ability (Chiappe & Siegel, 1999; Chiappe, Siegel, & Gottardo, 2002; Gottardo, 2002; Gottardo, Yan, Siegel & Wade-Woolley, 2001; Huang & Hanley, 1994; Lesaux & Siegel, 2003; Muter & Diethelm, 2001; Muter, Hulme, Snowling & Taylor, 1998). Therefore, phoneme deletion is a very important component of phonological awareness skills in English.

Each child was asked to delete an initial or final phoneme from the word and reproduce the remaining part. Some words required deleting the initial sound and others required deleting the final sound. Please note that what was deleted was only the sound, not the letters.

Reading ability subtests in English

While proficient reading involves more than just the ability to identify and pronounce individual words, it certainly depends upon the ability to read words. A central problem for the beginning reader is figuring out how to convert the letters on paper to speech (Litt, 2003). According to Ehri (1998), in order to be able to sight read most words, beginning readers go through several phases. The first phase is pre-alphabetic or visual cue reading, also known as logographic reading. In this phase, readers recognize a word by a salient visual cue such as the capital letter at the beginning of his or her name, the hexagonal shape of a stop sign, or remembering the two *o*'s in *look* as eyes. The second phase is partial alphabetic or phonetic cue reading. In this phase, a reader uses some of the available graphophonemic information, usually at the beginning or end of the word. For example, readers might confuse *like* with *look*, because phonetically the beginning and the end of the word are the same, and phonetic cues can support memory.

The third phase is the full alphabetic phase. All of the letters of a word are represented in the reader's memory. Spellings are bonded to pronunciations at this phase. Readers in this phase are now able to analogize new words to familiar words. The fourth phase is the consolidated alphabetic phase. The complete spellings of words are consolidated into units, or "unitized," and recognized as whole units upon sight. Readers at this phase recognize individual words as quickly as they recognize single letters.

Based on the fact that the Thai students I investigated were beginning readers who had studied English as a foreign language for just three years, I used real words to test students' sight word reading and pseudowords to test their analogizing ability in reading unfamiliar words.

I first made a letter identification in which I separated English letters into 26 letters in upper case and 26 letters in lower case. Then I used 60 selected words in the real word reading. Based on these real words and English pronunciation rules, I created pseudoword reading. The measures are as follows:

1. *English Letter Identification (English Letter Identification Upper Case and English Letter Identification Lower Case)*. Letter identification is known to have a strong relation with reading ability (Chiappe, Siegel & Gottardo, 2002; Lesaux & Siegel, 2003; Snow, Burns & Griffin, 1998) and is a very important part of early literacy-related skills or reading readiness skills. As Snow, Burns & Griffin (1998) stated, among the readiness skills that are traditionally evaluated, the one that appears to be the strongest predictor on its own is letter identification. Just measuring how many letters a kindergartner is able to name when shown letters in a random order appears to be nearly as successful at predicting future reading as is an entire readiness test. Each child was asked to name 26 lowercase letters and 26 uppercase letters in random order. At the very beginning, I had planned to have 26 letters in upper case and 26 letters in lower case in one independent variable, but during trials in Thailand I found that some students could read certain English letters only in lower case and not in upper case, or could read some letters only in upper case and not in lower case. Therefore, I decided to change this one variable into two variables (two scores) so that it would be clearer which variable predicts Thai

students' reading ability.

2. *English Real Word Reading.* Students were asked to read aloud words of different difficulty. All these words were selected from the third grade English curriculum guideline issued by the Thai Ministry of Education, and they were supposed to have learned them all. Some Thai pronunciation styles—for example, if a final consonant were only half-pronounced--would be considered correct.

3. English Pseudoword Reading. Pseudoword reading was used as an index of reading performance because it has been shown that it correlates highly with word recognition and reading comprehension (e.g., Rack, Snowling, & Olson, 1992). In Chapter 2, I reviewed two studies (Chiappe & Siegel, 1999; and Quiroga, Lemos-Britton, Mostafapour, Abbott, & Berninger, 2002) that found pseudoword reading is highly related to reading ability.

Students were asked to read aloud given pseudowords. All these words were modified from the words selected from the third grade English curriculum guideline. Students should have been able to read them because they follow basic English pronunciation rules, for example, "dat" (modified from the word "cat")

<u>Measures in Thai</u>

A single, mandated Thai language textbook is required for each grade; however, some schools may add one additional textbook for their classes. In order to be fair to all students, all words in the phonological awareness and real word reading measures in Thai were taken from the Grade three Thai curriculum guideline issued by the Ministry of Education. Pseudowords were created on the basis of those real words. All measures in Thai are given in APPENDIX D.

For the measures in Thai, I received expertise from my friend and former colleague, Associate Professor Dr. Arunee Onsawad, the former chairwoman of the Department of Education, and the current Deputy Director of the International College, Naresuan University. She helped me create measures in Thai at every step, and her expertise was critical in the creation of those measures for this dissertation. Dr. Onsawad also served as my research coordinator in Thailand for all nine provinces.

I followed almost the same procedures to create measures in Thai as for the English measures. Five third grade teachers of Thai were contacted for their help in selecting 20 easy words, 20 rather difficult words and 20 difficult words from their third grade Thai language curriculum guideline. After their selections, three third grade teachers of Thai from other schools were invited to check the appropriateness of their selections and choose the final 20 easy words, 20 rather difficult words and 20 difficult words. All three teachers highly agreed with each other in the final selections of the Thai words. Then four subtests were created including Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion for phonological awareness in Thai.

Certain differences between English and Thai are worth noting here. In English you can delete almost any phoneme in a word and the remaining word will not normally have changes in sound or tone. However, in Thai, this is often not the case. Because Thai has five tones fixed on letters, the deletion of one phoneme could make the remaining word change in sound or tone.

In addition, in English, if you change phonemes in initial positions, the new words usually still rhyme (for example, *bat*, *cat* and *hat*). However, in Thai the change of the phoneme in the initial position could change the pronunciation of the whole word, which is very difficult for native English speakers to understand. I would like to provide some examples, so it may be easier for non-Thai speakers to understand.

“ขนม”: if you delete the first sound /ข/, the rest will be pronounced “หนม”, not “นม”.

Translation: Khanom (sweet or dessert): if you delete the first sound /Kha/, the rest will be pronounced “hnom” (no meaning), not “nom” (milk).

“ม้า”: if you delete the first sound /ม/, the rest will be pronounced “อ๊า”, not “อ้า” (the second tone mark is changed to a third tone mark).

Translation: “Mah” (horse): if you delete the first sound /m/, the rest will be pronounced “ahh” (an exclamation for surprise), not “ah” (to open with mouth) (the second tone mark is changed to a third tone mark).

“ถวาย”: if you delete the first sound /ถ/, the rest will be pronounced “หวาย”, not “วาย”.

Translation: “Thwai” (to give to the higher rank of people, e.g. a monk): if you delete the first sound /th/, the rest will be pronounced “whai”, not “wai”.

“ครก”: if you delete the final sound /ก/, the rest will be pronounced “โคระ”, not “คร”.

Translation: “Krok” (mortar): if you delete the last sound /k/, the rest will be pronounced “kro” (short sound, no meaning), not “kro” (long sound, no meaning).

The phonological awareness in Thai subtests are as follows:

Phonological awareness subtests in Thai

1. *Thai Initial Sound Detection*. Students were asked to name the first sound in a word read to them. These words were selected from the third grade Thai curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all the words read to them.

2. Thai Final Sound Detection. Students were asked to name the ending sound in a word read to them. These words were selected from the third grade Thai curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all the words read to them.

3. *Thai Rhyme Task.* Two words were read to students and they were asked to say whether they rhymed with each other. These words were selected from the third

grade Thai curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all the words read to them.

4. *Thai Phoneme Deletion.* Each child was asked to delete an initial or final phoneme from the word and reproduce the remaining part. Some words required deleting the initial sound and some words required deleting the final sound. These words were selected from the third grade Thai curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all these words.

Reading ability subtests in Thai

For reading in Thai, first a letter identification subtest of 44 Thai letters was created. It should be made clear that Thai does not separate letters into upper case and lower case; each letter has just one form, unlike in English. Then the 60 selected Thai words were used in the real word reading measure. Based on these real words and Thai pronunciation rules, a pseudoword reading subtest was created. The measures are as follows:

1. *Thai Letter Identification*. Each child was asked to name 44 Thai letters in random order. In an informal trial with three Thai students, the Thai letter identification measure included all 44 letters. As you will read in more details, after obtaining the discrimination index for each of these letters, 16 letters were deleted due to their low or negative discrimination indices. The 16 deleted Thai letters were letter No. 1 ห, 3 ก, 4 ด, 7 น, 10 ล, 12 ว, 13 ง, 17 อ, 18 ท, 19 ม, 23 ค, 24 ต, 25 ข, 31 ษ,

32 ศ and 34 ฉ, leaving 28 letters in this measure. Thai Letter Identification is a very important part of reading readiness.

2. *Thai Real Word Reading.* Students were asked to read words of various levels of difficulty. These words were selected from the third grade Thai curriculum guideline issued by the Thai Ministry of Education. They were supposed to have learned all the words.

3. Thai Pseudoword Reading. Students were asked to read given pseudowords that had been created by replacing the initial consonant or the final consonant of a word with another consonant making a new word which does not exist in English.

After the measures in English and in Thai were created, three third grade students - one high achiever (above grade level), one medium achiever (on grade level) and one low achiever (below grade level) - were invited to check their understandings of directions, item difficulty, the way they answered, and whether the length of time needed to take each subtest was appropriate. The length of test-taking ranged from one hour to two hours and forty minutes. Students felt that the tests were too lengthy, even though they were given a ten minute break between measures in English and in Thai. Therefore, the test items for each subtest were decreased to 20 items, except that English Letter Identification had 52 items (26 for upper case and 26 for lower case) and Thai Letter Identification had 44 (it was later reduced to 28, after a pilot study which will be described later). Two experts in the Thai language at Naresuan University, Thailand -- Associate Professor Kasem Sarhaithip and Assistant Professor Siriporn Maneechukate -- and three third grade teachers of Thai -- Ms. Lumpung Reesomsa, Ms. Saifon Wiboonrungsan and Ms Lumjuan Sukkum -- were consulted in order to verify construct validity. They provided some valuable comments, and some items and subtest directions were revised according to their suggestions and students' feedback.

A pilot study was carried out in order to check discrimination indices (corrected item total correlation) and subtest reliability coefficients. Eighty-five students from ten schools in four provinces (Phitsanulok, Kamphaeng Phet, Phetchabun and Sukhothai) were selected. Please note that with the original 44 Thai letters in the Thai letter identification subtest, the reliability coefficient was about .6429. After deleting 16 Thai letters as noted earlier the reliability coefficient became .7896. One thing worth noting was that some Thai letters were so familiar that every participant recognized them, while some others were rarely used in daily life or in textbooks and no participants recognized them.

The discrimination index was another useful tool. It was important because it let us know which item was a good item -- a question where the high achievers (third graders) answered correctly and the low achievers answered wrongly. Thus, the discrimination index functions to show how well an item can discriminate among those participants of different abilities. If all test items have high discrimination indices, this will result in high test reliability automatically.

A discrimination index can be calculated in many ways. The one you see here is called “corrected item total correlation”. **Table 6** shows the item discrimination index range, item with minimum discrimination index and item with maximum discrimination index and reliability coefficients of each subtest. Cronbach alpha reliability coefficients were used.

Table 6 *Item discrimination index range, item with minimum discrimination index, item with maximum discrimination index and reliability coefficients of each subtest both in English and Thai*

Measures	*Discrimination Indices*	*(Min, Max)*	*Reliability*
einisd	.6662 – .9654	(1, 18)	.9919
efinsd	.6103 –.9527	(7, 9)	.9892
erhyw	.9170 – .9652	(7, 8)	.9941
ewphod	.7021 – .9700	(8, 14)	.9926
eletib	.3769 – .8302	(24, 20)	.9570
eletis	.2031 – .7122	(8, 21)	.9138
ereaw	.2986 – .7241	(15, 14)	.8936
epsew	.3096 – .8391	(14, 15)	.9378
tinisd	.0485 – .7024	(11, 19)	.8406
tfinsd	.3165 – .7363	(15, 14)	.9109
trhyw	.2458 – .6479	(7, 8)	.8377
tphod	.1170 – .5466	(14, 4)	.7452
tleti	.0664 – .6025	(5, 37)	.7896
treaw	.3157 – .6403	(14, 19)	.8473
tpsew	.2201 – .6430	(14, 5)	.8406

Notes:

1. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyw = English Rhyme Task; ewphod = English Phoneme Deletion; eletib = English Letter Upper Case; eletis = English Letter Lower Case; ereaw = English Real Word Reading; epsew = English Pseudoword Reading; tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyw = Thai Rhyme Task; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification; treaw = Thai Real Word Reading; tpsew = Thai Pseudoword Reading

2. The final measures in Thai had 7 subtests. Each subtest had 20 items except Thai letter identification which had 28 items.

3. The final measures in English had 7 subtests. Each subtest had 20 items except English Letter Identification which had 52 items consisting of 26 letters in upper case and 26 letters in lower case.

Procedure

Sampling method

Participants were randomly selected by the stratified random sampling method using provinces as strata. The sample size was 400 students, estimated using the Krejcie and Morgan table (see Appendix A) with a 95 percent confident interval and 5 percent error rate. The population and sample were proportionally allocated to each province as shown in the table below.

Table 7 *The third grade student population in each province and number of samples planned to draw*

Thai provinces	*Total third grade population*	*Sample Planned*
Kamphaeng Phet	9,035	52
Nakhon Sawan	10,482	60
Phetchabun	10,849	62
Phichit	5,738	33
Phitsanulok	9,685	56
Sukhothai	6,925	40
Tak	7,814	45
Uthai Thani	4,235	25
Uttaradit	4,710	27
Total	69,473	400

Note:

Sources for total third grade population were the Provincial Education Commissions of all the sample provinces in Thailand (2005).

Data collection

Data collector recruitment and training

Since the study was going to be carried out in nine provinces in Thailand, many qualified data collectors were needed. My research coordinator in Thailand helped me recruit some volunteers to do data collection. Ultimately, 5 doctoral and 15 master's students from the Faculty of Education, Naresuan University in Thailand were chosen. Participation was strictly voluntary, and no remuneration was offered.

One hour of intensive training was provided to the volunteers by the research coordinator. The research coordinator and I decided the contents of the training for all volunteers. I sent the recorded answers on the measures in English in digital files through email, and Dr. Arunee provided the answers to the measures in Thai. The training covered the following:

- Why is data collection needed?
- What is phonological awareness?
- Why do we need to administer the test individually?
- What is step by step data collection?
- How should we explain each subtest's directions?
- Why are item trials so important?
- How do you judge whether an answer is right or wrong?

- How do you score each subtest?
- Write down personal data (independent variables such as "When did you start learning English", "gender", and "which province were you from") (Where and why independent variable is needed?)
- How do you build rapport and create a relaxing situation?
- Why is taking a short break between the measures in English and measures in Thai required?
- What is the significance of the study?

During the training session, volunteers were encouraged to ask any questions related to data collection or to clarification of measures either in English or in Thai. They were also encouraged to call or email my research coordinator with any questions that arose after the training session. I was very pleased to hear that they enjoyed volunteering for the data collection and thought the tests were helpful to their students as well as to themselves. Their strong motivation and high spirits made the data collection very smooth.

Institutional Review Board permissions

Several steps were taken prior to data collection to ensure that all requirements were met. First, I submitted my application for carrying out the study in Thailand including all measures both in English and Thai to the University of

Maryland at College Park Institutional Review Board (IRB) for approval. After approval was granted, parental permission forms were sent to students' parents, who could choose without penalty whether or not to allow their children to participate in this study. Once parental permissions had been secured and before students took the measures in English and in Thai, the students were also asked to check the assent form. No child with a history of hearing, oral language and cognitive disabilities was selected for the sample. In the parental permission forms distributed to both parents and assent forms to children, participants were also informed that they could withdraw at any time without penalty and that withdrawal would not affect the children' scores in class.

Contacting administrators and building rapport

After the training, my research coordinator contacted all nine provincial Educational administrators as well as school administrators asking for permission to do research and making an appointment in advance for data collection.

A team of five volunteers went to each school. They explained the purpose of the data collection and the directions for each subtest to all participating students. At the same time they created a good rapport with the students.

Administration of subtests by volunteers

Then the five volunteers sat separately in five different testing rooms of a testing center in the school. Each volunteer administered only one or two subtests, and gave each subtest to participants one student at a time. Before the real test began, students practiced five trial items for each subtest. To avoid fatigue, they were given a ten-minute break after the measures in English and before the measures in Thai were administered individually. At that time, they could have some drinks and snacks provided. After the break, students entered other rooms to finish all other tests.

On average, each measure took about 20 minutes plus a ten minute break, so totally it took 50 minutes per student to finish all measures.

Each day 4 teams of volunteers went to one or 2 schools in different provinces until all data had been collected. Data collection began with the student participants helping data collectors to fill out a background questionnaire (see APPENDIX G). Measures in English were then administered. Measures in Thai followed the measures in English.

All testing was carried out in a quiet room in the children’s schools. Directions for all measures were given in Thai. Technical words like “phoneme” were not included; the word “sound” was used during the phonological awareness subtests. As final consonants in Thai are half-pronounced, the final consonants in English words, I had predicted, would also be half-pronounced, and such pronunciations would be accepted as correct. Students’ pronunciations of English words in the Thai style would be accepted as correct, too.

Data entry and review

After data had been collected, five volunteers in each team cross-checked their students' scores and exchanged the score sheets with another team that cross-checked the other teams' students' scores before data entry. After the data entry, the research coordinator checked each scoring sheet at least twice. A small number of errors were found. These errors were corrected once they were noticed. All data were entered into a database using Statistical Package for Social Sciences (SPSS) 11.5 software.

Data analysis

In order to answer Research Questions 1 and 2: What are the demographics of the participants in this study? What are the medians, means, and standard deviations for English phonological awareness subtests, English reading ability subtests, Thai phonological awareness subtests, and Thai reading ability subtests of Thai primary students in their native country? Statistical Package for Social Sciences (SPSS, 11.5) was used to apply descriptive function.

For Research Question 3: What are the intercorrelations among all of the subtests in English and Thai for Thai primary students in their native country? Statistical Package for Social Sciences (SPSS, 11.5) was used to apply correlation function.

For Research Questions 4-7, SPSS was used to apply multiple correlation analyses to examine the relationship between phonological awareness and reading ability in English and in Thai. The analyses could answer all these questions.

In order to answer Research Question 8--to what degree, if at all, is there transfer of phonological awareness from Thai to English among Thai primary school students? Multiple regression analysis was used to further investigate whether there is any phonological awareness transfer from Thai to English.

Summary of Chapter 3

This chapter has presented a description of how, where, and how many participants were selected for this dissertation research. I also mentioned how I recruited 20 graduate student volunteers to do data collection for this dissertation. Independent and dependent variables have been identified in this chapter as well. The four measures in English and Thai, the manner in which they were created and the nature of the tasks have been introduced. All measures and the directions that accompanied them have been referenced to their corresponding Appendices. The data collection, procedures and data analysis have been laid out.

CHAPTER 4: RESULTS

Overview

This chapter provides a summary of the demographics of participants in this study. Then the results of each of the research questions are addressed, starting with the first and going through to the eighth. To facilitate reading this chapter, I will reiterate the research questions below:

1. What are the demographics of the participants in this study?
2. What are the medians, means, and standard deviations for the English phonological awareness subtests, English reading ability subtests, Thai phonological awareness subtests, and Thai reading ability subtests of Thai primary students in their native country?
3. What are the intercorrelations among all of the subtests in English and Thai for Thai primary students in their native country?
4. Which phonological awareness subtest(s) in English provide(s) the best prediction of English reading ability among Thai primary school students in their native country?
5. What is the relationship between phonological awareness and reading ability in the English language of Thai primary school students in their native country?

6. Which phonological awareness subtest(s) in Thai provide(s) the best prediction of Thai reading ability among Thai primary school students in their native country?
7. What is the relationship between phonological awareness and reading ability in the Thai language of Thai primary school students in their native country?
8. To what degree, if at all, is there a transfer of phonological awareness from the Thai language to English among Thai primary school students?

Results for Research Question 1

As noted above, Research Question 1 is as follows: What are the demographics of the participants in this study?

The participants were 424 third grade students from nine provinces in the Lower Northern part of Thailand. All participants were Thai nationals. All students spoke Thai as their primary language. Any child who had a history of hearing, oral language or cognitive disabilities was not selected into the sample. Derived from background questionnaires that were collected, the following table shows the third grade population in each province and its percent in the total third grade population in nine provinces, the number drawn in the provincial sample and its percent in the total sample.

Table 8 *Total third grade population in nine provinces, sample drawn from each province and their percentages*

Provinces	*Total third grade population*	*Percentage of total third graders*	*Sample drawn*	*Percentage of total sample drawn*
Kamphaeng Phet	9,035	13.01	53	12.5
Nakhon Sawan	10,482	15.09	63	14.86
Phetchabun	10,849	15.62	65	15.33
Phichit	5,738	8.26	35	8.25
Phitsanulok	9,685	13.94	59	13.92
Sukhothai	6,925	9.97	44	10.38
Tak	7,814	11.25	50	11.79
Uthai Thani	4,235	6.10	27	6.37
Uttaradit	4,710	6.78	28	6.60
Total	69,473	100	424	100

Note:

Sources for the total third grade population were the Provincial Education Commissions of all sample provinces in Thailand (2005).

The following table shows the provinces that participants came from, the sample size for each province, the number of male students and its percentage in that sample province, and the number of female students and its percentage in that sample province.

Table 9 *Participant characteristics*

Provinces	*Sample size*	*Gender*			
		Male	Percent	Female	Percent
Kamphaeng Phet	53	25	47.17	28	52.83
Nakhon Sawan	63	26	41.27	37	58.73
Phetchabun	65	24	36.92	41	63.08
Phichit	35	17	48.57	18	51.43
Phitsanulok	59	21	35.59	38	64.41
Sukhothai	44	24	54.55	20	45.45
Tak	50	28	56	22	44
Uthai Thani	27	12	44.44	15	55.56
Uttaradit	28	14	50	14	50
Total	424	191	45.05	233	54.95

The participants started learning English at different times. Although the

Thai Ministry of Education requires that Thai students start learning English in Grade One throughout the whole country, some actually started learning English in kindergarten. The following table shows the number of students who started learning English in kindergarten and in Grade One.

Table 10 *When sampled students started learning English*

	Number of students	*Percent*
Kindergarten	131	30.9
Grade One	293	69.1

From this table, we can see that nearly 70% of the participants started learning English in Grade One, while the rest began in kindergarten. It is unknown whether there were any advantages in regard to the current study for those who started learning English earlier. That is not the topic of this study. Any investigation of the effects of starting time on English phonological awareness and English reading ability would have to investigate and take into account the quality of teaching, quality of materials, amount of practice at home, and other variables beyond the purview of this study.

Results for Research Question 2

Research Question 2 is: What are the medians, means, and standard deviations for the English phonological awareness subtests, English reading ability subtests, Thai phonological awareness subtests, and Thai reading ability subtests of Thai primary students in their native country?

Measures in English

Measures in English comprised phonological awareness subtests and reading ability subtests. All 424 students took measures in English.

Phonological awareness subtests in English

There were four subtests of phonological awareness in English, namely, English Initial Sound Detection, English Final Sound Detection, English Rhyme Task and English Phoneme Deletion. Table 11 shows the median, mean and standard deviation of participants' scores on each subtest of phonological awareness in English. The total possible score for each subtest was 20. The mean performance, from highest to lowest, was as follows: English Rhyme Task mean = 13.96, English Initial Sound Detection mean = 13.33, English Phoneme Deletion mean = 10.25, and English Final Sound Detection mean = 10.11. These results suggest that the participants performed at a moderate level on English phonological awareness subtests.

Table 11 *Participants' scores on four subtests of phonological awareness in English*

Subtest	*Total Possible Score*	*Median*	*Mean*	*SD*
einisd	20	15.50	13.33	6.169
efinsd	20	10.50	10.11	5.718
erhyt	20	15.00	13.96	4.722
ephod	20	10.50	10.25	6.747

Notes:

1. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion.

2. Number of participants = 424

<u>Reading ability subtests in English</u>

There were four subtests for reading ability in English, namely, English Letter Identification Upper Case, English Letter Identification Lower Case, English Real Word Reading and English Pseudoword Reading. See Table 12 for the median, mean and standard deviation of participants' scores on each subtest of English reading ability.

As Table 12 shows, there is a dramatic bimodal distribution occurring among the English reading ability subtests. Specifically, the English Letter Identification Upper Case and English Letter Identification Lower Case subtests had very high scores: 16.89 and 15.52, respectively. In contrast, the English Real Word Reading and English Pseudoword Reading subtests had quite low scores: 5.90 and 4.22, respectively. This makes sense. The reason that two subtests had high means and two had low means is that participants had had many years to practice English letters, while they had much less experience in practicing English words and no experience in practicing English pseudowords.

Table 12 *Participants' scores on four subtests of reading ability in English*

Subtest	*Total Possible Score*	*Median*	*Mean*	*SD*
eletiu	26	18.00	16.89	7.979
eletil	26	17.00	15.52	8.768
ereawr	20	3.00	5.90	6.202
epsewr	20	1.00	4.22	5.621

Notes:

1. eletiu = English Letter Identification Upper Case; eletil = English Letter

Identification Lower Case; ereawr = English Real Word Reading; epsewr = English Pseudoword Reading.

2. Number of participants = 424

Measures in Thai

Measures in Thai included phonological awareness subtests in Thai and reading ability subtests in Thai. All 424 students took all the subtests in each part.

Phonological awareness subtests in Thai

There were four subtests of phonological awareness in Thai, namely, Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion. Table 13 provides the median, mean and standard deviation of participants' scores on each subtest of phonological awareness in Thai.

As revealed in Table 13, all of the means for Thai phonological awareness were very high, ranging from the highest, 17.38 (for Thai Final Sound Deletion), to the lowest, 14.50 (for Thai Phoneme Deletion). The reason for these high means is that these subtests allowed the Thai participants to use their native language, with which they have a lifetime's worth of experience and in which they are obviously very fluent.

Table 13 *Participants' scores on four subtests of phonological awareness in Thai*

Subtest	*Total Possible Score*	*Median*	*Mean*	*SD*
tinisd	20	18.00	17.33	3.123
tfinsd	20	19.00	17.38	4.028
trhyt	20	17.00	15.67	3.733
tphod	20	16.00	14.50	5.344

Notes:

1. tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion.

2. Number of participants = 424

Reading ability subtests in Thai

There were three subtests of reading ability in Thai, namely, Thai Letter Identification, Thai Real Word Reading and Thai Pseudoword Reading.

In Table 14 are the median, mean and standard deviation of participants' scores on each subtest of reading ability in Thai. The means were quite high for all of the Thai reading ability subtests. Of the total possible score of 28 for the Thai Letter Identification subtest, the mean performance was 22.51. Two of the subtests, Thai Real Word Reading and Thai Pseudoword Reading, had total possible scores of

20 each. For those two subtests the means were 16.94 and 14.64, respectively. Just as for performance on Thai phonological awareness subtests, performance on Thai reading ability subtests was very good because participants were using their native language, which they had practiced for many years.

Table 14 *Participants' scores on three subtests of reading ability in Thai*

Subtest	*Total Possible Score*	*Median*	*Mean*	*SD*
tleti	28	22.00	22.51	4.203
treawr	20	18.00	16.94	3.739
tpsewr	20	16.00	14.64	4.929

Notes:

1. tleti = Thai Letter Identification; treawr = Thai Real Word Reading; tpsewr = Thai Pseudoword Reading.

2. Number of participants = 424

Results for Research Question 3

As shown earlier, Research Question 3 is: What are the intercorrelations among all of the subtests in English and Thai for Thai primary students in their native country? In the following paragraphs, intercorrelations are presented in this order: a) intercorrelations of English subtests, b) intercorrelations of Thai subtests, and c) intercorrelations of all English and Thai subtests. Tables 15-17 present these intercorrelations in the order shown.

Table 15--the intercorrelations of all subtests in English--reveals that most of the English subtests are intercorrelated significantly at the .001 level, but two pairs are correlated at the .01 level. The absolute size of the intecorrelations, i.e., the Pearson correlation coefficient for each pair of subtests, is not as crucial as the fact that these English subtests are significantly intercorrelated. When subtests are significantly intercorrelated, researchers must be very careful to assess whether these intercorrelations violate multicollinearity restrictions in multiple regression analyses. This topic will be mentioned again later in this chapter.

Table 15 *Intercorrelations of subtests in English*

Subtests	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
einisd	1.000							
efinsd	.679***	1.000						
erhyt	.355***	.398***	1.000					
ephod	.326***	.342***	.339***	1.000				
eletiu	.286***	.359***	.323***	.148**	1.000			
eletil	.281***	.364***	.324***	.143**	.928***	1.000		
ereawr	.211***	.382***	.295***	.256***	.560***	.598***	1.000	
epsewr	.179***	.300***	.300***	.317***	.458***	.471***	.725***	1.000

Notes:

1. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion; eletiu = English Letter Identification Upper Case; eletil = English Letter Identification Lower Case; ereawr = English Real Word Reading; epsewr = English Pseudoword Reading.

2. $^{**}p < 0.01$ $^{***}p < 0.001$ (2-tailed)

Table 16 demonstrates the intercorrelations of all Thai subtests. Just as with the English subtests, the Thai subtests were all significantly intercorrelated, this time at the .001 level for all pairings. Again, this signifies that it will be important to check later to ensure that these intercorrelations do not violate multicollinearity limitations in multiple regression analyses.

Table 16 *Intercorrelations of subtests in Thai*

Subtests	*1*	*2*	*3*	*4*	*5*	*6*	*7*
tinisd	1.000						
tfinsd	.617***	1.000					
trhyt	.405***	.514***	1.000				
tphod	.491***	.608***	.509***	1.000			
tleti	.189***	.210***	.269***	.304***	1.000		
treawr	.445***	.537***	.410***	.532***	.530***	1.000	
treawr	.451***	.495***	.370***	.554***	.453***	.731***	1.000

Notes:

1. tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification; treawr = Thai Real Word Reading; tpsewr = Thai Pseudoword Reading.

2. ***p< 0.001 level (2-tailed)

Table 17 shows the intercorrelations among all subtests in English and Thai. It is apparent from this table that all pairings of subtests except one were significant at levels between .05 and .001. Specifically, 49 of the 56 correlations were significant at the .001 level (2-tailed). Four correlations were significant at the .01 level, two were significant at the .05 level, and one correlation was not significant. The four correlations that were significant at the .01 level were a) Thai Letter Identification and English Rhyme Task, b) Thai Final Sound Detection and English Phoneme Deletion, c) Thai Real Word Reading and English Phoneme Deletion, and d) English Pseudoword Reading and Thai Initial Sound Detection. The two correlations that were significant at the .05 level were a) Thai Rhyme Task and English Phoneme Deletion and b) Thai Letter Identification and English Phoneme Deletion. The one that was not significant was the correlation between English Real Word Reading and Thai Initial Sound Detection. It was the only correlation that was not significant among all subtests either in English or in the Thai language. These results again indicate the need to check later that the significant intercorrelations do not violate multicollinearity restrictions in multiple regression analyses.

The results below show something even more important. They reveal the following: a) Thai phonological awareness is significantly correlated with English phonological awareness, b) Thai reading ability is significantly correlated with English reading ability, c) Thai phonological awareness is significantly correlated with English reading ability, and d) Thai reading ability is significantly correlated with English phonological awareness. Though the Pearson coefficients are only moderate to low, the fact that significant correlations were so abundant demonstrates that *phonological awareness* in one language is linked with phonological awareness in another language, that *reading ability* follows the same pattern, and that *phonological awareness and reading ability* are also associated across languages. This is all the more remarkable because Thai is a non-alphabetic language, while English is an alphabetic language.

The cross-language linkages show that Thai phonological awareness transfers into English phonological awareness and English reading ability. As Chapter 5 will discuss, this relates to one of the fundamental principles of bilingual education, i.e., that it is possible to improve competence in a foreign language by improving competence in the native language. Wei and Zhou (2003) provided a case study of a young ELL student who became an honor roll student in both English main stream classroom and Chinese weekend school.

Table 17 *Intercorrelations among all subtests in English and in Thai*

Subtests	*tinisd*	*Tfinsd*	*Trhyt*	*tphod*	*Tleti*	*treawr*	*tpsewr*
einisd	.267***	.301***	.302***	.300***	.212***	.302***	.301***
efinsd	.263***	.280***	.320***	.382***	.246***	.278***	.314***
erhyt	.262***	.283***	.347***	.280***	.143**	.261***	.290***
ephod	.177***	.151**	.113*	.268***	.099*	.148**	.226***
eletiu	.271***	.343***	.367***	.373***	.408***	.372***	.367***
eletil	.275***	.322***	.368***	.369***	.390***	.348***	.346***
ereawr	0.08	.221***	.320***	.321***	.282***	.282***	.266***
epsewr	.133**	.190***	.227***	.266***	.248***	.226***	.289***

Notes:

1. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion; eletiu = English Letter Identification Upper Case; eletil = English Letter Identification Lower Case; ereawr = English Real Word Reading; epsewr = English Pseudoword Reading; tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification; treawr = Thai Real Word Reading; tpsewr = Thai Pseudoword Reading

2. *p< 0.5 (2-tailed) **p< 0.01 ***p<0.001(2-tailed)

Results for Research Questions 4 and 5

Both Research Questions were answered through the same multiple regression analysis. Research Question 4 is as follows: Which phonological awareness subtest(s) in English provide(s) the best prediction of English reading ability among Thai primary school students in their native country? This actually breaks down into two subquestions:

4a. Which phonological subtest(s) in English provide(s) the best prediction of English Real Word Reading among Thai primary school students in their native country?

4b. Which phonological subtest(s) in English provide(s) the best prediction of English Pseudoword Reading among Thai primary school students in their native country?

Research Question 5 is: What is the relationship between phonological awareness and reading ability in the English language of Thai primary school students in their native country? This question breaks down into two subquestions:

5a. What is the relationship between phonological awareness and English

Real Word Reading in the English language of Thai primary school students in their native country?

5b. What is the relationship between phonological awareness and English Pseudoword Reading in the English language of Thai primary school students in their native country?

To answer Research Questions 4 and 5, it is necessary to explain carefully how this specific multiple regression analysis was conducted. While this is a methodological issue and has been treated to some extent in Chapter 3, information about the specific multiple regression analysis is included below in greater depth so that the reader will immediately have a complete context for the results.

Background to the results for Research Question 4a

First of all, English Real Word Reading was entered as the criterion and all four subtests of phonological awareness in English--again, English Initial Sound Detection, English Final Sound Detection, English Rhyme Task and English Phoneme Deletion--were entered as the predictors in that order. The method chosen was stepwise. The following ANOVA table shows the predictors and the criterion with an F test. The model selected as the best contained all four predictors. Other models with fewer predictors did not have as much predictive power.

Table 18 *ANOVA test of the predictors with English Real Word Reading as the criterion and four subtests of phonological awareness in English as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	3085.718	4	771.429	24.513	.000
Residual	13186.122	419	31.470		
Total	16271.840	423			

Note:

Predictors: (Constant), English Final Sound Detection, English Rhyme Task, English Phoneme Deletion, English Initial Sound Detection

Four subtests predicted English Real Word Reading: English Final Sound Detection, English Rhyme Task, English Phoneme Deletion, and English Initial Sound Detection, $F(4, 419) = 24.513$, $p<.001$. That indicates that all four subtests significantly explained the variance in English Real Word Reading. Stated differently, the four predictors linearly regressed on the criterion to create the optimal linear prediction equation. Table 19 shows the results of the stepwise multiple regression analysis with this model. This table shows, among other things, that the unadjusted R^2 statistic was .190. *This means that 19% of the variance in English Real Word Reading was explained by the four-predictor model.* Of course, this signifies that other factors were also at play, but 19% is nevertheless not a trivial amount of explained variance.

Table 19 *Stepwise multiple regression analysis with English Real Word Reading as the criterion and four subtests of English Phonological Awareness as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	-.333	.915				
efinsd	.401	.067				.370***
erhyt	.203	.065				.155**
ephod	.111	.045				.121*
einisd	-.135	.061	.435	.190	5.610	-.134*

Notes:

1. Adjusted R^2 = .182

2. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion

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

Answer to Research Question 4a

The answer to Question 4a is that English Final Sound Detection, among all of the subtests of English phonological awareness, was the best predictor of English

Real Word Reading. We know this by examining Table 19 and noting that the largest beta weight is .370 (associated with English Final Sound Detection). The largest beta weight is always known as the best predictor among all possible predictors included in the regression equation. The other possible predictors were significant in the following order of predictive value: English Rhyme Task (beta = .155), English Initial Sound Detection (beta = -.134), and finally English Phoneme Deletion (beta = .121).

Background to the results for Research Question 5a

Before going on to express the regression equations related to Research Question 5a, it was essential to conduct further analyses, because all subtests of phonological awareness in English were significantly correlated. APPENDIX M shows partial and part correlations and two collinearity statistics (tolerance and variance inflation factor). APPENDIX N provides actual collinearity diagnostics. In short, these appendices confirm that there is no problem with multicollinearity and that the four-predictor model presented above is adequate.

Answer to Research Question 5a

Now that this was resolved, I could derive the following equations for English Real Word Reading. Equation 1 used the unstandardized B (viewed vertically in Table 19), while Equation 2 used the standardized B (also viewed vertically in the same table).

Equation 1**: ereawr = .401efinsd + .203erhyt + .111ephod -.135einisd -.333**

Or

Equation 2: **Zereawr = .370Zefinsd + .155Zerhyt + .121Zephod -.134Zeinisd**

Looking at the standardized regression equation, it is clear that if you wish to increase one unit of English Real Word Reading, you should increase .370 unit of English Final Sound Detection, .155 unit of English Rhyme Task and .121 unit of English Phoneme Deletion; and decrease .134 unit of English Initial Sound Detection.

Background to the results for Research Question 4b

For the next step, English Pseudoword Reading was entered as the criterion and all four subtests of phonological awareness in English--again, English Initial Sound Detection, English Final Sound Detection, English Rhyme Task and English Phoneme Deletion--were entered as the predictors. The method chosen was also stepwise. The following ANOVA table shows the predictors and the criterion with an F test.

Table 20 *ANOVA test of the predictors with English Pseudoword Reading as the criterion and four subtests of English Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	2188.565	3	729.522	27.416	.000
Residual	11176.036	420	26.610		
Total	13364.601	423			

Note:

Predictors: (Constant), English Phoneme Deletion, English Rhyme Task, English Final Sound Detection

Three subtests predicted English Pseudoword Reading: English Phoneme Deletion, English Rhyme Task, and English Final Sound Detection, F (3, 420) = 27.416, p<.001. That indicates that those three predictors can significantly explain variance in English Pseudoword Reading or can linearly regress on the criterion and can further create the linear prediction equation.

Only English Initial Sound Detection was not among the most useful predictors in predicting English Pseudoword Reading, indicating that it would not significantly increase predictive validity in explaining variance in English

Pseudoword Reading.

The following table shows the results of the stepwise multiple regression analysis.

Answer to Research Question 4b

Table 21 indicates that English Phoneme Deletion was the better predictor (beta = 2.04), although English Rhyme Task (beta = .165) and English Final Sound Detection (beta = .165) were also significant predictors.

Table 21 *Stepwise multiple regression analysis with English Pseudoword Reading as the criterion and four subtests of English Phonological Awareness as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	-1.905	.806				
ephod	.170	.041				.204***
erhyt	.196	.0				.165**
efinsd	.162	.049	.405	.164	5.158	.165**

Notes:

1. Adjusted R^2 = .158

2. efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion

3. ** p<.01; *** p<.001

Background to the results for Research Question 5b

The multiple correlation coefficient (R) was .405, medium level, and R^2, the amount of variance explained by the whole model, was .164, or 16.4%. However, since all subtests of phonological awareness in English were significantly correlated, a collinearity diagnostic was also very necessary.

Collinearity diagnostics, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX O). The table shows that the values of partial and part correlations dropped slightly for the model. That means that most of the variance in English Pseudoword Reading could be explained by the predictors specified in the models.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, less than 17% -21% was explained by other predictors. The tolerances here were large and the variance inflation factors (VIF) were all less than 2. So there was no problem with multicollinearity.

The collinearity diagnostics confirmed that there was no problem with multicollinearity (see APPENDIX P).

Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here no condition index was greater than 15. Therefore, there was no problem with multicollinearity.

Answer to Research Question 5b

From Table 21, I derived the following equations for English Pseudoword Reading:

Equation 3: **epsewr = .170ephod + .196erhyt + .162efinsd -1.905**

Or

Equation 4: **Zepsewr = .204Zephod + .165Zerhyt + .165Zefinsd**

The most effective predictors for English Pseudoword Reading were English Phoneme Deletion, English Rhyme Task and English Final Sound Detection. If you want to increase one unit of English Pseudoword Reading, you should increase .204 unit of English Phoneme Deletion, .165 unit of English Rhyme Task and .165 unit of English Final Sound Detection.

Snow, Burns and Griffin (1998) mentioned that letter identification (English) is a very useful predictor of reading ability (English). In this dissertation, I wanted to investigate whether that statement was valid among Thai primary school students.

Thus, English Real Word Reading was entered as the criterion and all six subtests of phonological awareness in English--again, English Initial Sound Detection, English Final Sound Detection, English Rhyme Task, English Phoneme Deletion, English Letter Identification Upper Case and English Letter Identification Lower Case--were entered as the predictors. The method chosen was also stepwise. The following ANOVA table shows the predictors and the criterion with an F test.

Table 22 *ANOVA test of the predictors with English Real Word Reading as the criterion and four subtests of English Phonological Awareness, English Letter Identification Upper Case and English Letter Identification Lower Case as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	6766.669	4	1691.667	74.571	.000
Residual	9505.171	419	22.685		
Total	16271.840	423			

Note:

Predictors: (Constant), English Letter Identification Lower Case, English Final Sound Detection, English Phoneme Deletion, English Initial Sound Detection

Four subtests predicted English Real Word Reading: English Letter Identification Lower Case, English Final Sound Detection, English Phoneme

Deletion, and English Initial Sound Detection, $F(4, 419) = 74.571$, $p<.001$. That indicates that four subtests could significantly explain the variance in English Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

The other two subtests--English Letter Identification Upper Case and English Rhyme Task--were not among the most useful predictors of English Real Word Reading, indicating that they would not significantly increase predictive validity in explaining variance in English Real Word Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 23 *Stepwise multiple regression analysis with English Real Word Reading as the criterion and four subtests of English Phonological Awareness, English Letter Identification Upper Case and English Letter Identification Lower Case as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	-1.955	.645				
eletil	.376	.028				.532***
efinsd	.258	.058				.238***
ephod	.135	.037				.147***
einisd	-.149	.052	.645	.416	4.763	-.148**

Notes:

1. Adjusted $R^2 = .410$

2. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; ephod = English Phoneme Deletion; eletil = English Letter Identification Lower Case;

3. ** p<.01; *** p<.001

The multiple correlation coefficient (R) was .645 for the model - a mid-range number. However, since all subtests of phonological awareness in English, English Letter Identification Upper Case and English Letter Identification Lower

Case were significantly correlated, a collinearity diagnostic was also very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX Q). The table shows that the values of partial and part correlations dropped slightly for the model. That means that most of the variance in English Real Word Reading could be explained by the predictors specified in the models.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, less than 14% - 50% was explained by other predictors. The tolerances here were large but one variance inflation factor (VIF) was bigger than 2. So there was a possible problem with multicollinearity.

The collinearity diagnostics helped to determine whether there was a possible problem with multicollinearity (see APPENDIX R). Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here, no condition index was greater than 15. However, judging from the tolerance numbers, there might be a problem with multicollinearity. I wanted to do the prediction with standardized scores.

I had to fix the collinearity problems by rerunning the regression using log-transformed English Real Word Reading as the criterion and z scores for all six subtests of phonological awareness in English, English Letter Identification Upper Case and English Letter Identification Lower Case as the predictors. The chosen entry method was stepwise, in order to include only the most useful variables in the model (see APPENDIX S).

All of the condition indices were much less than 15. The strategy worked, and the model built using the stepwise method did not have problems with collinearity. The following ANOVA table shows the predictors and the criterion with an F test.

Table 24 *ANOVA test of the predictors with log-transformed English Real Word Reading as the criterion and z scores for four subtests in English Phonological Awareness, English Letter Identification Upper Case and English Letter Identification Lower Case*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	69.730	2	34.865	50.546	.000
Residual	208.308	302	.690		
Total	278.038	304			

Note:

Predictors: (Constant), Z score: English Letter Identification Lower Case; Z score: English Final Sound Detection

Two subtests predicted English Real Word Reading: English Letter Identification Lower Case, English Final Sound Detection, F (2, 302) = 50.546, $p<.001$.

Please note there were four variables that predicted English Real Word Reading. Due to violation of multicollinearity, I used a log-transformed criterion and z scores for all six subtests. After the treatment, only two predictors – English Letter Identification Lower Case and English Final Sound Detection – were left.

The new analysis looks as follows.

Table 25 *Stepwise multiple regression analysis with log-transformed English Real Word Reading as the criterion and z scores of all four subtests of phonological awareness in English and English Letter Identification (both Upper Case and Lower Case) as the predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	1.557	.052				
zeletil	.405	.062				.350***
zefinsd	.250	.052	.501	.251	.83052	.255***

Notes:

1. Adjusted R^2 = .246

2. zeletil = z score: English Letter Identification Lower Case; zefinsd = z score: English Final Sound Detection.

3. *** $p<.001$

Using Table 25, I derived the following equations for English Real Word Reading:

Equation 5: **LNereawr = 1.557 + .405Zeletil + .250Zefinsd**

Or

Equation 6: **Zereawr = .350Zeletil + .255Zefinsd**

The variance of English Real Word Reading that can be explained was 25.1%. The most effective predictors for English Real Word Reading were English Letter Identification Lower Case and English Final Sound Detection. If you want to increase one unit of English Real Word Reading, you should increase .350 unit of English Letter Identification Lower Case and .255 unit of English Final Sound Detection.

For the next step, English Pseudoword Reading was entered as the criterion and all six subtests of phonological awareness in English--again, English Initial Sound Detection, English Final Sound Detection, English Rhyme Task, English

Phoneme Deletion, English Letter Identification Upper Case and English Letter Identification Lower Case--were entered as the predictors. The method chosen was also stepwise. The following ANOVA table shows the predictors and dependent variable with an F test.

Table 26 *ANOVA test of the predictors with English Pseudoword Reading as the criterion and four subtests of English Phonological Awareness, English Letter Identification Upper Case and English Letter Identification Lower Case as predictors*

Source	*Sum of Squares*	*Df*	*Mean Square*	*F*	*Sig.*
Regression	3903.024	3	1301.008	57.752	.000
Residual	9461.577	420	22.528		
Total	13364.601	423			

Note:

Predictors: (Constant), English Letter Identification Lower Case, English Phoneme Deletion, English Rhyme Task

Three subtests predicted English Pseudoword Reading: English Letter Identification Lower Case, English Phoneme Deletion, and English Rhyme Task, F (3, 420) = 57.752, p<.001. That indicates that those three predictors could significantly explain variance in English Pseudoword Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

Only English Initial Sound Detection, English Final Sound Detection and English Letter Identification Upper Case were not among the most useful predictors of English Pseudoword Reading, indicating that they would not significantly increase predictive validity in explaining variance in English Pseudoword Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 27 *Stepwise multiple regression analysis with English Pseudoword Reading as the criterion and four subtests of English Phonological Awareness, English Letter Identification Upper Case and English Letter Identification Lower Case as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	-3.292	.756				
eletil	.262	.028				.409***
ephod	.189	.036				.227***
erhyt	.107	.054	.540	.292	4.746	.090*

Notes:

1. Adjusted R^2 = .287

2. eletil = English Letter Identification Lower Case; erhyt = English Rhyme Task; ephod = English Phoneme Deletion

3. * $p<.05$; *** $p<.001$

The multiple correlation coefficient (R) was .540 for the model - a mid-range number. However, since all subtests of phonological awareness in English and English Letter Identification Upper Case and English Letter Identification Lower Case were significantly correlated, a collinearity diagnostic was also very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX T). The table shows that the values of partial and part correlations dropped slightly for the model. That means that most of the variance in English Pseudoword Reading could be explained by the predictors specified in the models.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, less than 11% -20% was explained by other predictors. The tolerances here were large and the variance inflation factors (VIF) were all less than 2. So there was no problem with multicollinearity.

The collinearity diagnostics confirmed that there was no problem with multicollinearity (see APPENDIX U). Values of the condition indices greater than

15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here, no condition indices were greater than 15.

Using Table 27, I derived the following equations for English Pseudoword Reading:

Equation 7: **epsewr = .262eletil + .189ephod + .107erhyt -3.292**

Or

Equation 8: **Zepsewr = .409Zeletil + .227Zephod + .090Zerhyt**

The variance of English Pseudoword Reading that can be explained was 29.2%. The most effective predictors of English Pseudoword Reading were English Letter Identification Lower Case, English Phoneme Deletion and English Rhyme Task. If you want to increase one unit of English Pseudoword Reading, you should increase .409 unit of English Letter Identification Lower Case, .227 unit of English Phoneme Deletion and .090 unit of English Rhyme Task.

Results for Research Question 6

Research Question 6 is: Which phonological awareness subtest(s) in Thai provide(s) the best prediction of Thai reading ability among Thai primary school students in their native country? This question breaks down into two subquestions:

6a. Which phonological awareness subtest(s) in Thai provide (s) the best prediction of Thai Real Word Reading among Thai primary school students in their native country?

6b. Which phonological awareness subtests (s) in Thai provide(s) the best prediction of Thai Pseudoword Reading among Thai primary school students in their native country?

Results for Research Question 7

Research Question 7 is: What is the relationship between phonological awareness and reading ability in the Thai language of Thai primary school students in their native country? The research question breaks down into two subquestions:

7a. What is the relationship between phonological awareness and real word reading in the Thai language of Thai primary school students in their native country?

7b. What is the relationship between phonological awareness and pseudoword reading in the Thai language of Thai primary school students in their native country?

Background to the results for Research Question 6a

First, Thai Real Word Reading was entered as the criterion and all four subtests of phonological awareness in Thai--Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion--were entered as the predictors. The method chosen was again stepwise. The following ANOVA table shows the predictors and dependent variable with an F test.

Table 28 *ANOVA test of the predictors with Thai Real Word Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	2193.858	4	548.465	61.763	.000
Residual	3720.783	419	8.880		
Total	5914.642	423			

Note:

Predictors: (Constant), Thai Final Sound Detection, Thai Phoneme Deletion, Thai Initial Sound Detection, Thai Rhyme Task

All four subtests predicted Thai Real Word Reading: Thai Final Sound Detection, Thai Phoneme Deletion, Thai Initial Sound Detection and Thai Rhyme Task, F (4, 419) = 61.763, p<.001. That indicates that all four subtests could significantly explain variance in Thai Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation. Please note that all four subtests of phonological awareness in English also predicted English Real Word Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 29 *Stepwise multiple regression analysis with Thai Real Word Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	6.215	.890				
tfinsd	.231	.053				.249***
tphod	.192	.036				.275***
tinisd	.141	.060				.118*
trhyt	.094	.047	.609	.371	4.746	.094*

Notes:

1. Adjusted R^2 = .365

2. tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion

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

Background to the results for Research Question 7a

The multiple correlation coefficient (R) was .609 for the model - a mid-range number. However, since all subtests of phonological awareness in English were significantly correlated, a collinearity diagnostic was also very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX V). The table shows that the values of partial and part correlations dropped by about half in the model. That means that much of the variance in Thai Real Word Reading was explained by the predictors specified in the model.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, 33% - 54% was explained by other predictors. The tolerances here were medium and one of the variance inflation factors (VIF) was more than 2. So there was a possible problem with multicollinearity.

The collinearity diagnostics confirmed that there was a possible problem with multicollinearity (see APPENDIX W). Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here, two condition indices were greater than 15 but smaller than 30.

I tried to fix the collinearity problems by rerunning the regression using log-transformed Thai Real Word Reading as the criterion and z scores for all four subtests of phonological awareness in Thai as the predictors. The chosen entry method was stepwise, in order to include only the most useful variables in the model (see APPENDIX X).

All of the condition indices were much less than 15. The strategy worked, and the model built using the stepwise method did not have problems with collinearity. The following ANOVA table shows the predictors and the criterion with an F test.

Table 30 *ANOVA test of the predictors with log-transformed Thai Real Word Reading as the criterion and z scores for four subtests in Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	13.567	3	4.522	62.208	.000
Residual	30.532	420	.073		
Total	44.098	423			

Note:

Predictors: (Constant), Z score: Thai Final Sound Detection; Z score: Thai Phoneme Deletion; Z score: Thai Initial Sound Detection

Three subtests predicted Thai Real Word Reading: Thai Final Sound Detection, Thai Phoneme Deletion and Thai Initial Sound Detection, $F(3, 420) = 62.208$, $p<.001$. That indicates that the three subtests could significantly explain variance in Thai Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

Please note there were four subtests that predicted Thai Real Word Reading. Due to violation of multicollinearity, I used the log-transformed dependent variable and z scores of all four subtests of phonological awareness in Thai. After this treatment one independent variable – Thai Rhyme Task - was considered not useful in the prediction.

Answer to Research Question 6a

From Table 31, we can notice that the phonological awareness subtest that provides the best prediction of Thai Real Word Reading is standardized Thai Final Sound Detection (Beta = .294)

Table 31 *Stepwise multiple regression analysis with log-transformed Thai Real Word Reading as the criterion and z scores of all four subtests of phonological awareness in Thai as the predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	2.791	.013				
ztfinsd	.095	.019				.294***
ztphod	.079	.017				.243***
ztinisd	.034	.017	.555	.308	.26962	.106*

Notes:

1. Adjusted R^2 = .303

2. ztinisd = z score: Thai Initial Sound Detection; ztfinsd = z score: Thai Final Sound Detection; ztphod = z score: Thai Phoneme Deletion

3. *p<.05; *** p<.001

Answer to Research Question 7a

Using Table 31, I derived the following equations for Thai Real Word Reading:

Equation 9: **LNtreawr = 2.791 + .095Ztfinsd + .079Ztphod + .034Ztinisd**

Or

Equation 10: **Ztreawr = .294tfinsd +.243tphod + .106tinisd**

The variance of Thai Real Word Reading that can be explained was 30.8%.

The most effective predictors of Thai Real Word Reading were Thai Final Sound Detection, Thai Phoneme Deletion and Thai Initial Sound Detection. If you want to increase one unit of Thai Real Word Reading, you should increase .294 unit of Thai Final Sound Detection, .243 unit of Thai Phoneme Deletion and .106 unit of Thai Initial Sound Detection.

Background to the results for Research Question 6b

For the next step, Thai Pseudoword Reading was entered as the criterion and all four subtests of phonological awareness in Thai--Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion--were entered as the predictors. The method chosen was again stepwise. The following ANOVA table shows the predictors and the criterion with an F test.

Table 32 *ANOVA test of the predictors with Thai Pseudoword Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	3728.587	3	1242.862	79.708	.000
Residual	6548.922	420	15.593		
Total	10277.509	423			

Note:

Predictors: (Constant), Thai Phoneme Deletion, Thai Initial Sound Detection, Thai Final Sound Detection

Three subtests predicted Thai Pseudoword Reading: Thai Phoneme Deletion, Thai Initial Sound Detection and Thai Final Sound Detection, F (3, 420) = 79.708, $p<.001$. That indicates that the three subtests could significantly explain variance in Thai Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation. Only the Thai Rhyme Task was not among the most useful predictors of Thai Pseudoword Reading, indicating that it would not significantly increase predictive validity in explaining variance in Thai Pseudoword Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 33 *Stepwise multiple regression analysis with Thai Pseudoword Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	1.594	1.110				
tphod	.342	.046				.370***
tinisd	.261	.079				.165**
tfinsd	.206	.068	.602	.363	3.949	.168**

Notes:

1. Adjusted R^2 = .358

2. tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; tphod = Thai Phoneme Deletion

3. ** p<.01; *** p<.001

Background to the results for Research Question 7b

The multiple correlation coefficient (R) was .602 for the model - a mid-range number. However, since all subtests of phonological awareness in English were significantly correlated, a collinearity diagnostic was very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX Y). The table shows that the values of partial and part correlations dropped a lot in the model. That means that a good portion of the variance in Thai Pseudoword Reading could not be explained by the predictors specified in the model.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, about 40% - 50% was explained by other predictors. The tolerances here were medium to large, but one of the variance inflation factors (VIF) was more than 2. So there was a possible problem with multicollinearity.

The collinearity diagnostics confirmed that there was a possible problem with multicollinearity (see APPENDIX Z). Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here, one condition index was greater than 15 but smaller than 30.

I tried to fix the collinearity problems by rerunning the regression using log-transformed Thai Pseudoword Reading as the criterion and z scores for all four subtests of phonological awareness in Thai as the predictors. The chosen entry method was stepwise, in order to include only the most useful variables in the model (see APPENDIX AA).

All of the condition indices were much less than 15. The strategy worked, and the model built using the stepwise method did not have problems with collinearity. The following ANOVA table shows the predictors and the criterion with an F test.

Table 34 *ANOVA test of the predictors with log-transformed Thai Pseudoword Reading as the criterion and z scores for four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	30.703	3	10.234	53.272	.000
Residual	79.534	414	.192		
Total	110.237	417			

Note:

Predictors: (Constant), Z score: Thai Phoneme Deletion; Z score: Thai Final Sound Detection; Z score: Thai Initial Sound Detection

Three subtests predicted Thai Pseudoword Reading: Thai Phoneme Deletion, Thai Final Sound Detection and Thai Initial Sound Detection, $F(3, 414) = 53.272$, $p<.001$. That indicates that the three subtests could significantly explain variance in

Thai Pseudoword Reading or they could linearly regress on the criterion and could further create the linear prediction equation. Only the Thai Rhyme Task was not among the most useful predictors of Thai Pseudoword Reading, indicating that it would not significantly increase predictive validity in explaining variance in Thai Pseudoword Reading.

This is almost the same result as the ordinary stepwise multiple regression analysis, except that Thai Final Sound Detection changed from the third best predictor to the second best predictor.

Answer to Research Question 6b

From Table 35, we can notice that standardized Thai Phoneme Deletion is the best predictor (Beta = .317) among all Thai Phonological Awareness subtests in predicting Thai Pseudoword Reading.

Table 35 *Stepwise multiple regression analysis with log-transformed Thai Pseudoword Reading as the criterion and z scores of all four subtests of phonological awareness in Thai as the predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	2.602	.021				
ztphod	.167	.027				.317***
ztfinsd	.104	.032				.191**
ztinisd	.057	.028	.528	.279	.43831	.110*

Notes:

1. Adjusted R^2 = .273

2. ztinisd = z score: Thai Initial Sound Detection; ztfinsd = z score: Thai Final Sound Detection; ztphod = z score: Thai Phoneme Deletion

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

Answer to Research Question 7b

Using Table 35, I derived the following equations for Thai Pseudoword Reading:

Equation 11: **LNtpsewr = 2.602 + .167Ztphod + .104Ztfinsd + .057Ztinisd**

Or

Equation 12**: Ztpsewr = .317Ztphod + .191Ztfinsd + .110Ztinisd**

The variance of Thai Pseudoword Reading that can be explained was 27.9%. The most effective predictors of Thai Pseudoword Reading were Thai Phoneme Deletion, Thai Final Sound Detection and Thai Initial Sound Detection. If you want to increase one unit of Thai Pseudoword Reading, you should increase .317 unit of Thai Phoneme Deletion, .191 unit of Thai Final Sound Detection and .110 unit of Thai Initial Sound Detection.

Again, in this study I wanted to investigate whether Snow, Burns and Griffin's statement (1998) that letter identification (English) is a very useful predictor of reading ability (English) could be true for Thai Letter Identification to predict Thai reading ability among Thai primary school students. Thai Real Word Reading was entered as the criterion and all four subtests of phonological awareness in Thai--Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task, Thai Phoneme Deletion--plus Thai Letter Identification, were entered as the predictors. The method chosen was again stepwise. The following ANOVA table shows the predictors and the criterion with F test.

Table 36 *ANOVA test of the predictors with Thai Real Word Reading as the criterion and all four subtests of phonological awareness in Thai plus Thai Letter Identification as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	2436.223	4	609.056	73.365	.000
Residual	3478.418	419	8.302		
Total	5914.642	423			

Note:

Predictors: (Constant), Thai Final Sound Detection, Thai Letter Identification, Thai Phoneme Deletion, Thai Initial Sound Detection

Four variables predicted Thai Real Word Reading: Thai Final Sound Detection, Thai Letter Identification, Thai Phoneme Deletion and Thai Initial Sound Detection, $F(4, 419) = 73.365$, $p<.001$. That indicates that the four subtests could significantly explain variance in Thai Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

The following table shows the results of the stepwise multiple regression analysis.

Table 37 *Stepwise multiple regression analysis with Thai Real Word Reading as the criterion and all four subtests of phonological awareness in Thai plus Thai Letter Identification as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	3.154	1.028				
tfinsd	.252	.049				.272***
tleti	.203	.035				.228***
tphod	.168	.034				.241***
tinisd	.139	.058	.642	.412	2.881	.116*

Notes:

1. Adjusted R^2 = .406

2. tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification.

3. *p<.05;*** p<.001

The multiple correlation coefficient (R) was .642 for the model - a mid-range number. However, since all subtests of phonological awareness in English were significantly correlated, a collinearity diagnostic was also very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX BB). The table shows that the values of partial and part correlations dropped by about half in the model. That means that much of the variance in Thai Real Word Reading was not explained by the predictors specified in the models.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for model 4, 10% - 51% was explained by other predictors. The tolerances here were medium to large but one of the variance inflation factors (VIF) was more than 2. So there was a possible problem with multicollinearity.

The collinearity diagnostics confirmed that there was a possible problem with multicollinearity (see APPENDIX CC). Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here two condition indices were greater than 15 but smaller than 30.

I tried to fix the collinearity problems by rerunning the regression using log-transformed Thai Real Word Reading as the criterion and z scores for all four subtests of phonological awareness in Thai and Thai Letter Identification as the predictors. The chosen entry method was stepwise, in order to include only the most useful variables in the model (see APPENDIX DD).

All of the condition indices were much less than 15. The strategy worked, and the model built using the stepwise method did not have problems with collinearity. The following ANOVA table shows the predictors and the criterion with an F test.

Table 38 *ANOVA test of the predictors with log-transformed Thai Real Word Reading as the criterion and z scores for all four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	14.453	3	4.818	68.256	.000
Residual	29.645	420	.071		
Total	44.098	423			

Note:

Predictors: (Constant), Z score: Thai Final Sound Detection; Z score: Thai Phoneme Deletion; Z score: Thai Letter Identification

Three variables predicted Thai Real Word Reading: Thai Final Sound Detection, Thai Phoneme Deletion and Thai Letter Identification, $F(3, 420) = 68.256$, $p<.001$. That indicates that the three subtests could significantly explain variance in Thai Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

Please note there were four subtests that predicted Thai Real Word Reading.

Due to violation of multicollinearity, I used a log-transformed criterion and z scores of all four subtests of phonological awareness in Thai plus Thai Letter Identification. After the treatment, one independent variable – Thai Initial Sound Detection - was considered no longer useful in the prediction.

The new analysis looked as follows.

Table 39 *Stepwise multiple regression analysis with log-transformed Thai Real Word Reading as the criterion and z scores of all four subtests of phonological awareness in Thai and Thai Letter Identification as the predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	2.791	.013				
ztfinsd	.110	.016				.341***
ztphod	.069	.017				.214***
ztleti	.056	.014	.572	.328	.26568	.172***

Notes:

1. Adjusted R^2 = .323

2. ztfinsd = z score: Thai Final Sound Detection; ztphod = z score: Thai Phoneme Deletion; ztleti = z score: Thai Letter Identification

3. *** p<.001

Using Table 39, I derived the following equations for Thai Real Word Reading:

Equation 13: **treawr = 2.791 + .110tfinsd + .069tphod + .056tleti**

Or

Equation 14: **Ztreawr = .341Ztfinsd + .214Ztphod + .172Ztleti**

The variance of Thai Real Word Reading that can be explained was 32.8%. The most effective predictors of Thai Real Word Reading were Thai Final Sound Detection, Thai Phoneme Deletion and Thai Letter Identification. If you want to increase one unit of Thai Real Word Reading, you should increase .341 unit of Thai Final Sound Detection, .214 unit of Thai Phoneme Deletion and .172 unit of Thai Letter Identification.

For the next step, Thai Pseudoword Reading was entered as the criterion and all five subtests--Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task, Thai Phoneme Deletion and Thai Letter Identification--were entered as the predictors. The method chosen was again stepwise. The following ANOVA table shows the predictors and the criterion with an F test.

Table 40 *ANOVA test of the predictors with Thai Pseudoword Reading as the criterion and four subtests of Thai Phonological Awareness and Thai Letter Identification as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	4076.129	4	1019.032	68.852	.000
Residual	6201.381	419	14.800		
Total	10277.509	423			

Note:

Predictors: (Constant), Thai Phoneme Deletion, Thai Initial Sound Detection, Thai Letter Identification, Thai Final Sound Detection

Four subtests predicted Thai Pseudoword Reading: Thai Phoneme Deletion, Thai Initial Sound Detection, Thai Letter Identification and Thai Final Sound Detection, $F(4, 419) = 68.852$, $p<.001$. That indicates that those four subtests could significantly explain variance in Thai Pseudoword Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

Only the Thai Rhyme Task was not among the most useful predictors of Thai Pseudoword Reading, indicating that it would not significantly increase predictive validity in explaining variance in Thai Pseudoword Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 41 *Stepwise multiple regression analysis with Thai Pseudoword Reading as the criterion and four subtests of Thai Phonological Awareness and Thai Letter Identification as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	-2.501	1.372				
tphod	.293	.046				.318***
tinisd	.247	.077				.157**
tleti	.227	.047				.193***
tfinsd	.202	.066	.630	.397	3.847	.165**

Notes:

1. Adjusted $R^2 = .391$

2. tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification

3. ** $p<.01$; *** $p<.001$

The multiple correlation coefficient (R) was .630 for the model - a mid-range number. However, since all subtests of phonological awareness in Thai were significantly correlated, a collinearity diagnostic was very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX EE). The table shows that the values of partial and part correlations dropped a lot in the model. That means that a good portion of the variance in Thai Pseudoword Reading could not be explained by the predictors specified in the models.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, about 10% - 53% was explained by other predictors. The tolerances here were medium to large, but one of the variance inflation factors (VIF) was more than 2. So there was a possible problem with multicollinearity.

The collinearity diagnostics confirmed that there was a possible problem with multicollinearity (see APPENDIX FF). Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here, two condition indices were greater than 15 but smaller than 30.

I tried to fix the collinearity problems by rerunning the regression using log-transformed Thai Pseudoword Reading as the criterion and z scores for all four subtests of phonological awareness in Thai and Thai Letter Identification as the predictors. The chosen entry method was stepwise. That was in order to include only the most useful variables in the model (see APPENDIX GG).

All of the condition indices were much less than 15. The strategy worked, and the model built using the stepwise method did not have problems with collinearity. The following ANOVA table shows the predictors and the criterion with an F test.

Table 42 *ANOVA test of the predictors with log-transformed Thai Pseudoword Reading as the criterion and z scores for four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	32.875	3	10.958	58.642	.000
Residual	77.362	414	.187		
Total	110.237	417			

Note:

Predictors: (Constant), Z score: Thai Phoneme Deletion; Z score: Thai Final Sound Detection; Z score: Thai Letter Identification

Three subtests predicted Thai Pseudoword Reading: Thai Phoneme Deletion, Thai Final Sound Detection and Thai Letter Identification, $F(3, 420) = 53.272$, $p<.001$. That indicates that the three subtests could significantly explain variance in Thai Pseudoword Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

Thai Rhyme Task and Thai Initial Sound Detection were not among the most useful predictors of Thai Pseudoword Reading, indicating that they would not significantly increase predictive validity in explaining variance in Thai Pseudoword Reading.

The new analysis looks as follows.

Table 43 *Stepwise multiple regression analysis with log-transformed Thai Pseudoword Reading as the criterion and z scores of all four subtests of phonological awareness in Thai and Thai Letter Identification as the predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	2.602	.021				
ztphod	.153	.027				.289***
ztfinsd	.131	.027				.242***
ztleti	.089	.022	.528	.279	.43228	.172***

Notes:

1. Adjusted R^2 = .273

2. ztfinsd = z score: Thai Final Sound Detection; ztphod = z score: Thai Phoneme Deletion; ztleti = z score: Thai Letter Identification

3. *** p<.001

Using Table 43, I derived the following equations for Thai Pseudoword Reading:

Equation 15: **LNtpsewr = 2.602 + .153Ztphod + .131Ztfinsd + .089Ztleti**

Or

Equation 16: **Ztpsewr = .289Ztphod + .242Ztfinsd + .172Ztleti**

The variance of Thai Pseudoword Reading that can be explained was 27.9%. The most effective predictors of Thai Pseudoword Reading were Thai Phoneme Deletion, Thai Final Sound Detection and Thai Letter Identification. If you want to increase one unit of Thai Pseudoword Reading, you should increase .289 unit of Thai Phoneme Deletion, .242 unit of Thai Final Sound Detection and .172 unit of Thai Letter Identification.

Results for Research Question 8

As noted earlier, Research Question 8 is: To what degree, if at all, is there a transfer of phonological awareness from the Thai language to English among Thai primary school students? Multiple regression analysis was also used to answer this question.

In order to investigate whether there was any transfer of phonological awareness from Thai to English, two steps were taken. First, I checked the correlations between phonological awareness in English and phonological awareness in Thai. Then I used stepwise multiple regression analysis to investigate whether subtests of phonological awareness in Thai could predict reading ability in English.

For the first step, I entered all subtests of phonological awareness in English and in Thai into the SPSS correlation dialog box. The following table shows the Pearson product-moment correlations between phonological awareness in English and in Thai.

Table 44 *Intercorrelations between phonological awareness in English and in Thai*

subtests	*tinisd*	*Tfinsd*	*trhyt*	*tphod*
einisd	.267***	.263***	.262***	.177***
efinsd	.301***	.280***	.283***	.151**
erhyt	.302***	.320***	.347***	.113*
ephod	.300***	.382***	.280***	.268***

Notes:

1. einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion; tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyt = Thai

Rhyme Task; tphod = Thai Phoneme Deletion.

2. *p<.05; **p<.01; ***p<.001 (2-tailed)

All subtests of phonological awareness in English were highly correlated with all subtests of phonological awareness in Thai. They were all significant at the .001 level (2-tailed), except one correlation significant at .01 (English Final Sound Detection and Thai Phoneme Deletion) and another one significant at the .05 level (English Rhyme Task and Thai Phoneme Deletion).

For the second step, multiple regression analysis was used to investigate whether phonological awareness in Thai could predict reading ability in English.

First, English Real Word Reading was entered as the criterion and all four subtests of phonological awareness in Thai, namely Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion, were entered as the predictors. The method chosen was stepwise. The following ANOVA table shows the predictors and the criterion with an F test.

Table 45 *ANOVA test of the predictors with English Real Word Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	2482.905	3	827.635	25.209	.000
Residual	13788.935	420	32.831		
Total	16271.840	423			

Note:

Predictors: (Constant), Thai Phoneme Deletion, Thai Rhyme Task, Thai Initial Sound Detection

Three subtests of phonological awareness in Thai predicted English Real Word Reading: Thai Phoneme Deletion, Thai Rhyme Task and Thai Initial Sound Detection, F (3, 420) = 25.209, p<.001. That indicates that the three subtests could significantly explain variance in English Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

The other subtest showed that Thai Final Sound Detection was not among the most useful predictors of English Real Word Reading, indicating that it would not significantly increase predictive validity in explaining variance in English Real Word Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 46 *Stepwise multiple regression analysis with English Real Word Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	.215	1.699				
tphod	.315	.065				.271***
trhyt	.404	.089				.243***
tinisd	-.300	.105	.391	.153	5.730	-.151**

Notes:

1. Adjusted R^2 = .147

2. tinisd = Thai Initial Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion

3. ** p<.01; *** p<.001

The multiple correlation coefficient (R) was .391 for the model. The number was low. However, since all subtests of phonological awareness in English were significantly correlated, a collinearity diagnostic was very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX HH). The table shows that the values of partial and part correlations dropped slightly in the model. That means that most of the variance was not explained by the predictors specified in the model.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, 28% - 36% of variance was explained by other predictors. The tolerances here were large and none of the variance inflation factors (VIF) were more than 2. So there was no problem with multicollinearity from that perspective.

However, the collinearity diagnostics indicated a possible problem with multicollinearity (see APPENDIX II). Values of the condition indices greater than 15 indicate a possible problem with collinearity, and values greater than 30 indicate a serious problem. Here, one condition index was greater than 15 but smaller than 30. Therefore, there was a possible problem with multicollinearity.

I tried to fix the collinearity problems by rerunning the regression using log-transformed English Real Word Reading as the criterion and z scores for all four subtests of phonological awareness in Thai as the predictors. The chosen entry method was stepwise. That was in order to include only the most useful variables in the model (see APPENDIX JJ).

All of the condition indices were much less than 15. The strategy worked, and the model built using the stepwise method did not have problems with collinearity. The following ANOVA table shows the predictors and the criterion with an F test.

Table 47 *ANOVA test of the predictors with log-transformed English Real Word Reading as the criterion and z scores for four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	40.112	3	13.371	16.915	.000
Residual	237.926	301	.790		
Total	278.038	304			

Note:

Predictors: (Constant), Z score: Thai Rhyme Task; Z score: Thai Phoneme Deletion; Z score: Thai Initial Sound Detection

Three subtests of phonological awareness in Thai predicted English Real Word Reading: Thai Rhyme Task, Thai Phoneme Deletion and Thai Initial Sound Detection, $F(3, 301) = 16.915$, $p<.001$. That indicates that the three subtests could significantly explain variance in English Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

The other subtest, Thai Final Sound Detection, was not among the most useful predictors of English Real Word Reading, indicating that it would not significantly increase predictive validity in explaining variance in English Real Word Reading.

Please note the results were almost the same except the Thai Rhyme Task become the best predictor among all four subtests.

The new analysis looks as follows.

Table 48 *Stepwise multiple regression analysis with log-transformed English Real Word Reading as the criterion and z scores of all four subtests of phonological awareness in Thai as the predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	1.663	.052				
ztrhyt	.288	.063				.278***
ztphod	.252	.068				.236***
ztinisd	-.140	.058	.380	.144	.88907	-.152*

Notes:

1. Adjusted R^2 = .136

2. ztinisd = z score: Thai Initial Sound Detection; ztrhyt = z score: Thai Rhyme Task; ztphod = z score: Thai Phoneme Deletion

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

Using Table 48, I derived the following equations for English Real Word

Reading:

Equation 17: **LNereawr = 1.663 + .288Ztrhyt +.252Ztphod -.140Ztinisd**

Or

Equation 18: **Zereawr = .278Ztrhyt + .236Ztphod - .152Ztinisd**

The variance of English Real Word Reading that can be explained was 14.4%. The most effective predictors of English Real Word Reading were Thai Rhyme Task, Thai Phoneme Deletion and Thai Initial Sound Detection. If you want to increase one unit of English Real Word Reading, you should increase .278 unit of Thai Rhyme Task and .236 unit of Thai Phoneme Deletion, and decrease .152 unit of Thai Initial Sound Detection.

Lastly, English Pseudoword Reading was entered as the criterion and all four subtests of phonological awareness in Thai, namely, Thai Initial Sound Detection, Thai Final Sound Detection, Thai Rhyme Task and Thai Phoneme Deletion, were entered as the predictors. The method chosen was stepwise. The following ANOVA table shows the predictors and the criterion with an F test.

Table 49 *ANOVA test of the predictors with English Pseudoword Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Source	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	1097.625	2	548.813	18.835	.000
Residual	12266.976	421	29.138		
Total	13364.601	423			

Note:

Predictors: (Constant), Thai Phoneme Deletion, Thai Rhyme Task

Two subtests of phonological awareness in Thai predicted English Pseudoword Reading: Thai Phoneme Deletion and the Thai Rhyme Task, F (2, 421) = 18.835, p<.001. That indicates that the two subtests could significantly explain variance in English Real Word Reading or they could linearly regress on the criterion and could further create the linear prediction equation.

The other subtests--Thai Initial Sound Detection and Thai Final Sound Detection--were not among the most useful predictors of English Pseudoword Reading, indicating that they would not significantly increase predictive validity in explaining variance in English Pseudoword Reading.

The following table shows the results of the stepwise multiple regression analysis.

Table 50 *Stepwise multiple regression analysis with English Pseudoword Reading as the criterion and four subtests of Thai Phonological Awareness as predictors*

Variable	B	*SE* B	*R*	R^2	*SE est.*	*Beta*
(Constant)	-1.787	1.146				
tphod	.214	.057				.204***
trhyt	.185	.082	.287	.082	5.398	.123*

Notes:

1. Adjusted R^2 = .078
2. trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion
3. *p<.05; *** p<.001

The multiple correlation coefficient (R) was .287 – a low number - for the model. However, since all subtests of phonological awareness in English were significantly correlated, a collinearity diagnostic was very necessary.

A collinearity diagnostic, partial and part correlations were selected under the linear regression analysis in SPSS (see APPENDIX KK). The table shows that the values of partial and part correlations dropped slightly in the model. That means that most of the variance was explained by the predictors specified in the model.

As I mentioned above, the tolerance is the percentage of the variance in a given predictor that cannot be explained by the other predictors. Here, for the model, about 26% was explained by other predictors. The tolerances here were large and none of the variance inflation factors (VIF) was more than 2. So there was no problem with multicollinearity.

The collinearity diagnostics confirmed that there was no problem with multicollinearity (see APPENDIX LL). Values of the condition indices greater than 15 indicate a possible problem with collinearity. Values greater than 30 indicate a serious problem. Here, no condition index was greater than 15.

Using Table 50, I derived the following equations for English Pseudoword Reading:

Equation 19: **epsewr = .214tphod + .185trhyt -1.787**

Or

Equation 20: **Zepsewr = .204Ztphod + .123Ztrhyt**

The variance of English Pseudoword Reading that can be explained was 8.2%. The most effective predictors of English Pseudoword Reading were Thai Phoneme Deletion and Thai Rhyme Task. If you want to increase one unit of English Pseudoword Reading, you should increase .204 unit of Thai Phoneme Deletion and .123 unit of Thai Rhyme Task.

Summary of Chapter 4

The highlights of the results found in this study are summarized here. First, the demographics reveal that all 424 participants came from 10 schools in nine provinces in Lower Northern part of Thailand with more female students than male students.

Second, the medians, means, and standard deviations reveal that students' performance in Thai was better than that in English, since they had much more time practice Thai, their native language, than English, a foreign language in Thailand. This chapter shows that the subtests are all intercorrelated significantly except for one. As we know, when predictors are significantly related to criterion, it shows there is a strong relation between predictors and the criterion. When the predictors are significantly correlated, there is a possibility that multicollinearity might be violated, as I have assessed, fixed and described in this chapter.

Third, the best multiple regression model for predicting English Real Word Reading had four predictors and used the following equation: In raw score form, ereawr = .401efinsd + .203erhyt + .111ephod -.135einisd -.333; or in standardized score form, Zereawr = .370Zefinsd + .155Zerhyt + .121Zephod -.134Zeinisd.

The optimal model for predicting English Pseudoword Reading in raw score form was: epsewr = .170ephod + .196erhyt + .162efinsd -1.905; or in standardized score form, Zepsewr = .204Zephod + .165Zerhyt + .165Zefinsd.

For Thai Real Word Reading, LNtreawr = 2.791 + .095Ztfinsd + .079Ztphod + .034Ztinisd; or Ztreawr = .294tfinsd +.243tphod + .106tinisd.

For Thai Pseudoword Reading, LNtpsewr = 2.602 + .167Ztphod + .104Ztfinsd + .054Ztinisd; or Ztpsewr = .317Ztphod + .191Ztfinsd + .110Ztinisd.

Fourth, intercorrelation analyses and multiple regression analyses confirmed that there was a transfer of phonological awareness from Thai to English.

CHAPTER 5: DISCUSSION, IMPLICATIONS AND CONCLUSION

Overview

In this chapter, I will first provide an overview of the chapter, then answer and discuss the research questions one by one in the order they were presented in the first chapter. Next I will present implications for future research and for teaching. The chapter ends with major conclusions of the dissertation.

Research Questions and Their Sources

1. What are the demographics of the participants in this study?
2. What are the medians, means, and standard deviations for English phonological awareness subtests, English reading ability subtests, Thai phonological awareness subtests, and Thai reading ability subtests of Thai primary students in their native country?
3. What are the intercorrelations among all of the subtests in English and Thai for Thai primary students in their native country?
4. Which phonological awareness subtest(s) in English provide(s) the best prediction of English reading ability among Thai primary school students

in their native country?

5. What is the relationship between phonological awareness and reading ability in the English language of Thai primary school students in their native country?
6. Which phonological awareness subtest(s) in Thai provide(s) the best prediction of Thai reading ability among Thai primary school students in their native country?
7. What is the relationship between phonological awareness and reading ability in the Thai language of Thai primary school students in their native country?
8. To what degree, if at all, is there a transfer of phonological awareness from the Thai language to English among Thai primary school students?

The present study was aimed at investigating the relationship between phonological awareness and reading ability both in English and Thai of primary school Thai students in their native country. Stahl and Murray (1998) mentioned that a lot of research has been done on the relationship between phonological awareness and reading ability and we have learned much more than we knew a decade ago. However, some questions remain to be answered, as Stahl and Murray suggested: What kind of "phonological awareness" is related to reading? About what kind of relation are we talking? And how are we defining reading?

Some of my research questions were framed based on these suggestions, with the goal of addressing explicitly and in detail the components of phonological awareness, of reading, and of the relationship between them. In addition, because it is a study involving two languages, the questions also investigated whether there is any transfer of phonological awareness from Thai to English among Thai students. I will discuss the results of the present study in the order of the eight research questions.

Discussion of Research Question 1

Research Question 1 is: What are the demographics of the participants in this study?

All 424 students came from ten schools in nine provinces in the Lower Northern part of Thailand. There were somewhat more female students than male students. This is consistent with Thailand's population, which has more Thai females than males. Although the Thai Ministry of Education requires that students should start learning English in Grade One, 30.9% of the sample students started learning English in Kindergarten.

Discussion of Research Question 2

Research Question 2 is: What are the medians, means, and standard deviations for English phonological awareness subtests, English reading ability subtests, Thai phonological awareness subtests, and Thai reading ability subtests of Thai primary students in their native country?

Students' performance in Thai was much better than their performance in English. This is because Thai students had much more time to practice Thai, their native language, than English, a foreign language in Thailand. More specifically, Thai students' performance in English phonological awareness was better than their performance in English reading ability. Students need to produce phonemes before they can produce words (both real words and pseudowords). This fact, in another way, supported the idea that phonological awareness is the foundation for reading.

Among English phonological awareness subtests, the mean differences were not big, with the range of means from 10.11 to 13.33 out of a total possible score of 20. Among English reading subtests, students did much better on English Letter Identification (both Upper Case and Lower Case) than they did on English Real Word Reading and English Pseudoword Reading. This is easily understood because students learned how to read English letters before they learned English words. In English word reading, students read real words better than pseudowords, since they had time to practice English words from their curriculum but had never seen the pseudowords created by the researcher. The mean difference between English Real Word Reading and English Pseudoword Reading was not great, which indicates that the rules the Thai students learned about how to pronounce English words were applied to pronounce English pseudowords. This means that the students automatically transferred these rules without being told to do so.

Students did quite well on both Thai phonological awareness subtests and Thai reading ability subtests. The mean differences among and across Thai phonological awareness and Thai reading ability subtests were not large. This is understandable because Thai is the national language, and the only national language in Thailand. Thai curriculum guidelines require a lot of practice and instruction every school day. The Thai language is enforced not only in schools but also at home and everywhere else.

Discussion of Research Question 3

Research Question 3 is: What are the intercorrelations among all of the subtests in English and Thai for Thai primary students in their native country?

All intercorrelations among English and Thai subtests in this dissertation were significant except one pair. The only correlation that was not significant was between English Real Word Reading and Thai Initial Sound Detection. The reason for this lack of significance is not clear from this study.

For Research Questions 4, 5, 6, and 7, as shown in Chapter 4 and discussed below, all English phonological awareness subtests and Thai phonological awareness subtests were used as predictors in the multiple regression analyses, while English Real Word Reading, English Pseudoword Reading, Thai Real Word Reading, and Thai Pseudoword Reading were used as criteria. One reason for the resulting significant predictions (see Chapter 4 and the discussion of Research Questions 4, 5, 6, and 7 below) was the significant correlations between all the predictors and all the criteria except one.

While significant correlations between predictors and criteria were very important and revealing in the multiple regression analyses, significant correlations among all the predictors had a downside. Significant correlations among predictors might mean a possible violation of multicollinearity in multiple regression analysis. For that reason, during the multiple regression analyses, I kept assessing whether multicollinearity had been violated. If so, I had to adjust and rerun multiple regression analyses with log-transformed criteria and standardized z scores for all predictors.

Discussion of Research Questions 4 and 5

Research Question 4 is: Which phonological awareness subtest(s) in English provide(s) the best prediction of English reading ability among Thai primary school students in their native country? Research Question 5 is: What is the relationship between phonological awareness and reading ability in the English language of Thai primary school students in their native country?

For Research Question 4, from stepwise multiple regression analyses, we can see that for Thai students in this study the best predictor for English Real Word Reading was English Final Sound Detection. Next to that, the most useful predictors were English Rhyme Task, English Phoneme Deletion and English Initial Sound Detection. The predictive abilities of all four predictors were close. All the predictions were significant.

The best predictor for English Pseudoword Reading was English Phoneme Deletion. Following that, the most useful predictors were English Rhyme Task and English Final Sound Detection. English Initial Sound Detection had been removed from the model because of nonsignificance as a predictor, so the remaining predictors were significant. Differences in predictive strength of the significant predictors were not large.

Perfetti, Beck, Bell, and Hughes (1987) stated that the best predictor of word reading, in general, was deletion. One finding in this dissertation was consistent with that: the best predictor for English Pseudoword Reading was English Phoneme Deletion. However, for English Real Word Reading, English Phoneme Deletion was not the best predictor but was among the significant predictors.

Lesaux and Siegel (2003) used multiple regression analysis to show that phonological processing was the single best predictor of Grade Two word reading ability. Muter and Diethelm (2001) confirmed that phonological abilities were good predictors of both concurrent and later reading achievement. The findings in this study demonstrated clear and consistent relationships between phonological skills and learning to read among children from multilingual backgrounds.

In order to answer Research Question 5, I entered all four subtests of phonological awareness in English as predictors and each subtest of English reading ability as a criterion.

All four predictors of English Real Word Reading were significant. These were English Final Sound Detection, English Rhyme Task, English Initial Sound Detection and English Phoneme Deletion, with the first being the most useful of these four.

For the second prediction, I used all four subtests of phonological awareness in English as predictors and English Pseudoword Reading as the criterion. Three of the four English phonological awareness subtests significantly predicted English Pseudoword Reading, with predicative ability as follows: English Phoneme Deletion, English Rhyme Task, and English Final Sound Detection. Only English Initial Sound Detection was not among the most useful predictors of English Pseudoword

Reading.

The variance in English Real Word Reading explained by English phonological awareness subtests was 19%, while the variance in English Pseudoword Reading explained by English phonological awareness subtests was 16.4%.

These findings were consistent with many studies on English as a first language (L1) reading, which found that phonemic awareness is a powerful predictor of future reading success (Liberman, Shankweiler, Fischer, & Carter, 1974; Mann & Liberman, 1984; Share, Jorm, MacLean, & Mathews, 1984; Stanovich, Cunningham, & Cramer, 1984; Tunmer & Nesdale, 1985). Some studies also found that phonological processing is one of the major cognitive determinants of the development of word-level reading skills in the early phases of learning to read (Goswami & Bryant, 1990; Share, 1995; Share & Stanovich, 1995; Wagner & Torgesen, 1987). Perfetti, Beck, Bell, and Hughes (1987) found that phonemic awareness was strongly related to reading ability. They mentioned that one way to see the predictive value of deletion was through a multiple regression analysis, in which each phonemic test was entered as a predictor variable, with the reading readiness scores as another predictor. In their analysis, the last three together accounted for 77% of the explained variance in word reading. That further indicated that phonemic awareness is strongly related to reading ability but that reading readiness was also a powerful predictor in the equation. Reading readiness is a much larger and more encompassing construct than was used for any of the predictors in the current dissertation study. Phonemic awareness, in contrast, was a smaller construct than the phonological awareness used in the current study.

Vellutino and Scanlon (1987) showed that facility in phonemic segmentation is causally related to success in reading. Maclean, Bryant and Bradley (1987) demonstrated that early rhyme and alliteration detection scores are related to the success at the early stage of reading. This result considerably extends the evidence for a connection between phonological skills and learning to read. Wagner, Torgesen and Rashotte (1994) produced a study showing that there was a causal relation between the development of phonological processing abilities and the acquisition of reading skills.

Lundberg, Olofsson and Wall (1980) reported that the most powerful determinant of reading achievement in Grade One was the ability in kindergarten to analyze phonemes. That strongly suggested that the achievement levels in children’s reading in the first school years could be validly predicted from an assessment of their phonemic awareness skills at a time well before formal reading instruction had commenced. Bryant, Maclean, Bradley and Crossland (1990) used multiple regression analysis that included both a measure of rhyme or alliteration detection and one of phoneme detection and discovered that these were all significant predictors of young learners' reading ability. So there was certainly a connection between early phonological skills and the child's progress in reading. The current study also confirmed the existence of strong, consistent, and specific relationships between children's phonological skills and reading.

Snider's (1997) investigation replicated previous research and supported the predictive value of phonemic awareness to later reading achievement. The results also indicated that three subtests--phonemic segmentation, strip initial consonant (initial consonant deletion), and substitution of initial consonant--and the total score were highly predictive of later reading achievement. The combination of quantitative and qualitative data in this article supported a powerful and predictable relationship between phonemic awareness and future reading achievement. PA (phonological awareness) was the more powerful predictor in kindergarten and Grade One. Children who had low PA and slow NS (naming speed) in kindergarten made slower progress in reading development and were more likely to suffer from reading difficulties by Grade Five.   Hulme, Hatcher, Nation, Brown, Adams and Stuart (2002) concluded that measures of phonemic awareness were excellent predictors of early reading skills. It is phonemic awareness that is consistently the stronger predictor of emerging reading skill in children on the brink of kindergarten entry.

Snow, Burns and Griffin (1998) stated that (English) letter identification is a very useful predictor of English reading ability. Therefore, I used English Letter

Identification Upper Case and English Letter Identification Lower Case as predictors, along with all four subtests of English phonological awareness, of each of the two subtests of English reading ability. Inclusion of letter identification among the predictors was done to test whether Snow et al.'s statement (1998) would hold valid among Thai students.

The assertion of Snow et al. about the predictive value of letter identification was supported by the current study. For the prediction of English Real Word Reading in the current study, two subtests proved to be significant predictors: English Letter Identification Lower Case and English Final Sound Detection. The other predictors, including English Letter Identification Upper Case and three English phonological awareness subtests, were not significant predictors. The variance of English Real Word Reading explained by English phonological awareness subtests and English Letter Identification was 25.1%.

In the current investigation, letter identification was also a significant predictor of English Pseudoword Reading. Three subtests predicted English Pseudoword Reading: English Letter Identification Lower Case, English Phoneme Deletion, and English Rhyme Task. English Initial Sound Detection, English Final Sound Detection and English Letter Identification Upper Case were not among the most useful predictors of English Pseudoword Reading. The variance of English Pseudoword Reading explained by English phonological awareness subtests and

English Letter Identification was 29.2%.

It should be noted that English Letter Identification Upper Case was not a significant predictor of either English Real Word Reading or English Pseudoword Reading, although English Letter Identification Lower Case was a significant predictor of both. The reason for this disparity is as yet unestablished.

Snow, Burns and Griffin (1998) went on to explain, based on a meta-analysis of many studies, that among the readiness skills that are traditionally evaluated, the one that appears to be the strongest predictor on its own is letter identification. Just measuring how many letters a kindergartner is able to name when shown letters in a random order appears to be nearly as successful at predicting future reading as is an entire readiness test. Hulme, Hatcher, Nation, Brown, Adams and Stuart (2002) also showed that, next to phonological awareness, letter knowledge is one of the best predictors of children's reading ability. The findings of this study supported this result.

As noted earlier, Stahl and Murray (1998) called for researchers to state explicitly which types of phonological awareness subtests and reading ability subtests are involved in any prediction of reading ability based on phonological awareness. The current study has gone to great lengths to fulfill this mandate, and the results of Research Questions 4 and 5 seemed to have proved the appropriateness of doing so.

Discussion of Research Questions 6 and 7

Research Question 6 is: Which phonological awareness subtest(s) in Thai provide(s) the best prediction of Thai reading ability among Thai primary school students in their native country? Research Question 7 is: What is the relationship between phonological awareness and reading ability in the Thai language of Thai primary school students in their native country?

For Research Question 6, the best predictor for Thai Real Word Reading was Thai Final Sound Detection. Next to that, the most useful predictors were Thai Phoneme Deletion and Thai Initial Sound Detection. Of the Thai phonological awareness subtests, the Thai Rhyme Task was the only nonsignificant predictor. The variance of Thai Real Word Reading explained by Thai phonological awareness subtests was 30.8%.

The best predictor for Thai Pseudoword Reading was Thai Phoneme Deletion. Next to that, the most useful predictors were Thai Final Sound Detection and Thai Initial Sound Detection. Of the Thai phonological awareness subtests, only the Thai Rhyme Task was not among the significant predictors of Thai Pseudoword Reading, just as it was not among the significant predictors of Thai Real Word Reading. The variance of Thai Pseudoword Reading that can be explained by the four Thai phonological awareness subtests was 27.9%.

Since there is no prior study investigating the relationship between Thai phonological awareness and Thai reading ability, what I could do was to infer some implications from other languages to which the Thai language has a close relationship. The study by McBridge-Chang and Kail (2002) showed remarkable similarities in the early phases of reading Chinese and English for monolinguals in their native countries, Taiwan and the U.S. Phonological awareness in both languages was strongly associated with character or word recognition.

In a different study, Huang and Hanley (1994) found that phoneme deletion scores were significantly correlated with reading scores in both the Hong Kong and the Taiwan groups, but both phonological awareness subtests were highly correlated with English reading among the U.K. subjects. The phoneme deletion test, in particular, was highly related to English reading in the U.K. group, but a combined phonological test score was the most powerful predictor of English reading for English children. In this dissertation, Thai Phoneme Deletion was the best predictor for Thai Pseudoword Reading. This finding supported the finding in Huang and Hanley (1994), though the latter one was conducted in the English and Chinese contexts.

I wanted to test whether the Snow et al.'s English-language-referring statement, i.e., that letter identification is a very useful predictor of reading ability, would work in the same way for the Thai language among Thai students. Therefore, I used all four subtests of phonological awareness in Thai plus Thai Letter Identification as predictors and each subtest of reading ability in Thai as a criterion. Three variables significantly predicted Thai Real Word Reading: Thai Final Sound Detection, Thai Phoneme Deletion and Thai Letter Identification. Thai Initial Sound Detection and Thai Rhyme Task proved not to be significant as predictors. The variance of Thai Real Word Reading explained by Thai phonological awareness subtests and Thai Letter Identification was 32.8%.

Similarly, three subtests significantly predicted Thai Pseudoword Reading: Thai Phoneme Deletion, Thai Final Sound Detection and Thai Letter Identification. These are the same subtests that significantly predicted Thai Real Word Reading, although in a slightly different order. Again, Thai Rhyme Task and Thai Initial Sound Detection were not among the significant predictors. The variance of Thai Pseudoword Reading explained by Thai phonological awareness subtests and Thai Letter Identification was 27.9%.

Discussion of Research Question 8

Research Question 8 is: To what degree, if at all, is there a transfer of phonological awareness from the Thai language to English among Thai primary school students?

I first checked the intercorrelations between English phonological awareness subtests and Thai phonological awareness subtests. They were all significantly correlated (see Table **44**). This showed that when students had high scores in Thai phonological awareness, they often had high scores in English phonological awareness. That was the first step to determine whether there might be a transfer from Thai to English among these Thai students.

For the second step, multiple regression analysis was used to investigate whether phonological awareness in Thai could predict reading ability in English. Three subtests of phonological awareness in Thai predicted English Real Word Reading: Thai Rhyme Task, Thai Phoneme Deletion, and Thai Initial Sound Detection. The other phonological awareness subtest, Thai Final Sound Detection, was not a significant predictor of English Real Word Reading. The variance in English Real Word Reading explained by Thai phonological awareness subtests was 14.4%.

Two of the four subtests of Thai phonological awareness predicted English Pseudoword Reading: Thai Phoneme Deletion and Thai Rhyme Task. The other subtests, Thai Initial Sound Detection and Thai Final Sound Detection, were not significant predictors of English Pseudoword Reading. The variance in English Pseudoword Reading explained by Thai phonological awareness subtests was 8.2%.

Since there has been no earlier study investigating whether there is any transfer from Thai to English, I could only reference some studies that included

English along with languages other than Thai. McBridge-Chang and Kail (2002) showed that phonological awareness was strongly related to reading acquisition across English and Chinese. Similar results had also been found in Durgunoglu et al. (1993) across Spanish and English. The importance of phonological awareness for reading acquisition across orthographies was that it involved mapping an oral referent to a written symbol, whether the symbol represents a morpheme/syllable, as in Chinese, or a phoneme, as in English.

Thus, Durgunoglu et al. (1993) showed that, at least for the very earliest states of reading acquisition, some level of phonological awareness, depending on orthography/language, is a universal aspect of learning to read and that this transfers across languages. The findings in this dissertation supported this claim. In this dissertation, Thai students who could perform well on Thai phonological awareness subtests were likely to be able to read English Real Words and English Pseudowords.

The cross-language transfer summarized by Durgunoglu et al. (1993) indicated that it is possible to build on the strengths that a child already had in his or her first language. A child who already knew how to read in Spanish and who had a high level of phonological awareness in Spanish was more likely to perform well on English word and pseudoword recognition tests. In contrast, a child who had some Spanish word recognition skills but low phonological awareness tended to perform poorly on English transfer tests. Developing phonological awareness and word recognition skills in the first language was likely to help in second-language word recognition. The findings in the Thai to English phonological awareness transfer investigation support that conclusion.

Cisero and Royer (1995) examined whether phonological awareness skills develop in a specific pattern, and once developed, whether they transfer to another language. Their findings indicated that native language performance was a significant predictor of the gain in second language performance from experiment one to experiment two. The authors believed it was not accidental that the only significant evidence they found in the regression analyses for cross-language transfer came from the initial phoneme task. In this dissertation, three Thai phonological awareness subtests predicted English Real Word Reading and two Thai phonological awareness subtests predicted English Pseudoword Reading. This is different from Cisero and Royer's (1995) claim that the only significant evidence they found in the regression analyses for cross-language transfer came from the initial phoneme task.

I checked their sample size: 21 students were from a TBE classroom and 14 were from a mainstream classroom for experiment one. TBE students were native Spanish-speaking children and mainstream students were native English speakers. The subjects for experiment two were first grade and kindergarten students from the same state. There were a total of 10 kindergarten and 11 first grade TBE students and

49 kindergarten and 29 first grade mainstream students. The results might have come from the unequal sample size and/or small sample size.

Phonological awareness is not only related to learning to read in English, but is also an important factor in learning to read in other languages such as French, Italian, Serbo-Croatian, Spanish, and Swedish (e.g., Alegria, Pignot, & Morais, 1982; Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; de Manrique & Gramigna, 1984; Lundberg, Oloffson, & Wall, 1980; Ognjenovie, Lukatela, Feldman, & Turvey, 1983). Cisero and Royer (1995)'s study also stated that, with respect to the transfer of phonological awareness from the native language to another language, the language needed to be alphabetic with similar phonological structure. The Thai language uses an alphabetic symbol system, but does not have a phonological structure similar to English. This dissertation provided evidence that there is transfer from Thai to English even though the phonological structure is different.

The following is another study on transfer of phonological awareness from Chinese to English. Chinese is a language that does not meet the above-noted requirements; however, transfer of phonological awareness from Chinese to English was still found. The comparison of Chinese to English is very similar to that of Thai to English: different characters and different phonological structures.

Gottardo, Yan, Siegel and Wade-Woolley (2001) in their study demonstrated that the same relationship existed among English tasks that measured phonological processing and reading in children who were native Chinese speakers. This cross-language transfer of phonological processing skill is consistent with previous research conducted with other groups of ESL learners who spoke European languages and who learned to read alphabetic writing systems in their native languages (Cisero & Royer, 1995; Durgunoglu et al., 1993). Both English and Chinese phonological processing contributed unique variance to English reading.

The finding in Gottardo et al. (2001)'s study that Chinese rhyme detection was predictive of English reading points to the importance of phonological processing skill in the child's native language for learning to decode an alphabetic orthography, even if the orthography of the child's native language is not alphabetic.

Huang and Hanley (1994) found that Taiwanese children who have learned Zhu-Yin-Fu-Hao performed much better than Hong Kong children on the Chinese Phoneme Deletion test. This was reminiscent of Read et al's (1986) finding that phoneme deletion was superior in Chinese adults who had been taught the alphabetic script Pinyin. In short, performance on phoneme deletion tests seemed to be dependent on one's experience of learning an alphabetic script in the language in which one was being tested. That claim was not supported by this dissertation. Among all Thai primary school students, no alphabetic system like Zhu-Yin-Fu-Hao or Pinyin had been taught to them in Thai schools. That alphabetic system was simply not in Thai public schools' or private schools' curriculum. Still, there is transfer of phonological awareness from Thai to English among Thai primary school students.

Lopez and Greenfield (2004) revealed that phonological awareness in English was directly related to phonological awareness in Spanish in Hispanic Head Start children, which supports prior research with older children that found phonological awareness skills in one language are related to phonological skills in a second language. English phonological awareness, beyond its unique relationship with Spanish Phonological Awareness, was also related to both English and Spanish language proficiency. Lindsey, Manis, and Bailey (2003) found that phonological awareness was a general and not a language-specific cognitive process involved in early reading, and cross-linguistic transfer was not unique to phonological skills but occurred for measures of print awareness, letter knowledge, and rapid serial naming. Their study also found that phonological awareness had a high degree of transfer from Spanish to English and was predictive of word-identification skills.

Gottardo (2002) showed that language and reading measures were significantly correlated within languages as well as between the English and Spanish languages. In particular, reading and phonological processing were related within languages and across languages. More specifically, English phonological processing variables, English oral language variables, and English rapid naming variables all correlated with English reading performance. In addition, phonological processing skill in Spanish, the child’s L1, was related to L2 reading acquisition performance. Phonological processing in English and Spanish was related to English reading and explained the highest proportion of variance on English reading. Multiple regression analysis revealed that the strongest predictors of English word reading ability were L1 and L2 phonological processing, L1 reading and L2 vocabulary.

Quiroga, Lemos-Britton, Mostafapour, Abbott, and Berninger (2002) provided evidence that phonological awareness was related to learning to read English when one's first language was Spanish and reading instruction was conducted in English. Both Spanish and English phonological awareness predicted English word reading. They also found that phonological awareness in Spanish, the first language, predicted reading in English, the second language, and that phonological awareness correlated across the first and second language. In summary, consistent with prior research findings, this dissertation provided evidence that there is transfer of phonological awareness from Thai to English among Thai students.

Implications for Future Research

More research on the relationship between phonological awareness and reading ability in English should be carried out in the ESL context as well as the EFL context. This is because there is comparatively much less research in these contexts.

No prior study has ever been done on the relationship between phonological awareness and reading ability in Thai, thus the measures in Thai (both Thai phonological awareness and Thai reading ability) in this dissertation are the first of their kind in Thai reading. More research is needed to replicate this study to generalize the findings in this dissertation.

Thai is a monosyllabic language (like Chinese) with a shallow orthography (like Spanish). It is possible to generalize the findings in Thai readings to Chinese and Spanish, depending on the theory that we are talking about.

Implications for Teaching Second Language Reading

Second or foreign language reading could be improved by focusing on students' second or foreign language or on students' first language. Taken together, this dissertation and several other studies supported the assertion that there is a transfer of phonological awareness across languages, specifically from the native language to a foreign or second language. This dissertation concerned phonological awareness transfer from Thai to English, while other studies have focused on phonological awareness transfer from Chinese to English and from Spanish to English. Positive results from these studies concerning transfer of phonological awareness suggest that "bilingual education" might make sense, although this is different from current policies in many states. This would allow the use of the second language when students arrive in an English-speaking country, but the native language would still be studied in school and could therefore serve as a bridge from native language knowledge to second language learning.

Major Conclusions

First it is important to consider the role of phonological awareness in understanding the reading ability of second language learners in their own language and the second language. Second, patterns of prediction of reading ability based on phonological awareness are different for the first language vs. the second language, as well as across languages. This is important because we can improve students' native language in order to improve their second language. We can also improve their second language in order to improve their native language. Third, this dissertation has proved that there is a transfer of phonological awareness from Thai to English, i.e. from shallow orthography to deep orthography. This can mean that phonological awareness transfer occurs in different orthography.

Summary of Chapter 5

In this chapter, I have discussed all eight of my research questions in the order they were presented. First I provided demographics of all participants, and then I provided the medians, means and standard deviations for all subtests in both languages. All intercorrelations have been calculated. I discussed the relationship between English phonological awareness and English reading ability among Thai primary school students. I also answered and discussed the relationship between Thai phonological awareness and Thai reading ability among Thai primary school students. The best predictors among phonological awareness subtests in both languages have been identified. I proved that there is transfer of phonological awareness from Thai to English among Thai primary school students. Finally, implications for future research and for teaching reading were discussed.

APPENDIX A: TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

Required Sample Size, Given a Finite Population, Where N = Population Size and n = Sample Size

N – n	N – n	N – n	N - n	N – n
10 – 10	100 - 80	280 – 162	800 - 260	2800 - 338
15 – 14	110 – 86	290 – 165	850 - 265	3000 – 341
20 – 19	120 – 92	300 – 169	900 - 269	3500 – 346
25 – 24	130 - 97	320 – 175	950 - 274	4000 – 351
30 – 28	140 - 103	340 – 181	1000 - 278	4500 – 354
35 – 32	150 – 108	360 – 186	1100 - 285	5000 – 357
40 – 36	160 – 113	380 – 191	1200 - 291	6000 – 361
45 – 40	170 – 118	400 – 196	1300 - 297	7000 – 364
50 – 44	180 – 123	420 – 201	1400 - 302	8000 – 367
55 – 48	190 – 127	440 – 205	1500 - 306	9000 – 368
60 – 52	200 – 132	460 – 210	1600 - 310	10000 – 370
65 – 56	210 – 136	480 – 241	1700 - 313	15000 – 375
70 – 59	220 – 140	500 – 217	1800 - 317	20000 – 377

75 – 63	230 – 144	550 – 226	1900 - 320	30000 – 379
80 – 66	240 – 148	600 – 234	2000 - 322	40000 – 380
85 – 70	250 – 152	650 – 242	2200 - 327	50000 – 381
90 – 73	260 – 155	700 – 248	2400 - 331	75000 – 382
95 – 76	270 – 159	750 – 254	2600 - 335	100000 – 384

(Adapted from Krejcie & Morgan, 1970, p. 608)

APPENDIX B: MEASURES IN ENGLISH

Phonological awareness in English

1. *English Initial Sound Detection*

For this task, you will hear some words you know from your English language studies. First, you will answer five questions in order to get familiar with the task. For example, when you hear the word “father”, you need to tell your examiner what the initial sound or the first sound is in this word. (Here, the answer is /f/.) When you say the initial sound, try to say it as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, we will start doing test words in the same way you did the trial words. Please note that if you don’t hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1. arm 2. leg 3. father 4. fox. 5. black

Test:

Easy words:

1. bat, 2. rat, 3. cat, 4. mat, 5. map, 6. hat, 7. cap

Rather difficult words:

1. sing 2. neck 3. dear 4. foot 5. gun 6. bus 7. wig

Difficult words: 1. hut 2. bug 3. jug. 4. bear 5. sock 6. sheep

2. *English Final Sound Detection*

For this task, you will hear some words chosen from your English curriculum. You will begin this task by doing five trials in order to make yourself acquainted with the task. For example, when you hear the word “fox”, you need to tell your examiner what the final sound or the last sound is in this word. (Here the correct answer is /s/.) When you say the final sound, try to pronounce it as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you do the trial words. Please note that if you don’t hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1. arm 2. leg 3. father 4. fox. 5. black

Tests:

Easy words:

1. pan, 2. pen, 3. bin, 4. pin, 5. pig, 6. cup, 7. can

Rather difficult words:

1. fish 2. dish 3. game 4. cake 5. ring 6. door 7. school

Difficult words:

1. zebra 2. rabbit 3. apple 4. mango 5. coconut 6. banana

3. *English Rhyme Task*

For this task, you will hear two words in a pair; at least one of the words will be chosen from your English curriculum. You will begin this task by doing five trials in order to make yourself familiar with the task. For example, when you hear “yell” and “cell”, you will notice the last part of the two words has the same sound /ell/. Then you just say “yes” which means these two words rhyme with each other. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did trial words. Please note if you don’t hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1.yell-cell 2.green-grill 3.fox-box 4.man-mail 5.hack-kick

Test:

1.Bat-rod 2.cat-map 3.map-lad 4.hack-cat 5.cap-tap 6.pan-man

7. pen-den 8. bin-tin 9.pin-din 10.pig-wig 11.door-floor 12.boy-coy

13. girl-gird 14.hand-ham 15.leg-lack 16.fox-pox 17.green-gray

18.yell-yield 19.black-blade 20.blue-flew

4. *English Phoneme Deletion*

For this task, you will hear a word chosen from your English curriculum and you will be told to delete a sound in the initial position or final position and give the rest of the pronunciation of this word. You will begin this task by doing five trials in order to make yourself familiar with the task. For example, when you hear “cake” and the examiner tells you to delete the first sound and give the rest of the pronunciation, you’ll say /eik/. When you say the rest of the pronunciation, try to make it as clear as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did trial words. Please note that if you don’t hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1.can (delete the first sound) 2.hat (delete the first sound) 3.cake (delete the first sound) 4.game (delete the first sound) 5.sheep (delete last sound)

Tests:

Easy words (delete the first sound):

1. bat, 2. pan, 3. bin, 4. hand, 5. bear 6. face 7. think

Rather difficult words (delete the first sound):

1. bus, 2. seat, 3. chair, 4. fox, 5. sled. 6. toe

Difficult words (delete the last sound):

1. mane, 2. wise, 3. seal, 4. boat, 5. plane 6. ghost 7. laugh

Reading in English

1. *English Letter Identification*

For this task, you will be asked to read English letters, including 26 letters in the lower case and 26 letters in the upper case. When you are shown a letter, try to pronounce it as clearly as you can. You will not have trials for this task. This will be an easy task for you. Enjoy it!

2. *English Real Word Reading*

For this task, you will be asked to read some words with increasing difficulty chosen from your English curriculum. You will begin this task by doing five trials in order to make yourself acquainted with the task. When you read these words, try to pronounce them as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did trial words.

Trials: 1. arm 2. leg 3. father 4. fox 5. black.

Tests:

Easy words:

1.pig 2.ran 3.can 4.van 5.boy 6.girl 7.hand

Rather difficult words:

1.door 2.school 3.house 4.net 5.market 6.mother

Difficult words:

1. orange 2. fruit 3. tree 4. papaya 5. blue 6 green 7. yellow

3. *English Pseudoword Reading*

For this task, you will be asked to read some pseudowords modified from words chosen from your English curriculum. Pseudowords are words that do not exist in English but they follow the English spelling-sound rules, so it is not difficult to pronounce them. For example, "dat" is a pseudoword, but it is easy to pronounce because if you know how to pronounce the word "cat", you should not have any problems in pronouncing "dat" by simply replacing the "c" with a "d". You will begin this task by doing five trials in order to make yourself familiar with the task. When you read these pseudowords, try to pronounce them as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you do trial words.

Trials: 1. larm 2. teg 3. dather 4. dox. 5. glack.

Tests:

Easy words:

1.dat 2.gat 3.jat 4.kat 5.bap 6.zat 7.vap

Rather difficult words

1.tey 2.meck 3.vear 4.doot 5.vun 6.tus 7.sig

Difficult words:

1.sut 2.gug 3.kug 4.lear 5.vock 6.teep

APPENDIX C: MEASURES IN ENGLISH (Thai translation)

ภาคผนวก ข. แบบวัดภาคภาษาอังกฤษ

ความตระหนักในเสียงภาษาอังกฤษ

1. เสียงแรกของคำ

ในตอนที่ 1 นี้ นักเรียน จะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียนภาษาอังกฤษ ชั้นประถมปีที่ 3 รวม 20 คำ ให้นักเรียนบอกว่าคำที่ได้ยิน มี เสียงอะไรเป็นเสียงแรก เช่น เมื่อนักเรียนได้ยิน

"father" นักเรียนจะต้องตอบว่าเสียงแรกคือ / f /

นักเรียนต้องออกเสียงให้ถูกต้องชัดเจนขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกทำ 5 คำ จนเข้าใจก่อนลงมือทำ ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง:

Trials: 1. arm 2. leg 3. father 4. fox. 5. black

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ:

<u>คำง่าย</u>

1. bat, 2. rat, 3. cat, 4. mat, 5. map, 6. hat, 7. cap

<u>คำยากปานกลาง</u>

1. sing 2. neck 3. dear 4. foot 5. gun 6. bus 7. wig

คำยาก

1 hut 2. bug 3. jug. 4. bear 5. sock 6. sheep

2. เสียงท้ายของคำ

ในตอนที่ 2 นี้ นักเรียน จะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คำ ให้นักเรียนบอกว่าคำที่ได้ยิน มี เสียงอะไรเป็นเสียงท้ายของคำเช่น

"fox"มีเสียงท้ายของคำเป็น /s/ ดังนั้นนักเรียนจะต้องตอบครูว่าเสียง /s/ นักเรียนต้องออกเสียงให้ถูกต้องชัดเจนขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกทำ 5 คำ จนเข้าใจก่อนลงมือทำ ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง: 1. arm 2. leg 3. father 4. fox. 5. black

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ:

คำง่าย

1. pan, 2. pen, 3. bin, 4. pin, 5. pig, 6. cup, 7. can

คำยากปานกลาง

1. fish 2. dish 3. game 4. cake 5. ring 6. door 7. school

คำยาก

1. zebra 2. rabbit 3. apple 4. mango 5. coconut 6. banana

3. คำคล้องจอง

ในตอนที่ 3 นี้ นักเรียน จะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คู่ ให้นักเรียนบอกว่าคำคู่ที่ได้ยิน มี เสียงคล้องจองกันหรือไม่ ถ้าคล้องจองกันให้นักเรียนบอกว่า

"YES" แต่ถ้าไม่คล้องจองกันให้นักเรียนบอกว่า "NO" เช่น

"yell" and "cell" มีเสียง /ell/ เหมือนกัน นักเรียนต้องบอกว่า "YES"

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกทำ 5 คู่ จนเข้าใจก่อนลงมือทำ ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง :

1.yell-cell 2. green-grill 3. fox-box 4. man-mail 5.hack-kick

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ :

1.Bat-rod 2.cat-map 3.map-lad 4.hack-cat 5.cap-tap 6.pan-man

7. pen-den 8. bin-tin 9.pin-din 10. pig-wig 11.door-floor 12.boy-coy

13. girl-gird 14.hand-ham 15.leg-lack 16.fox-pox 17.green-gray 18.yell-yield

19.black-blade 20.blue-flew

4. การตัดเสียง

ในตอนที่ 4 นี้ นักเรียนจะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คำ ให้นักเรียนบอกว่าคำที่ได้ยินเมื่อตัดเสียงแรกออกหรือตัดเสียงท้ายออกแล้วส่วนที่เหลือจะออกเสียง ว่าอย่างไร เช่น

"cake" เมื่อเสียงแรก / c / ออก จะออกเสียงส่วนที่เหลือว่า /eik/.

นักเรียนต้องออกเสียงให้ชัดเจนถูกต้องขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกออกเสียง 5 คำ จนเข้าใจก่อนลงมือทำ ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง :

1.can (**ตัดเสียงแรก**) 2. hat (**ตัดเสียงแรก**) 3.cake (**ตัดเสียงแรก**)

4. game (**ตัดเสียงแรก**) 5. sheep (**ตัดเสียงท้าย**)

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ :

<u>คำง่าย</u> ตัดเสียงแรก

1. bat, 2. pan, 3. bin, 4. hand, 5. bear 6. face 7. think

<u>คำยากปานกลาง</u> ตัดเสียง**แรก**

1. bus, 2. seat, 3. chair, 4. fox, 5. sled. 6. toe 7. mane

<u>คำยาก</u> ตัดเสียงท้าย

1. wise, 2. seal, 3. boat, 4. plane 5. ghost 6. laugh

การอ่านภาษาอังกฤษ

1. **อ่านอักษรอังกฤษ**

ตอนที่ 5 นี้นักเรียนจะได้อ่านตัวอักษรภาษาอังกฤษ ทั้งตัวพิมพ์ (ใหญ่) 26 ตัว และตัวเขียน (เล็ก) 26 ตัว ซึ่งไม่ได้เรียงตามลำดับ ไม่มีอะไรยากขอให้สนุกกับการอ่าน

2. **อ่านคำ มีความหมาย**

ในตอนที่ 6 นี้ ให้นักเรียนอ่านคำที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 ทีละคำรวม 20 คำ นักเรียนต้องอ่านออกเสียงเองให้ชัดเจนถูกต้อง เช่น .

ขม อ่านว่า /ขม / เกย อ่านว่า /เกย/

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกอ่าน

5 คำ จนเข้าใจก่อนลงมือทำ

คำทดลอง :

1. arm 2. leg 3. father 4. fox 5. black.

คำทดสอบ:

<u>คำง่าย</u>

1. pig, 2. ran, 3. can, 4. van, 5. boy, 6. girl, 7. hand

<u>คำยากปานกลาง</u>

1. door 2. school 3. house 4. net 5. market 6. mother

<u>คำยาก</u>

1. orange 2. fruit 3. tree 4. papaya 5. blue 6 green 7. yellow

3. **อ่านคำไม่มีความหมาย**

ในตอนที่ 7 นี้ให้นักเรียนอ่านคำที่ไม่มีความหมายแต่มีหลักการอ่านเช่นเดียวกับคำที่นักเรียน เคยพบมา จากแบบเรียน ชั้นประถมปีที่ 3 นักเรียนต้องออกเสียงคำที่กำหนดให้ทีละคำ จนครบ 20 คำ เช่น “dat” เป็นคำสมมุติที่ไม่มีความหมาย แต่ก็อ่านไม่ยากถ้านักเรียนอ่าน “cat” ได้นักเรียนก็แทนตัว“c” ด้วย “d”. ก็จะอ่านว่า /dat/

นักเรียนพยายามออกเสียงให้ชัดเจนทุกคำ ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกอ่าน 5 คำ จนเข้าใจก่อนลงมือทำ

คำทดลอง:

1. larm 2. teg 3. dather 4. dox. 5. glack.

คำทดสอบ :

<u>คำง่าย</u>

1. dat, 2. gat, 3. jat, 4. kat, 5. bap, 6. zat, 7. vap

<u>คำยากปานกลาง</u>

1. tey 2. meck 3. vear 4. doot 5. vun 6. tus 7. sig

คำยาก

1. sut 2. gug 3. kug. 4. lear 5. vock 6. teep

APPENDIX D: MEASURES IN THAI

ภาคผนวก ค. แบบวัดความตระหนักในเสียงภาษาไทย

1. เสียงแรกของคำ

ในตอนที่ 1 นี้ นักเรียน จะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คำ

ให้นักเรียนบอกว่าคำที่ได้ยิน มี เสียงอะไรเป็นเสียงแรก เช่น

ขม มีเสียงแรกเป็น ข ดังนั้นนักเรียนจะต้องตอบครูว่าเสียง /ข/

เกย มีเสียงแรกเป็น ก ดังนั้นนักเรียนจะต้องตอบครูว่าเสียง /ก/

นักเรียนต้องออกเสียงให้ถูกต้องชัดเจนขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกทำ 5 คำ จนเข้าใจก่อนลงมือทำ ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง: 1. ขม 2. เกย 3. ทาก 4. เตียง 5. ช้อน

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ:

<u>คำง่าย</u>

1. นาง 2. พาน 3. แอบ 4. ปีก 5. ช้าง 6. นิด 7. ดอง

<u>คำยากปานกลาง</u>

1. ลม 2. เคย 3. ครบ 4. กวน 5. ปรุง 6. ยืม 7. เขียว

<u>คำยาก</u>

1. โทษ 2. ป่วย 3.หมาย 4. แหวน 5.เหลือง 6. กล้วย

2. เสียงท้ายของคำ

ในตอนที่ 2 นี้ นักเรียน จะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คำ ให้นักเรียนบอกว่าคำที่ได้ยิน มี เสียงอะไรเป็นเสียงท้ายของคำเช่น

ขม มีเสียงท้ายของคำเป็น ม ดังนั้นนักเรียนจะต้องตอบครูว่าเสียง /ม/

เกย มีเสียงท้ายของคำเป็น ย ดังนั้นนักเรียนจะต้องตอบครูว่าเสียง /ย/

นักเรียนต้องออกเสียงให้ถูกต้องชัดเจน

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที

นักเรียนจะได้ฝึกทำ 5 คำ จนเข้าใจก่อนลงมือทำ

ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง: 1. ขม 2. เกย 3. ทาก 4. เตียง 5. ช้อน

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ:

<u>คำง่าย</u>

1. นาง 2. พาน 3. แอบ 4. ปีก 5. ช้าง 6. นิด 7. ดอง

<u>คำยากปานกลาง</u>

1. ลม 2. เคย 3. ครบ 4. กวน 5. ปรุง 6. ยืม 7. เขียว

<u>คำยาก</u>

1. โทษ 2. ป่วย 3.หมาย 4. แหวน 5.เหลือง 6. กล้วย

3. คำคล้องจอง

ในตอนที่ 3 นี้ นักเรียน จะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คู่ ให้นักเรียนบอกว่าคำคู่ที่ได้ยิน มี เสียงคล้องจองกันหรือไม่ ถ้าคล้องจองกันให้นักเรียนบอกว่า

" คล้องจอง " แต่ถ้าไม่คล้องจองกันให้นักเรียนบอกว่า "ไม่ " เช่น

นิด - นก ไม่คล้องจองกันดังนั้นนักเรียนจะต้องตอบครูว่า "ไม่"

ปั้น–ลั้น คล้องจองกันดังนั้นนักเรียนจะต้องตอบครูว่า "คล้องจอง"

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที

นักเรียนจะได้ฝึกทำ 5 คู่ จนเข้าใจก่อนลงมือทำ

ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง :

1. นิด - นก 2. ปั้น - ลั้น 3. หมาย - เหมือน 4. ทวน - สวน 5. สรวม - ส้วม

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ :

<u>คำง่าย</u> 1. นาง - นอน 2. ท้อง - น้อง 3. ลาก - มาก 4. นัก - รัก

5. บัว - มัว 6. ขม - ขึ้น 7. กวน - จวน

<u>คำยากปานกลาง</u> 1. โบก - โยก 2. เค็ม - เต็ม 3. แกลง - กลอน 4. ค้าง - คาว

5. เทียม - เรียม 6. เพียร - เวียน 7. เปื่อย - เลื่อย

<u>คำยาก</u> 1. โปรด - โกรธ 2. กล้วย - ถ้วย 3. ร้าย - ร้าว 4. คลุ้ง - คุ้น

5. กล่อม – ก้อน 6. หยวก - หยาก

4. การตัดเสียง

ในตอนที่ 4 นี้ นักเรียนจะได้ยินคำศัพท์ที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คำ ให้นักเรียนบอกว่าคำที่ได้ยินเมื่อตัดเสียงแรกออกหรือตัดเสียงท้ายออกแล้วส่วนที่เหลือจะออกเสียง อย่างไร เช่น จาน เมื่อตัดเสียงแรก / จ / ออก จะออกเสียงส่วนที่เหลือว่า /อาน/

โครง เมื่อตัดเสียงท้าย / ง / ออก จะออกเสียงส่วนที่เหลือว่า /โคร/

นักเรียนต้องออกเสียงให้ชัดเจนถูกต้อง

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที นักเรียนจะได้ฝึกออกเสียง 5 คำ จนเข้าใจก่อนลงมือทำ

ถ้านักเรียนได้ยินครูไม่ชัด นักเรียนขอให้ครูออกเสียงให้ฟังใหม่ได้

คำทดลอง : 1. พาน 2. โรง 3. เกาะ 4. เปลว 5. น้ำ

เมื่อนักเรียนไม่มีอะไรสงสัยให้นักเรียนเริ่มทำเหมือนที่ได้ทดลอง

คำทดสอบ :

<u>คำง่าย</u> ตัดเสียง**แรก**

1. งาน 2. เรียง 3. แกง 4. พูน 5. ความ 6. ภาพ 7. ลึก

<u>คำยากปานกลาง</u> ตัดเสียง**แรก**

1. ท้อง 2. เทียม 3. เกวียน 4. กลืน 5. เตือน 6. เพียร 7. เปื่อย

<u>คำยาก</u> ตัดเสียงท้าย

1. หมอบ 2. คราง 3.เหลือง 4. เปลี่ยน 5. โกรก 6.ควาญ

การอ่านภาษาไทย

1. อ่านอักษรไทย

1) ฟ 2) พ 3) ร 4) ย 5) บ 6) ส 7) ผ 8) ฌ 9) ป 10) ฝ

11) ภ 12) ถ 13) ข 14) ช 15) ฏ 16) ฆ 17) ฎ 18) ซ 19) ฮ 20) ฒ

21) ฬ 22) ฑ 23) ศ 24) ฃ 25) ญ 26) ณ 27) ฐ 28) ธ

2. อ่านคำ มีความหมาย

ในตอนที่ 6 นี้ ให้นักเรียนอ่านคำที่เลือกมาจากแบบเรียน ชั้นประถมปีที่ 3 รวม 20 คำ นักเรียนต้องอ่านออกเสียงเองให้ชัดเจนถูกต้อง เช่น .

ขม อ่านว่า /ขม / และ เกย อ่านว่า /เกย/

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที

นักเรียนจะได้ฝึกอ่าน 5 คำ จนเข้าใจก่อนลงมือทำ

คำทดลอง : 1.ขม 2.เกย 3.ทาก 4.เตียง 5.ช้อน

คำทดสอบ:

<u>คำง่าย</u>

1. วาง 2. มาก 3. วาด 4. รัก 5. ตอบ 6. มิด 7. กวน

<u>คำยากปานกลาง</u>

1. ร้อง 2. แปลง 3. ย่อย 4. เด็ด 5. โกย 6. คลอน 7. เหนียว

<u>คำยาก</u>

1. โปรด 2. เถื่อน 3. กล้อง 4. หยวก 5.หมื่น 6. พลิ้ว

3. **อ่านคำไม่มีความหมาย**

ในตอนที่ 7 นี้ให้นักเรียนอ่านคำที่ไม่มีความหมายแต่มีหลักการอ่านเช่นเดียวกับคำที่นักเรียน เคยพบมา จากแบบเรียน ชั้นประถมปีที่ 3 นักเรียนต้องออกเสียงคำที่กำหนดให้ทีละคำ จนครบ 20 คำ เช่น ฉม อ่านว่า ฉม เพย อ่านว่า เพย

พยายามออกเสียงให้ชัดเจนทุกคำ

ขณะนี้นักเรียนสงสัยอะไรหรือไม่ ถ้านักเรียนมีอะไรสงสัย ให้ถามครูทันที

นักเรียนจะได้ฝึกอ่าน 5 คำ จนเข้าใจก่อนลงมือทำ

คำทดลอง: 1.ฉม 2.เพย 3. วาก 4.เดียน 5.ฆิด

คำทดสอบ :

<u>คำง่าย</u>

1.ชาง 2.ศาน 3.แชน 4.งีก 5.ธิด 6. ตวน 7.ษอบ

<u>คำยากปานกลาง</u>

1.แรบ 2.เว็ม 3.โนย 4.น่อย 5.แบลง 6.ตลอย 7.เวียด

<u>คำยาก</u>

1. ช้อง 2. พ่วย 3. หนาง 4. แหลด 5. เหนือม 6. ปล้วย

APPENDIX E: MEASURES IN THAI (English translation)

Phonological awareness in Thai

1. *Thai Initial Sound Detection*

For this task, you will hear some words you know from your Thai language studies. First, you will answer five questions in order to get familiar with the task. For example, when you hear the word "ขม " here the first sound is / ข /. When you say the initial sound, try to say it as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, we will start doing test words in the same way you did the trial words. Please note that if you don't hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1. ขม 2. เกย 3. ทาก 4. เตียง 5. ช้อน

Test:

Easy words: 1. นาง 2. พาน 3. แอบ 4. ปีก 5. ช้าง 6. นิด 7. ดอง

Rather difficult words: 1. ลม 2. เคย 3. ครบ 4. กวน 5. ปรุง 6. ยืม 7. เขียว

Difficult words: 1. โทษ 2. ป่วย 3.หมาย 4. แหวน 5.เหลือง 6. กล้วย

2. *Thai Final Sound Detection*

For this task, you will hear some words chosen from your Thai curriculum.

You will begin this task by doing five trials in order to make yourself acquainted with the task. For example, when you hear the word

“ขม” the final sound is / ม / then you must pronounce /ม/

“เกย” the final sound is / ย / then you must pronounce /ย/

When you say the final sound, try to pronounce it as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did the trial words. Please note if you don’t hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1. ขม 2. เกย 3. ทาก 4. เตียง 5. ช้อน

Tests:

Easy words: 1. นาง 2. พาน 3. แอบ 4. ปีก 5. ช้าง 6. นิด 7. ดอง

Rather difficult words: 1. ลม 2. เคย 3. ครบ 4. กวน 5. ปรุง 6. ยืม 7. เขียว

Difficult words: 1. โทษ 2. ป่วย 3.หมาย 4. แหวน 5.เหลือง 6. กล้วย

3. *Thai Rhyme Task*

For this task, you will hear two words in a pair’ at least one of the words will be chosen from your English curriculum. You will begin this task by doing five trials in order to make yourself familiar with the task. For example,

นิด - นก the last part of the two words has a different sound then tell me

"NO"

ปั้น–ลั้น the last part of the two words has the same sound then tell me "YES"

You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you do trial words. Please note if you don't hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1. นิด - นก 2. ปั้น - ลั้น 3. หมาย - เหมือน 4. ทวน - สวน 5. สรวม - ส้วม

Test:

Easy words:1. นาง – นอน 2. ท้อง - น้อง 3. ลาก - มาก 4. นัก – รัก

5. บัว - มัว 6. ขม - ขืน 7. กวน – จวน

Rather difficult words: 1. โบก - โยก 2. เค็ม - เต็ม3. แกลง - กลอน 4. ค้าง - คาว

5. เทียม - เรียม 6. เพียร - เวียน 7. เปื่อย – เลื่อย

Difficult words: 1. โปรด – โกรธ 2. กล้วย - ถ้วย 3. ร้าย - ร้าว 4. คลุ้ง - คุ้น

5. กล่อม – ก้อน 6. หยวก - หยาก

4. *English Phoneme Deletion*

For this task, you will hear a word chosen from your Thai curriculum and you will be told to delete a sound in the initial position or final position and give the rest of the pronunciation of this word. You will begin this task by doing five trials in order to make yourself familiar with the task. For example, when you hear

“ จาน” when you delete the first sound / จ / then for the remaining part, you’ll say /อาน/

“โครง” when you delete the final sound / ง / then for the remaining part, you’ll say /โคร/

When you say the rest of the pronunciation, try to make it as clear as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did trial words. Please note that if you don’t hear a word clearly, you can ask your examiner to repeat the word.

Trials: 1. พาน (delete the first sound) 2. โรง (delete the first sound) 3. เกาะ (delete the first sound) 4. เปลว (delete last sound) 5. น้ำ (delete the first sound)

Tests:

Easy words (delete the first sound):

1. งาน 2. เรียง 3. แกง 4. พูน 5. ความ 6. ภาพ 7. ลึก

Rather difficult words (delete the first sound):

1. ท้อง 2. เทียม 3. เกวียน 4. กลืน 5. เตือน 6. เพียร 7. เปื่อย

Difficult words (delete the last sound):

1. หมอบ 2. คราง 3.เหลือง 4. เปลี่ยน 5. โกรก 6.ควาญ

Reading in Thai

1. *Thai Letter Identification*

For this task, you will be asked to read Thai letters; only 28 letters were selected. When you are shown a letter, try to pronounce it as clearly as you can. You will not have trials for this task. This will be an easy task for you. Enjoy it!

1) ฟ 2) พ 3) ร 4) ย 5) บ 6) ส 7) ผ 8) ฌ 9) ป 10) ฝ

11) ภ 12) ถ 13) ข 14) ช 15) ฎ 16) ฆ 17) ฏ 18) ซ 19) ฮ 20) ฒ

21) ฬ 22) ฑ 23) ฅ 24) ฃ 25) ญ 26) ณ 27) ฐ 28) ธ

2. *Thai Real Word Reading*

For this task, you will be asked to read some words with increasing difficulty chosen from your Thai curriculum. For example, for the word “ขม”, you would say / ขม / and “เกย” you would say /เกย/. You will begin this task by doing five trials in order to make yourself acquainted with the task. When you read these words, try to pronounce them as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did trial words.

Trials: Tests: 1.ขม 2.เกย 3.ทาก 4.เตียง 5.ช้อน

Easy words: 1. วาง 2. มาก 3. วาด 4. รัก 5. ตอบ 6. มิด 7. กวน

Rather difficult words: 1. ร้อง 2. แปลง 3. ย่อย 4. เด็ด 5. โกย 6. คลอน 7. เหนียว

Difficult words: 1. โปรด 2. เถื่อน 3. กล้อง 4. หยวก 5.หมื่น 6. พลิ้ว

3. *Thai Pseudoword Reading*

For this task, you will be asked to read some pseudowords modified from words chosen from your Thai curriculum. Pseudowords are words that do not exist in Thai but they follow the Thai spelling-sound rules, so it is not difficult to pronounce them. For example, " ฉม " is a pseudoword, but it is easy to pronounce because if you know how to pronounce the word /ขม /, you should not have any problems pronouncing "ฉม" by simply replacing the "ฉ " with a "ข" and "เพย" you would read / เพย /.You will begin this task by doing five trials in order to make yourself familiar with the task. When you read these pseudowords, try to pronounce them as clearly as you can. You will have five trials before your real test begins. So, if you have any questions, please ask your examiner at this time. When you have no more questions, you will start doing test words in the same way you did trial words.

Trials: 1.ฉม 2.เพย 3. วาก 4.เดียน 5.ฆิด

Tests:

Easy words: 1.ชาง 2.ศาน 3.แชน 4.งึก 5.ธิด 6. ตวน 7.ษอบ

Rather difficult words : 1.แรบ 2.เว็ม 3.โนย 4.น่อย 5.แบลง 6.ตลอย 7.เวียด

Difficult words: 1. ช้อง 2. พ่วย 3. หนาง 4. แหลด 5. เหนือม 6. ปล้วย

APPENDIX F: BACKGROUND QUESTIONNAIRE

ภาคผนวก ง : ข้อมูลพื้นฐาน

1. วันที่....................

2. เพศ.....................

3. เริ่มเรียนภาษาอังกฤษชั้นใด ....อนุบาล .... ป1 .... ป2 ....ป 3

APPENDIX G: BACKGROUND QUESTIONNAIRE (English Translation)

1. Date.............................
2. Gender...........................
3. In what grade did you start learning English?

   Kindergarten ….. Grade One ……. Grade Two ……. Grade Three ……..

APPENDIX H: UNIVERSITY OF MARYLAND, COLLEGE PARK INSTITUTIONAL REVIEW BOARD APPLICATION FOR INITIAL REVIEW OF RESEARCH USING HUMAN SUBJECTS

Application to Human Subjects Review Committee

Project Title: The Relationship between Phonological Awareness and Reading Ability of Thai Students in English and Thai in Primary Schools of Thailand

1. **Abstract**: The purpose of the study is to investigate the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students in their native country. Participants are about 400 Thai primary school students in the Lower Northern part of Thailand. One background questionnaire and some measures will be administered to all students one by one. The measures are separated into (a) Phonological awareness in English and in Thai and (b) Reading in English and in Thai. Phonological awareness measures include Initial sound detection, Final sound detection, Rhyme task and Phoneme deletion. Reading measures include Letter Identification, Real Word Reading and Pseudoword Reading. After data collection, I will first determine whether the relationship between phonological awareness and reading ability holds in the

English as a Foreign Language (EFL) classroom context in Thailand. I will investigate the relationship between phonological awareness and reading ability in the Thai language. In addition, I will investigate whether there is any transfer of phonological awareness from Thai to English at the young age of these Thai students.

The selected students can choose to participate or not to participate. All the data gathered will be kept strictly confidential. Moreover, the students are free to withdraw at any time without punishment.

2. **Subject selection**:

a. The participants will be about 400 third grade primary school students from the Lower Northern part of Thailand. Each student's parents will be sent a letter requesting their permission for their child to participate in the study.
b. Subjects will not be selected based on age, sex, race, religion or any social or economic qualifications.
c. Students will be selected randomly from name lists provided by Education commissions in each province in the Lower Northern Part of Thailand. Number of students in each province selected into sample depends on the proportion of students of that province in total number of students in the

Lower Northern Part of Thailand.

3. **Procedures:** Students who have been granted parental permission to participate will be given some tests of phonological awareness and reading in both English and Thai (see attachment measures in English and measures in Thai). They will also be given a background questionnaire (see APPENDIX G) to fill out. All assessment measures and the questionnaire are attached.
4. **Risks and Benefits**: It takes about 1 hour for each student to do all tests and one questionnaire. The benefits are that students may become more aware of the process of combining sounds (phonemes) to create words and that their ability to read vocabulary in their curriculum may be developed. The risk is that students may feel fatigue or stress and they can use this period of time to do something else.
5. **Confidentiality**: Students' names will not appear anywhere in the study. Students will be identified by number only, for instance as "student No. 1-400". Data collected will be kept confidentially in the student investigator's private computer located at his home. The home address is 3366 Toledo Terrace Apt#G5, Hyattsville, MD 20782. The computer is secured with a password. The principal investigator and student investigator are the only two persons who have the access to the data. The data will be kept for two years (Jan. 2005 – Jan. 2007). After Jan.

2007, the data will be deleted completely from the computer.

6. **Information and consent forms**: The subjects and their parents/guardians of the study will be told that the purpose of the study is to investigate the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students in their native country. After subjects and their parents/guardians decide to participate, the parents/guardians are asked to sign at the bottom of Parental Permission Form.

7. **Conflict of interes**t: Investigators do not have a real or potential conflict of interest.

8. **HIPAA Compliance**: Investigators will not use protected health information.

APPENDIX I: UMCP IRB PARENTAL PERMISSION FORM

Parental Permission Form

Project title:

The Relationship between Phonological Awareness and Reading Ability of Thai Students in English and Thai in Primary Schools of Thailand

Statement of Subject's parents/guardian:

I state that I am over 18 years of age, in good physical health, and the parent/guardian of the student, and I grant my permission for my child to participate in the program of research being conducted by Dr. Rebecca L. Oxford in the Department of Curriculum and Instruction at the University of Maryland, College Park, Maryland 20742.

Purpose:

The purpose of the study is to investigate the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students in their native country.

Procedures:

The students will be given a background questionnaire in Thai to fill out (Questions are: Student number, Testing date, Gender, Age (in months), In what grade did you start learning English?). Time needed for this activity is about 2-5 minutes.

Then students will be given some tests of phonological awareness and reading in both English and Thai. Example questions are as follows:

Initial Sound Detection (about 5 minutes): What is the first sound for the following words? 1. arm 2.leg 3. father 4. fox. 5. black

Final Sound Detection (about 5 minutes): What is the last sound for the following words? 1. arm 2. leg 3. father 4. fox. 5. black

Rhyme Task (about 5 minutes): Do the following pairs of words rhyme? 1.yell-cell 2. green-grill 3. fox-box 4. man-mail 5.hack-kick

Phoneme Deletion (about 5 minutes): 1.can (delete the first sound) 2. hat (delete the first sound) 3.cake (delete the first sound) 4. game (delete the first sound) 5. sheep (delete last sound)

Letter Identification (about 5 minutes): read English letters

Real Word Reading (about 5 minutes): 1. arm 2. leg 3. father 4. fox 5. black.

Pseudoword Reading (about 5 minutes): 1. larm 2. teg 3. dather 4. dox. 5. glack.

Students will also be given all these activities in Thai language with different words from their textbooks. Each activity will need about the same length of time.

Confidentiality:

Students' names will not appear anywhere in the study. Students will only be identified by number, for instance as "student No. 1- 400". Data collected will be kept confidentially in the student investigator's private computer located at home. The home address is 3366 Toledo Terrace Apt#G5, Hyattsville, MD 20782. The computer is secured with a password. The principal investigator and student investigator are the only two persons who have the access to the data. The data will be kept for two years (Jan. 2005 – Jan. 2007). After Jan. 2007, the data will be deleted completely from the computer.

Risks:

Risks are minimal. The foreseen risk of answering questions in the interview may be fatigue or stress. In addition, students may use this time to do something else if they are not answering these questions.

Benefits, Freedom to Withdraw, & Ability to Ask Questions:

The study will help to develop my child's awareness that words are created by combining sounds and that they can read vocabulary in their curriculum. Furthermore, the most important thing is to help the researchers learn more about the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students. My child and I are free to ask questions or to withdraw from participation at any time and without penalty.

Contact Information of Principal Investigator:

Dr. Rebecca L. Oxford, 2227 Benjamin Building, College of Education, University of Maryland, College Park, MD 20742. Tel: 301-405-8157. Email: ro38@umail.umd.edu.

Contact Information of Institutional Review Board:

If my child and I have questions about my child's rights as a research subject or wish to report a research-related injury, I understand that I should contact: Institutional Review Board Office, University of Maryland, College Park, Maryland 20742; Email: Irb@deans.umd.edu; Tel: 301-405-4212

Print name of parent/guardian: ________________________________

Signature of parent/guardian__________________________________

Date:______________________

APPENDIX J: UMCP IRB PARENTAL PERMISSION FORM (Thai Translation)

ใบอนุญาตของผู้ปกครอง

ชื่อโครงการ ความสัมพันธ์ระหว่างความตระหนักในเสียง และ ความสามารถในการอ่านภาษาไทยและภาษาอังกฤษของนักเรียนชั้นประถมศึกษาในประเทศไทย

คำยืนยันของผู้ปกครอง ข้าพเจ้าขอยืนยันว่า ข้าพเจ้ามีอายุเกิน 18 ปี มีสุขภาพแข็งแรง และสติสัมปชัญญะสมบูรณ์ดี ในฐานะผู้ปกครองของนักเรียน ข้าพเจ้ายินยอมให้...................................เข้าร่วมโครงการวิจัยของ ดร.รีเบคคา แอล. ออกซ์ฟอร์ด จากภาควิชาหลักสูตรและการสอนมหาวิทยาลัยแมรี่แลนด์ คอลเลจ พาร์ค รัฐแมรี่แลนด์ 20742

จุดมุ่งหมายของการวิจัย การวิจัยนี้มีจุดมุ่งหมายเพื่อหาความสัมพันธ์ระหว่างความตระหนักในเสียง และ ความสามารถในการอ่านภาษาไทยและภาษาอังกฤษของนักเรียนชั้นประถมศึกษาที่เรียนในประเทศไทย

กระบวนการ กระบวนการเริ่มด้วยนักเรียนจะให้ข้อมูลส่วนตัว (เลขที่ เพศ ชั้นที่เริ่มเรียนภาษาอังกฤษ) โดยใช้เวลาประมาณ 1- 2 นาที ขั้นต่อไปนักเรียนจะได้รับการทดสอบความตระหนักในเสียง และ ความสามารถในการอ่านภาษาไทยและภาษาอังกฤษ ดังตัวอย่างคำถามต่อไปนี้

<u>1. เสียงแรกของคำ (ประมาณ 5 นาที)</u> :เสียงแรกของคำต่อไปนี้คือเสียงอะไร

1. arm 2. leg 3. father 4. fox 5. black

<u>2.เสียงท้ายของคำ (ประมาณ 5 นาที)</u> : เสียงท้ายของคำต่อไปนี้คือเสียงอะไร

1. arm 2 leg 3. father 4. fox 5. black

3.คำคล้องจอง (ประมาณ 5 นาที) : คำแต่ละคู่ต่อไปนี้ คู่ใดมีเสียงคล้องจองกัน

1. yell – cell 2. green – grill 3. fox – box 4. man – mail

5. hack - kick

4.การตัดเสียง (ประมาณ 5 นาที) : 1. can (ตัดเสียงแรก) 2. hat (ตัดเสียงแรก)

3. cake (ตัดเสียงแรก) 4. game (ตัดเสียงแรก) 5. sheep (ตัดเสียงท้าย)

5.การอ่านอักษรภาษาอังกฤษ (ประมาณ 5 นาที) : 1. b 2. k …

6.การอ่านคำที่มีความหมาย (ประมาณ 5 นาที) :

1. arm 2. leg 3. father 4. fox 5. black

7.อ่านคำไม่มีความหมาย (ประมาณ 5 นาที) :

1. larm 2 teg 3. dather 4. dox 5. glack

ต่อไป นักเรียนจะได้รับการทดสอบในกิจกรรมเหล่านี้ในภาคภาษาไทย โดยใช้คำจากแบบเรียนภาษาไทย ซึ่งแต่ละกิจกรรมจะใช้เวลาพอๆ กับภาคภาษาอังกฤษ

การรักษาความลับ ชื่อของนักเรียนจะไม่ปรากฏในส่วนใดๆของรายงานวิจัย ทั้งนี้นักเรียนจะได้รับการบันทึกรหัสตัวเลขแทนชื่อ เช่น นักเรียนคนที่ 1 จนถึงคนที่ 400 ข้อมูลที่บันทึกจะถูกรักษาเป็นความลับในคอมพิวเตอร์ส่วนตัวของนักวิจัย ที่บ้านเลขที่ 3366 Toledo Terrace Apt # G5, Hyattsville, MD 20782 คอมพิวเตอร์มีระบบรักษาความปลอดภัยโดยใช้รหัสผ่าน มีเพียงนักวิจัยหลักและนักวิจัยที่เป็นนักศึกษาเท่านั้นที่จะใช้ข้อมูลชุดนี้ได้ ซึ่งข้อมูลชุดนี้จะถูกเก็บไว้ใช้เป็นเวลา 2 ปี (มกราคม 2548 - 2550) หลังจาก

เดือน มกราคม 2550 ข้อมูลชุดนี้จะถูกลบออกจากคอมพิวเตอร์

ความเสี่ยง คือ นักเรียนมีความเสี่ยงน้อยมาก เช่น อาจจะเหนื่อยล้าหรือเครียดและนักเรียนอาจเสียเวลาที่ควรจะทำกิจกรรมอย่างอื่นในช่วงที่รับการทดสอบ

ประโยชน์ เสรีภาพในการถอนตัว และความสามารถในการถามข้อสงสัย การศึกษาครั้งนี้จะช่วยให้นักเรียนสามารถพัฒนาความตระหนักว่า คำ เกิดจากการประสมเสียง และนักเรียนจะอ่านคำศัพท์ต่างๆ ในหนังสือได้ดีขึ้น และที่สำคัญที่สุดคือ ทำให้ผู้วิจัยเรียนรู้ว่าความสัมพันธ์ระหว่างความตระหนักในเสียง และความสามารถในการอ่านภาษาไทยและภาษาอังกฤษของนักเรียนชั้นประถมศึกษาในประเทศไทยเป็นเช่นไร ลูกและข้าพเจ้ามีเสรีภาพในการถามข้อสงสัย หรือถอนตัวจากการเข้าร่วมทดสอบเวลาใดก็ได้โดยไม่ถูกลงโทษ

การติดต่อกับผู้วิจัยหลัก ข้าพเจ้าสามารถติดต่อผู้วิจัยหลักได้ที่ ดร.รีเบคคา แอล. ออกซ์ฟอร์ด ภาควิชาหลักสูตรและการสอน มหาวิทยาลัยแมรี่แลนด์ คอลเลจ พาร์ค รัฐแมรี่แลนด์ 20742

รายละเอียดในการติดต่อคณะกรรมการของสถาบัน ถ้าลูกหรือนักเรียนในความดูแลของข้าพเจ้าและข้าพเจ้ามีข้อสงสัยเกี่ยวกับสิทธิเด็กในฐานะเป็นตัวอย่างในการวิจัย หรือต้องการจะรายงานความเสียหายอันเนื่องจากการวิจัย ข้าพเจ้าทราบดีว่าจะร้องเรียนได้ที่สำนักงานคณะกรรมการรับเรื่องร้องเรียนของสถาบัน โทรศัพท์:301-405-4212

ชื่อผู้ปกครอง..

ลายเซ็นผู้ปกครอง..

วันที่..

APPENDIX K: UMCP IRB ASSENT FORM

Assent Form

Project title:

The Relationship between Phonological Awareness and Reading Ability of Thai Students in English and Thai in Primary Schools of Thailand

Statement of Subject's parents/guardian:

I state that I am under 18 years of age, in good physical health, and wish to participate in the program of research being conducted by Dr. Rebecca L. Oxford in the Department of Curriculum and Instruction at the University of Maryland, College Park, Maryland 20742.

Purpose:

The purpose of the study is to investigate the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students in their native country.

Procedures:

I will be asked to fill out a background questionnaire in Thai (Questions are: Student number, Testing date, Gender, Age (in months), In what grade did you start learning English?). Time needed for this activity is about 2-5 minutes.

Then I will be asked to do some tests of phonological awareness and reading in both English and Thai. Example questions are as follows:

Initial Sound Detection (about 5 minutes): What is the first sound for the following words? 1. arm 2.leg 3. father 4. fox. 5. black

Final Sound Detection (about 5 minutes): What is the last sound for the following words? 1. arm 2. leg 3. father 4. fox. 5. black

Rhyme Task (about 5 minutes): please tell if the following pair of words rhyme. 1.yell-cell 2. green-grill 3. fox-box 4. man-mail 5.hack-kick

Phoneme Deletion (about 5 minutes): 1.can (delete the first sound) 2. hat (delete the first sound) 3.cake (delete the first sound) 4. game (delete the first sound) 5. sheep (delete last sound)

Letter Identification (about 5 minutes): read English letters

Real Word Reading (about 5 minutes): 1. arm 2. leg 3. father 4. fox 5. black.

Pseudoword Reading (about 5 minutes): 1. larm 2. teg 3. dather 4. dox. 5. glack.

I will also be given all these activities in Thai language with different words from my textbooks. Each activity will need about the same length of time.

Confidentiality:

My name will not appear anywhere in the study. My name will only be identified by number, for instance as “student No.1- 400. Data collected will be kept confidentially in the student investigator’s private computer located at home. The home address is 3366 Toledo Terrace Apt#G5, Hyattsville, MD 20782. The computer is secured with password. The principal investigator and student investigator are the only two persons who have the access to the data. The data will be kept for two years (Jan. 2005 – Jan. 2007). After Jan. 2007, the data will be deleted completely from the computer.

Risks:

Risks are minimal. The foreseen risk of answering questions in the interview may be fatigue or stress. In addition, I may use this time to do something else if I do not answer these questions.

Benefits, Freedom to Withdraw, & Ability to Ask Questions:

The study will help me to develop awareness that words are created by combining sounds and I can read words in my textbook. Furthermore, the most important thing is to help the researchers learn more about what are the relationship between phonological awareness and reading ability in English and Thai of primary school Thai students. I am free to ask questions or to withdraw from participation at any time and without penalty.

Contact Information of Principal Investigator:

Dr. Rebecca L. Oxford, 2227 Benjamin Building, College of Education, University of Maryland, College Park, MD 20742. Tel: 301-405-8157. Email: ro38@umail.umd.edu.

Contact Information of Institutional Review Board:

If I have questions about my rights as a research subject or wish to report a research-related injury, I understand that I should contact: Institutional Review Board Office, University of Maryland, College Park, Maryland 20742; Email: Irb@deans.umd.edu; Tel:301-405-4212

[ ] Check if I agree to participate

Name of Subject:_________________________________

Date:____

APPENDIX L: UMCP IRB ASSENT FORM (Thai translation)

ใบแสดงคำยินยอมของนักเรียน

ชื่อโครงการ ความสัมพันธ์ระหว่างความตระหนักในเสียง และ ความสามารถในการอ่านภาษาไทยและภาษาอังกฤษของนักเรียนชั้นประถมศึกษาในประเทศไทย

คำยืนยันของนักเรียนที่เข้าร่วมโครงการ ข้าพเจ้าขอยืนยันว่า ข้าพเจ้ามีอายุต่ำกว่า 18 ปี มีสุขภาพแข็งแรง สมบูรณ์ดี ยินดีเข้าร่วมโครงการวิจัยของ ดร.รีเบคคา แอล .ออกซ์ฟอร์ด จากภาควิชาหลักสูตรและการสอนมหาวิทยาลัยแมรี่แลนด์ คอลเลจ พาร์ค รัฐแมรี่แลนด์20742

จุดมุ่งหมายของการวิจัย การวิจัยนี้มีจุดมุ่งหมายเพื่อหาความสัมพันธ์ระหว่างความตระหนักในเสียง และ ความสามารถในการอ่านภาษาไทยและภาษาอังกฤษของนักเรียนชั้นประถมศึกษาที่เรียนในประเทศไทย

กระบวนการ กระบวนการเริ่มด้วยข้าพเจ้าจะให้ข้อมูลส่วนตัว) วันที่ เพศ ชั้นที่เริ่มเรียนภาษาอังกฤษ (โดยใช้เวลาประมาณ 2 -1 นาที ขั้นต่อไปข้าพเจ้าจะได้รับการทดสอบความตระหนักในเสียง และ ความสามารถในการอ่านภาษาไทยและภาษาอังกฤษ ดังตัวอย่างคำถามต่อไปนี้

<u>1. เสียงแรกของคำ (ประมาณ 5 นาที)</u> :เสียงแรกของคำต่อไปนี้คือเสียงอะไร

1. arm 2. leg 3. father 4. fox 5. black

<u>2.เสียงท้ายของคำ (ประมาณ 5 นาที)</u> : เสียงท้ายของคำต่อไปนี้คือเสียงอะไร

1. arm 2 leg 3. father 4. fox 5. black

<u>3.คำคล้องจอง (ประมาณ 5 นาที)</u> : คำแต่ละคู่ต่อไปนี้ คู่ใดมีเสียงคล้องจองกัน

1. yell – cell 2. green – grill 3. fox – box 4. man – mail

5. hack - kick

4.การตัดเสียง (ประมาณ 5 นาที) : 1. can (ตัดเสียงแรก) 2. hat (ตัดเสียงแรก)

3. cake (ตัดเสียงแรก) 4. game (ตัดเสียงแรก) 5. sheep (ตัดเสียงท้าย)

5.การอ่านอักษรภาษาอังกฤษ (ประมาณ 5 นาที) : 1. b 2. k …

6.การอ่านคำที่มีความหมาย (ประมาณ 5 นาที) :

1. arm 2. leg 3. father 4. fox 5. black

7.อ่านคำไม่มีความหมาย (ประมาณ 5 นาที) :

1. larm 2 teg 3. dather 4. dox 5. glack

ต่อไป ข้าพเจ้าจะได้รับการทดสอบในกิจกรรมเหล่านี้ในภาคภาษาไทย โดยมีคำจากแบบเรียนภาษาไทย ซึ่งแต่ละกิจกรรมจะใช้เวลาพอๆ กับภาคภาษาอังกฤษ

การรักษาความลับ ชื่อของข้าพเจ้าจะไม่ปรากฏในส่วนใดๆของรายงานวิจัย ทั้งนี้ชื่อนักเรียนจะได้รับการบันทึกด้วยรหัสตัวเลข เช่น นักเรียนคนที่ 1 จนถึงคนที่ 400 คะแนนที่บันทึกจะถูกรักษาเป็นความลับในคอมพิวเตอร์ส่วนตัวของนักวิจัย ที่บ้านเลขที่ 3366 Toledo Terrace Apt # G5, Hyattsville, MD 20782 คอมพิวเตอร์มีระบบรักษาความปลอดภัยโดยใช้รหัสผ่าน มีเพียงนักวิจัยหลักและนักวิจัยที่เป็นนักศึกษาเท่านั้นที่จะใช้ข้อมูลชุดนี้ได้ ซึ่งข้อมูลชุดนี้จะถูกเก็บไว้ใช้เป็นเวลา 2 ปี) มกราคม25 - 2548 50 (หลังจากเดือน มกราคม25 50 ข้อมูลชุดนี้จะถูกลบออกจากคอมพิวเตอร์

ความเสี่ยง ข้าพเจ้าทราบว่าจะมีความเสี่ยงน้อยมาก เช่น อาจจะเหนื่อยล้าหรือเครียดและอาจ

เสียเวลาที่ควรจะทำกิจกรรมอย่างอื่นในช่วงที่รับการทดสอบ

ประโยชน์ เสรีภาพในการถอนตัว และความสามารถในการถามข้อสงสัย การศึกษาครั้งนี้จะช่วยให้ข้าพเจ้าสามารถพัฒนาความตระหนักว่า คำ เกิดจากการประสมเสียง และข้าพเจ้าจะอ่านคำศัพท์ต่างๆ ในหนังสือได้ดีขึ้น และที่สำคัญที่สุดคือ ทำให้ผู้วิจัยเรียนรู้ว่าความสัมพันธ์ระหว่างความตระหนักในเสียง และความสามารถในการอ่านภาษาไทยและภาษาอังกฤษของนักเรียนชั้นประถมศึกษาในประเทศไทยเป็นเช่นไร อย่างไรก็ตาม ข้าพเจ้ามีเสรีภาพในการถามข้อสงสัยหรือถอนตัวจากการเข้าร่วมทดสอบเวลาใดก็ได้โดยไม่มีการลงโทษ

การติดต่อกับผู้วิจัย ข้าพเจ้าสามารถติดต่อผู้วิจัยหลักได้ที่ ดร.รีเบคคา แอล .ออกซ์ฟอร์ด 2227อาคารเบนจามิน วิทยาลัยการศึกษา มหาวิทยาลัยแมรี่แลนด์ คอลเลจ พาร์ค รัฐแมรี่แลนด์20742

โทรศัพท์ 301-405-8157 อีเมล์ ro38@umail.umd.edu

การติดต่อคณะกรรมการรับข้อร้องเรียนของสถาบัน ถ้าข้าพเจ้ามีข้อสงสัยเกี่ยวกับสิทธิในฐานะเป็นตัวอย่างในการวิจัย หรือต้องการจะร้องเรียนความเสียหายอันเนื่องจากการวิจัย ข้าพเจ้าทราบดีว่าจะร้องเรียนได้ที่สำนักงานคณะกรรมการรับเรื่องร้องเรียนของสถาบัน มหาวิทยาลัยแมรี่แลนด์ คอลเลจ พาร์ค รัฐแมรี่แลนด์20742 อีเมล์ Irb@deans.umd.edu

โทรศัพท์: 4212-405-301

[ ] ยินดีเข้าร่วมรับการทดสอบ ขีด/

ลงชื่อนักเรียน ....

วันที่...

APPENDIX M: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH ENGLISH REAL WORD READING AS THE CRITERION

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
4	(Constant)					
	efinsd	.382	.280	.262	.503	1.988
	erhyt	.295	.151	.137	.787	1.270
	ephod	.256	.121	.110	.824	1.214
	einisd	.211	-.107	-.097	.524	1.910

Note:

einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion.

APPENDIX N: COLLINEARITY DIAGNOSTICS WITH ENGLISH REAL WORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
4	1	4.519	1.000
	2	.210	4.640
	3	.155	5.393
	4	.068	8.180
	5	.049	9.630

APPENDIX O: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH ENGLISH PSEUDOWORD READING AS THE CRITERION

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
3	(Constant)					
	ephod	.317	.200	.187	.834	1.199
	erhyt	.300	.159	.147	.795	1.258
	efinsd	.300	.159	.147	.793	1.261

Note:

efinsd = English Final Sound Detection; erhyt = English Rhyme Task; ephod = English Phoneme Deletion.

APPENDIX P: COLLINEARITY DIAGNOSTICS WITH ENGLISH PSEUDOWORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	3.607	1.000
	2	.197	4.279
	3	.144	4.997
	4	.051	8.390

APPENDIX Q: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH ENGLISH REAL WORD READING AS THE CRITERION AND SIX SUBTESTS AS PREDICTORS

Coefficients

Model		*Correlations*			*Collinearity Statistics*	
		Zero-order	Partial	Part	Tolerance	VIF
4	(Constant)					
	eletil	.598	.544	.495	.865	1.156
	efinsd	.382	.214	.167	.492	2.031
	ephod	.256	.176	.137	.866	1.154
	einisd	.211	-.139	-.107	.528	1.896

Note:

einisd = English Initial Sound Detection; efinsd = English Final Sound Detection; ephod = English Phoneme Deletion; eletil = English Letter Identification Lower Case

APPENDIX R: COLLINEARITY DIAGNOSTICS WITH ENGLISH REAL WORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
4	1	4.414	1.000
	2	.238	4.304
	3	.171	5.079
	4	.116	6.158
	5	.060	8.584

APPENDIX S: COLLINEARITY DIAGNOSTICS WITH LOG-TRANSFORMED ENGLISH REAL WORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
2	1	1.620	1.000
	2	.884	1.354
	3	.497	1.806

APPENDIX T: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH ENGLISH PSEUDOWORD READING AS THE CRITERION

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
3	(Constant)					
	eletil	.471	.418	.387	.894	1.119
	ephod	.317	..246	.214	.884	1.132
	erhyt	.300	.096	.081	.808	1.238

Note:

erhyt = English Rhyme Task; ephod = English Phoneme Deletion; eletil = English Letter Identification Lower Case

APPENDIX U: COLLINEARITY DIAGNOSTICS WITH ENGLISH PSEUDOWORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	3.576	1.000
	2	.238	3.876
	3	.134	5.168
	4	.052	8.303

APPENDIX V: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH THAI REAL WORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
4	(Constant)					
	tfinsd	.537	.210	.170	.469	2.133
	tphod	.532	.252	.206	.564	1.774
	tinisd	.445	.114	.091	.594	1.683
	trhyt	.410	.097	.077	.670	1.492

Note:

tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion

APPENDIX W: COLLINEARITY DIAGNOSTICS WITH THAI REAL WORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
4	1	4.868	1.000
	2	.069	8.413
	3	.029	12.892
	4	.021	15.299
	5	.013	19.629

APPENDIX X: COLLINEARITY DIAGNOSTICS WITH LOG-TRANSFORMED THAI REAL WORD READING AS THE CRITERION AND Z SCORES FOR ALL FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	2.146	1.000
	2	1.000	1.465
	3	.509	2.053
	4	.345	2.495

APPENDIX Y: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH THAI PSEUDOWORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
3	(Constant)					
	tphod	.554	.340	.289	.608	1.644
	tinisd	.451	.158	.128	.598	1.672
	tfinsd	.495	.147	.118	.496	2.015

Note:

tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; tphod = Thai Phoneme Deletion

APPENDIX Z: COLLINEARITY DIAGNOSTICS WITH THAI PSEUDOWORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	3.898	1.000
	2	.068	7.559
	3	.021	13.667
	4	.013	17.364

APPENDIX AA: COLLINEARITY DIAGNOSTICS WITH LOG-TRANSFORMED THAI PSEUDOWORD READING AS THE CRITERION AND Z SCORES FOR FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	2.114	1.000
	2	.998	1.455
	3	.529	2.000
	4	.359	2.427

APPENDIX BB: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH THAI REAL WORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AND THAI LETTER IDENTIFICATION AS PREDICTORS

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
4	(Constant)					
	tfinsd	.537	.242	.191	.496	2.015
	tleti	.380	.272	.217	.905	1.105
	tphod	.532	.232	.183	.579	1.726
	tinisd	.445	.116	.090	..597	1.674

Note:

tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification

APPENDIX CC: COLLINEARITY DIAGNOSTICS WITH THAI REAL WORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AND THAI LETTER IDENTIFICATION AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
4	1	4.864	1.000
	2	.076	8.012
	3	.032	12.280
	4	.016	17.373
	5	.011	20.672

APPENDIX DD: COLLINEARITY DIAGNOSTICS WITH LOG-TRANSFORMED THAI REAL WORD READING AS THE CRITERION AND Z SCORES FOR FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	1.779	1.000
	2	1.000	1.334
	3	.838	1.457
	4	.383	2.156

APPENDIX EE: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH THAI PSEUDOWORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AND THAI LETTER IDENTIFICATION AS PREDICTORS

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
4	(Constant)					
	tphod	.554	.297	.242	.579	1.726
	tinisd	.451	.154	.121	.597	1.674
	tleti	.354	.230	.184	.905	1.105
	tfinsd	.495	.148	.116	.496	2.015

Note:

tinisd = Thai Initial Sound Detection; tfinsd = Thai Final Sound Detection; tphod = Thai Phoneme Deletion; tleti = Thai Letter Identification

APPENDIX FF: COLLINEARITY DIAGNOSTICS WITH THAI PSEUDOWORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AND THAI LETTER IDENTIFICATION AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
4	1	4.864	1.000
	2	.076	6.012
	3	.032	12.280
	4	.016	17.373
	5	.011	20.672

APPENDIX GG: COLLINEARITY DIAGNOSTICS WITH LOG-TRANSFORMED THAI PSEUDOWORD READING AS THE CRITERION AND Z SCORES FOR FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AND THAI LETTER IDENTIFICATION AS PREDICTORS

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	1.743	1.000
	2	.999	1.321
	3	.845	1.436
	4	.413	2.055

APPENDIX HH: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH ENGLISH REAL WORD READING AS THE CRITERION AND FOUR SUBTESTS OF THAI PHONOLOGICAL AWARENESS AS PREDICTORS

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
3	(Constant)					
	tphod	.382	.272	.256	.793	1.261
	trhyt	.295	.140	.128	.795	1.258
	tinisd	.256	.110	.100	.834	1.199

Note:

tinisd = Thai Initial Sound Detection; trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion

APPENDIX II: COLLINEARITY DIAGNOSTICS WITH ENGLISH REAL WORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	3.889	1.000
	2	.069	7.520
	3	.029	11.669
	4	.014	16.571

APPENDIX JJ: COLLINEARITY DIAGNOSTICS WITH LOG-TRANSFORMED ENGLISH REAL WORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
3	1	1.937	1.000
	2	.976	1.408
	3	.597	1.802
	4	.490	1.988

APPENDIX KK: PARTIAL CORRELATIONS, PART CORRELATIONS, TOLERANCE AND VIF WITH ENGLISH PSEUDOWORD READING AS THE CRITERION

Coefficients

		Correlations			*Collinearity Statistics*	
Model		Zero-order	Partial	Part	Tolerance	VIF
2	(Constant)					
	tphod	.266	.180	.176	.741	1.349
	trhyt	.227	.110	.106	.741	1.349

Note:

trhyt = Thai Rhyme Task; tphod = Thai Phoneme Deletion

APPENDIX LL: COLLINEARITY DIAGNOSTICS WITH ENGLISH PSEUDOWORD READING AS THE CRITERION

Collinearity Diagnostics

Model	*Dimension*	*Eigenvalue*	*Condition Index*
2	1	2.910	1.000
	2	.065	6.695
	3	.025	10.764

REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT press.

Alderson, J. C. (1984). Reading in a foreign language: A reading problem or a language problem? In J. C. Alderson & A. H. Urquhart (Eds.), *Reading in a Foreign Language* (pp.1-24). London: Longman.

Alegria, J., Pignot, E., & Morais, J. (1982). Phonemic analysis of speech and memory codes in beginning readers. *Memory & Cognition*, *10*, 451-456.

Allen-Tamai, M. (2000). *Phonological awareness and reading development of young Japanese learners of English*. Unpublished doctoral dissertation: Temple University.

Allor, J. H. (2002). The relationships of phonemic awareness and rapid naming to reading development. *Learning Disability Quarterly*, *25*, 47-57.

Ball, E. W., & Blachman, B. A. (1991). Does phoneme segmentation training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly*, *26*, 49-66.

Baum Bursztyn, S. E. (1998). *Phonological awareness and reading ability in bilingual native Spanish and monolingual English-speaking children*. Unpublished doctoral dissertation, Hofstra University, Hempstead.

Beck, I., & Mitroff, D. (1972). *The rationale and danger of a primary grades* *reading system for an individualized classroom*. University of Pittsburgh: Learning Research and Development Center.

Benton, A. L., Hamsher, K., Varney, N. R., & Spreen, O. (1983). *Contributions to neuro-psychological assessment.* New York: Oxford University Press.

Bradley, L., & Bryant, P. (1985). *Rhyme and reason in reading and spelling*. Ann Arbor, MI: University of Michigan Press.

Brady, S. A., & Shankweiler, D. P. (Eds.) (1991). *Phonological processes in literacy*. Hillsdale, NJ: Erlbaum.

Bryant, N. D. (1963). *Diagnostic Test of Phonic Skills*. Published by the author.

Bryant, P. E., & Bradley, L. (1985). *Children's reading problems: psychology and education.* Oxford: Blackwell.

Bryant, P. E., MacLean, M., Bradley, L. L., & Crossland, J. (1990). Rhyme and alliteration, phoneme detection, and learning to read. *Developmental Psychology*, *26*(3), 429-438.

Carlisle, J. F., Beeman, M., Davis, L. H. & Spharim, G. (1999). Relationship of metalinguistic capabilities and reading achievement for children who are becoming bilingual. *Applied Psycholinguistics*, *20*, 459-478.

Chiape, P., & Siegel, L. S. (1999). Phonological awareness and reading acquisition in English- and Punjabi-speaking Canadian children. *Journal of Educational Psychology*, *91*, 20-28.

Chiappe, P., Siegel, L. S. & Gottardo, A. (2002). Reading-related skills of kindergarteners from diverse linguistic backgrounds. *Applied Psycholinguistics*, *23*, 95-116.

Cisero, C. A., & Royer, J. (1995). The development and cross-language transfer of phonological awareness. *Contemporary Educational Psychology, 20*, 275-303.

Cossu, G., Shankweiler, D., Liberman, I. Y., Katz, K., & Tola, G. (1988). Awareness of phonological segments and reading ability in Italian children. *Applied Psycholinguistics, 9,* 1-16.

Crowder, R. G., & Wagner, R. K. (1991). *The psychology of reading: An introduction*. New York: Oxford University Press.

Cuetos, F., & Labos, E. (2001). The autonomy of the orthographic pathway in a shallow language: Data from an aphasic patient. *Aphasiology*, *15*, 333-342.

Cunningham, B. B. (1990). Explicit versus implicit instruction in phonemic awareness. *Journal of Experimental Child Psychology*, *50*, 429-444.

De Manrique, A. M. B., & Gramigna, S. (1984). Phonological and syllabic segmentation in preschool and first grade children. *Lectura y Vida*, *5,* 4-13.

Denckla, M. B., & Rudel, R. G. (1974). Rapid “automatized” naming of pictured objects, colors, letters and numbers by normal children. *Cortex*, *10*, 186-202.

Denckla, M., & Rudel, R.G. (1976). Rapid “automatized” naming (R.A.N.): Dyslexia differentiated from other learning disabilities. *Neuropsychologia*, *14*, 471-479.

Department of Academic Research, Ministry of Education, Thai Government (1996). *English curriculum*. No information about the printing house provided.

Dewsbury, A., Jennings, J., & Boyle, D. (1983). *Bridge reading*. Toronto, Ontario: O.I.S.E. Press.

Dhanesschaiyakupta, U. (2003). *L1 orthography: The effects on L2 word recognition of Thai and Chinese ESL learners*. Unpublished doctoral dissertation, University of Pittsburgh, Pittsburgh.

Duncan, S. E., & DeAvila, E. A. (1998). *Pre-language assessment scale 2000*. Monterey, CA: CTB/McGraw-Hill.

Dunn, L. N., & Dunn, L. M. (1981). *Peabody picture vocabulary test*. Circle Pines, Minnesota: American Guidance Service.

Dunn, L. N., Dunn, L. M., & Whetton, C. (1982). *British picture vocabulary scale: Manual for long and short forms*. Windsor, UK: NFER-Nelson.

Durgunoglu, A. Y., Nagy, W. E., & Hancin-Bhatt, B. J. (1993). Cross-language transfer of phonological awareness. *Journal of Educational Psychology*, *85*(3), 453-465.

Ehri, L. C. (1998). Grapheme-phoneme knowledge is essential for learning to read words in English. In J. L. Metsala & L. C. Ehri (Eds.), *Word recognition in beginning literacy* (pp.3-44). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Ehri, L., Nunes, S., Willows, D., Schuster, B., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly*, *36*, 250-287.

Foy, J. G., & Mann, V. A. (2001). Does strength of phonological representations predict phonological awareness in preschool children? *Applied Psycholinguistics*, *22*(3), 301-325.

Frost, R. (1992). Orthography and phonology: The psychological reality of orthographic depth. In P. Downing, M. Noonan, & S. D. Lima (Eds.), *The linguistics of literacy* (pp. 255-274). Philadelphia: John Benjamins Publishing.

Frost, R. (1994). Prelexical and postlexical strategies in reading: Evidence from a deep and a shallow orthography. *Journal of Experimental Psychology, Learning, Memory, and Cognition, 20*, 1, 116-129.

Frost, R., & Katz, L. (1987). Strategies for visual word recognition and orthographical depth: A multilingual comparison. *Journal of Experimental Pschology, Human, Perception, and Performance, 13*, 104-115.

General Education Department, Ministry of Education, Thai Government. (1997). *The 8th Educational Development Plan (1997-2001)*. No information on publishing house provided.

Goldman, R., Fristoe, M., & Woodcock, R. W. (1974). *GFW sound symbol tests*.

Circle Pines, MN: American Guidance Service.

Goswami, U., & Bryant, P. (1990). *Phonological skills and learning to read*. Hove, England: Erlbaum.

Goswami, U. (2000). Phonological and lexical processes. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research* (Vol. III, pp. 251-267). Mahwah, NJ: Lawrence Erlbaum Associates.

Gottardo, A. (2002). The relationship between language and reading skills in bilingual Spanish-English speakers. *Topics in Language Disorders*, *22*(5), 46-70.

Gottardo, A., Yan, B., Siegel, L. S., & Wade-Woolley, L. (2001). Factors related to English reading performance in children with Chinese as a first language: More evidence of cross-language transfer of phonological processing. *Journal of Educational Psychology, 93*(3), 530-542.

Haberlandt, K. (1994). Methods in reading research. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp.1-32). San Diego, CA: Academic Press.

Hatcher, P. J., Hulme, C., & Ellis, A.W. (1994). Ameliorating early reading failure by integrating the teaching of reading and phonological skills: The phonological linkage hypothesis. *Child Development*, *65,* 41-57.

Huang, H. S., & Hanley, J. R. (1994). Phonological awareness and visual skills in learning to read Chinese and English. *Cognition*, *54*, 73-98.

Hulme, C., Hatch, P. J., Nation, K., Brown, A., Adams, J., & George, S. (2002).

Phoneme awareness is a better predictor of early reading skills than onset-rime awareness. *Journal of Experimental Child Psychology*, *82*(1), 2-28.

Jimenez-Gonzalez, J. E. (1997). A reading-level match study of phonemic processes underlying reading disabilities in a transparent orthography. *Reading and Writing: An Interdisciplinary Journal*, *9*, 23-40.

Karlsen, B., & Gardner, E. (1994). *Stanford diagnostic reading test*. San Francisco: Harcourt Brace.

Katz, L., & Feldman, L. B. (1981). Linguistic coding in word recognition. In A. M. Lesgold & C. A. Perfetti (Eds.), *Interactive processes in reading* (pp. 85-105). Hillsdale, NJ: Lawrence Erlbaum Associates.

Katz, L., & Frost, L. (1992). Reading in different orthographies: The orthographic depth hypothesis. In R. Frost & L. Katz (Eds.), *Orthography, phonology, morphology, and meaning* (pp.67-84). Amsterdam, North-Holland: Elsevier Science Publishers.

Kirby, J. R., Parrila, R. K. & Pfeiffer, S. L. (2003). Naming speed and phonological awareness as predictors of reading development. *Journal of Educational Psychology*, *95*(3), 453-464.

Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*, 607-610.

Kunlawanit, P. (1984). *Comparative Tai*. Bangkok: Chulalongorn University Press.

Lesaux, N. K., & Siegel, L. S. (2003). The development of reading in children who speak English as a second language. *Developmental Psychology*, *39*(6), 105-1019.

Liberman, I. Y., Shankweiler, D., Fischer, F. W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology*, *18*, 201-212.

Lie, A. (1991). Effects of a training program for stimulating skills in word analysis in first-grade children. *Reading Research Quarterly*, *26*, 234250.

Lindsey, K. A., Manis, F. R., & Bailey, C. E. (2003). Prediction of first-grade reading in Spanish-speaking English-language learners. *Journal of Educational Psychology, 95*(3), 482-94.

Litt, D. G. (2003). *An exploration of the double-deficit hypothesis in the reading recovery population*. Unpublished doctoral dissertation, University of Maryland, College Park.

Lopez, L. M., & Greenfield, D. B. (2004). The cross-language transfer of phonological skills of Hispanic Head Start children. *Bilingual Research Journal*, *28*(1), 2004.

Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research*

Quarterly, 23, 263-284.

Lundberg, I., Olofsson, A., & Wall, S. (1980). Reading and spelling skills in the first school years predicted from phonemic awareness skills in kindergarten. *Scandinavian Journal of Psychology, 21*, 159-173.

Maclean, M., Bryant, P., & Bradley, L. (1987). Rhymes, nursery rhymes, and reading in early childhood. *Merrill-Palmer Quarterly*, *33*(3), 255-281.

Mann, V.A. (1986). Phonological awareness: the role of reading experience. *Cognition*, *24*, 65-92.

Mann, V.A., & Foy, J.G. (2003). Phonological awareness, speech development, and letter knowledge in preschool children. *Annals of Dyslexia*, *53*, 149-173.

Mann, V. A., & Liberman, I. Y. (1984). Phonological awareness and verbal short-term memory. *Journal of Learning Disabilities, 17*, 592-599.

McBride-Chang, C., & Kail, R.V. (2002). Cross-cultural similarities in the predictors of reading acquisition. *Child Development, 73*(5), 1392-1407.

Muter, V., & Diethelm, K. (2001). The contribution of phonological skills and letter knowledge to early reading development in a multilingual population. *Language Learning, 51*(2), 187-219.

Muter, V., Hulme, C., & Snowling, M. (1997). *The phonological abilities test, PAT*. London: The Psychological Corporation.

Muter, V., Hulme, C., Snowling, M., & Taylor, S. (1998). Segmentation, not rhyming, predicts early progress in learning to read. *Journal of Experimental Child Psychology*, *71*, 3-27.

Naglieri, J. A., & Das, J. P. (1997). *Das–Naglieri: Cognitive assessment system interpretive handbook.* Itasca, IL: Riverside.

National Identity Office under the Office of the Prime Minister, Royal Thai Government (2002). *The national language*. Retrieved July 14, 2004, from www.mahidol.ac.th/thailand/language.html.

Ognjenovic, V., Lukatela, G., Feldman, L. B., & Turvey, M. T. (1983). Misreadings by beginning readers of Serbo-Croatian. *Quarterly Journal of Experimental Psychology, 35A*, 97-109.

Perfetti, C. A., Beck, I., Bell, L. C., & Hughes, C. (1987). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first grade children. *Merrill-Palmer Quarterly*, *33* (3), 283-319.

Prapaisit, L. (2003). *Changes in teaching English after the educational reform in Thailand*. Unpublished doctoral dissertation, Michigan State University, East Lansing.

Rack, J. P., Snowling, M. J., & Olson, R. K. (1992). The nonword reading deficit in developmental dyslexia: A review. *Reading Research Quarterly*, *27*, 29-53.

Rosner, J. (1973). *Perceptual skills curriculum: Auditory motor skills training*. New York: Walker & Co.

Rosner, J. (1975). *Helping children overcome learning difficulties.* New York: Walker & Co.

Quiroga, T., Lemos-Britton, Z., Mostafapour, E., Abbott, R. D. & Berninger, V. W. (2002). Phonological awareness and beginning reading in Spanish-speaking ESL first graders: Research into practice. *Journal of School Psychology*, *40*(1), 85-111.

Raven, J.C. (1956). *Guide to using the colored progressive matrices* (Reprinted). Dumfries:Crichton Royal.

Read, C., Zhang, Y., Nie, H., & Ding, B. (1986). The ability to manipulate speech sounds depends on knowing alphabetic writing. *Cognition, 24*, 31-45.

Seidenberg, M. S., Waters, G. S., Barnes, M. A., & Tanenhaus, M. K. (1984). When does irregular spelling or pronunciation influence word recognition? *Journal of Verbal Learning and Verbal Behavior*, *23*, 283-404.

Share, D. L. (1995). Phonological recording and self-teaching acquisition. *Cognition*, *55*, 151–218.

Share, D. L., Jorm, A. F., Maclean, R., & Matthews, R. (1984). Sources of individual differences in reading acquisition. *Journal of Educational Psychology*, *76*, 1209-1324.

Share, D. L., & Stanovich, K. E. (1995). Cognitive processes in early reading development: Accommodating individual differences into a model of acquisition. Issues in education: Contributions from *Educational Psychology*, *1*, 1–57.

Siegel, L. S., & Ryan, E. B. (1989). The development of working memory in normally achieving and subtypes of learning disabled children. *Child Development, 60*, 973-980.

Siegel, L. S. (1993). The development of reading. In H. W. Reese (Ed.), *Advances in child development and behavior* (Vol. 24, p.63-97). San Diego, CA: Academic Press.

Singnoi, U. (2000). *Nominal constructions in Thai*. Unpublished doctoral dissertation, University of Oregon, Eugene.

Snider, V. E. (1997). The relationship between phonemic awareness and later reading achievement. *Journal of Educational Research*, *90*(4), 203-211.

Snow, C. E., Burns, M. S., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, D.C.: National Academy Press.

Soegard, A., & Bording-Peterson, P. S. (1974). *OS 400 silent word reading*. Kobenhavn: Dansk Psykologisk Forlag.

Stahl, S. A., & Murray, B. (1998). Issues involved in defining phonological awareness and its relation to early reading. In J. L. Metsala, & L. C. Ehri (Eds.), *Word recognition in beginning literacy*. Mahwah, NJ: Lawrence Erlbaum.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology*, *38*(2), 175-190.

Stuart, M., & Coltheart, M. (1988). Does reading develop in a sequence of stages? *Cognition*, *30*, 139-181.

Thai Oregon (2004). *The Thai writing system*. Retrieved July 14, 2004, from www.thaioregon.com/thailanguage.htm

Torgesen, J. K. (1999). Reading disabilities. In R. Gallimore, A. Bernheimer, G. MacMillan, D. Speece, & S. Vaughn (Eds.). *Developmental perspectives on children with high incidence disabilities: Papers in honor of Barbara K. Keogh* (pp. 157-182). Mahwah, NJ: Lawrence Erlbaum Associates.

Torneus, M. (1984). Phonological awareness and reading: a chicken and egg problem? *Journal of Educational Psychology, 76*(6), 1346-1358.

Treiman, R., Goswami, U., & Bruck, M. (1990). Not all nonwords are alike: Implications for reading development and theory. *Memory and Cognition, 18*, 559-567.

Tunmer, W. E., & Nesdale, A. R. (1985). Phonemic segmentation skill and beginning reading. *Journal of Educational Psychology*, *77*, 417-427.

Vandervelden, M. C., & Siegel, L. S. (1995). Phonological recoding and phoneme awareness in early literacy: A developmental approach. *Reading Research Quarterly*, *30*, 854-875.

Vellutino, F. R., & Scanlon, D. M. (1987). Phonological coding, phonological awareness, and reading ability: Evidence from a longitudinal and experimental study. *Merrill-Palmer Quarterly*, *33*(3), 321-363.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin*, *101*, 192–212.

Wagner, R. K., Torgesen, J. K., Laughon, P. L., Simmons, K., & Rashotte, C. (1993). Development of young readers' phonological processing abilities. *Journal of Educational Psychology*, *85*, 85–103.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (1994). Development of reading-related phonological processing abilities: New evidence of bi-directional causality from a latent variable longitudinal study. *Developmental Psychology*, *30*(1), 73-87.

Wechsler, D. (1992). *Wechsler intelligence scale for children*. London: Psychological Corporation.

Wei, Y. & Zhou, Y. (2002). *Insights into English pronunciation problems of Thai students*. (ERIC Document Reproduction Service No. ED476746)

Wei, Y. & Zhou, Y. (2003). *Language minority parents' involvement in their child's English education: A case study of an ELL student.* (ERIC Document Reproduction Service No. ED476593)

Wiederholt, J. L., & Bryant, B. R. (1992). *Gray oral reading tests*. Austin, TX: ProEd.

Wilkinson, G. S. (1993). *The wide range achievement test—3*. Wilmington, DE: Jastak Associates.

Wilkinson, G. S. (1995). *The wide range achievement test—3*. Wilmington, DE: Jastak Associates.

Willows, D. M., & Ryan, E. B. (1981). Differential utilization of syntactic and semantic information by skilled and less skilled readers in the intemediate grades. *Journal of Educational Psychology, 73*, 607-615.

Wolf, M., Bally, H., & Morris, R. (1986). Automaticity, retrieval processes and reading: A longitudinal study in average and impaired readers. *Child Development*, *57*, 988–1000.

Wolf, M., & Bowers, P. G. (1999). The double-deficit hypothesis for the developmental dyslexias. *Journal of Educational Psychology, 91*, 415–438.

Woodcock, R. M. (1987). *Woodcock reading mastery--Revised, Form G*. Circle Pines, MN: American Guidance Service.

Woodcock, R. M. (1987). *Woodcock reading mastery--Revised, Form H*. Circle Pines, MN: American Guidance Service.

Woodcock, R. W., & Johnson, M. B. (1989). *Woodcock–Johnson Psychoeducational Battery--Revised.* Allen, TX: DLM Teaching Resources.

Yopp, H. K. (1992). Developing phonemic awareness in young children. *Reading*

Teacher, *45*, 696-703.

Yopp, H. K., & Yopp, R. H. (2000). Supporting phonemic awareness development in the classroom. *The Reading Teacher*, *54*(2), 130-143.