The Role of Phonological Awareness:
Phonological Awareness in Alphabetic and
Logographic Languages for Taiwanese Students

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Chapter 1

Introduction

Taiwanese students are generally observed to have some level of difficulty in English learning. The reasons why this phenomenon came about have been discussed for a long period of time. Many Taiwanese parents still consider the ideal English-learning age to be “the earlier, the better.” Based on the learning experiences of Taiwanese teachers of English, age is not the major issue when acquiring English-speaking ability, but rather learning environments and language exposures are the issues. There are countries where EFL is taught and the first language is a nonalphabetic language, such as Taiwan. In Taiwan, English is a foreign language, so language exposure for Taiwanese students is limited; they are unable to use fluent English to communicate with people whose first language is English. Most students speak either Taiwanese or Mandarin Chinese as their first language and they started to learn English at thirteen years of age or later. Because of this, most Taiwanese students have less realization that English is an alphabetic language in which the phoneme-grapheme correspondence is the foundation of the language. The Chinese “Zhuyin Fuhao” is the first system in which Taiwanese students are exposed to the knowledge of phonological awareness. They usually learn these phonological systems in the first grade of elementary school or even earlier when in kindergarten.
In order to make English a commonly-used language in Taiwan, the nine year integration curriculum came into effect and students started to receive formal English instructions in the third grade. This occurred in 2005. Even though the government adheres to this policy, English is still localized; different cities and different schools have different projects for English learning. Some students have been learning English since kindergarten, whereas some private school teachers started to teach students English earlier than the government’s mandate, but their success in learning English is not guaranteed. According to Akamatsu (2003), learners from a logographic language background might encounter difficulties in learning to read an alphabetic language. Taiwanese students are contained in one of the language groups who use a nonalphabetic language, and so many students rely on Zhuyin Fuhao to spell out English words; and some decode English words through memorizing the shapes of the words. The phenomenon indicates their lack of remedial training in English learning. They regard English words as a combination of letters. Students from a logographic language background might not fully understand the correspondence between the sounds and the words. According to Wagner (1998), phonological awareness is being aware of and using how a language is put together phonologically to understand information that is given verbally and on paper. Based on Baddeley (1986), phonological processing is important for reading ability. Furthermore, phonological awareness is prerequisite knowledge to the practice of phonological processing. From my own observations and previous teaching experience, Taiwanese students have seldom been taught about the relevance of phonological awareness when learning English; thus, the ways that they learned English
could be incorrect. They need more remedial courses to enhance their English ability. One of the measures in helping poor English learners to improve their English abilities is to enhance their knowledge of phonological awareness. Therefore, it is necessary for EFL students to understand the importance of phonological awareness.

1.1 What is the role of phonological awareness in language?

Many researchers demonstrated substantial relationships between phonological awareness and various language processing skills. Hu (2003) indicated that poor phonological awareness ability would lead learners to have difficulty in their later L1 and L2 vocabulary learning. Moreover, Chen & Chien (2002) and De Jong, Seveke, & Van Veen (2000) pointed out that learning with low phonological awareness is highly related to poor new-word reading achievement and spelling. Consequently, phonological awareness plays a crucial role for learners to succeed in various language tasks.

The current study investigates Taiwanese students’ ability to process phonological awareness, and indicates the importance of the Chinese phonological awareness effect on their learning English phonological awareness.

1.2 The Organization of the Thesis

This thesis contains four main sections. The first contains the needs of the study. The second section reviews the empirical studies as the background of phonological awareness and the role of phonological awareness in nonalphabetic languages. The third
section describes the purpose of the study, the research questions, the subjects’
information, the instruments, the procedure, and the data analysis of the study. The fourth
section considers the results and covers a discussion of the study. Finally, the closing
section points out the limitations, suggestions, and conclusions drawn from the study.
Chapter 2

Literature Review

2.1 What is phonological awareness?

The term “phonemic awareness” is often confused with “phonological awareness.” In the developmental levels of phonemic awareness for native children identified by Pressley (2006), phonemic awareness is the skill for the children to be aware that the rules of individual phonemes can be built and combined into a word. The first level is prone to memorizing rhyming words rather than words that do not rhyme. The children at the second level can become conscious of words, such as rat, sit, and box, which can be combined into a set of words. The children at the third level will have the ability to blend sounds from different letters (e.g., to blend the sounds c, a, and t, into the word cat). The fourth level can segment a word into its sounds (e.g., to separate the word “cat” into the individual sounds c, a, and t.). Those in the fifth level are able to delete one of the sounds from a word, and keep the rest of the word (e.g., take away c sound from cat, the children will answer at.); while the learners are familiar with all the processes, it could be concluded that they have acquired the technique of phonemic awareness. However, O’Connor, Slocum and Jenkins (1995) simply introduced that phonological awareness as awareness of the sound structure of a language that is combined with the knowledge of
grapheme-phoneme correspondences for children to develop phonological processing abilities. Phonological awareness is the ability that learners can be aware of and can manipulate the words composed of individual phonemes (Wagner & Torgesen, 1987).

According to the Alabama Reading Initiative (2001), phonological awareness is awareness of speech sounds that include spoken words, syllables, onsets, rhymes, and phonemes. Researchers have various definitions for phonological awareness. Perfetti, Beck and Hughes (1987) introduced the phonological structure of spoken words as a basic appreciation for a child to understand that the words in print represent the sounds of the language. Similar to findings by O’Connor, Slocum and Jenkins (1995), phonological awareness is the ability to rhyme, segment, delete and blend sounds of written or oral information by use of grapheme-phoneme correspondence (Wagner, 1988). Morais (2003) demonstrated that phonological awareness includes the ability to construct and manipulate the sound correlation of both written words and spoken words. Treimen and Zukowski (1991) pointed out that phonological awareness involves three levels: awareness of syllables, awareness of onsets and rhymes, and awareness of phonemes.

According to Dechant (1993), phonological awareness should include syllable deletion, syllable segmentation, phoneme recognition, phoneme identification, phoneme segmentation, and phoneme deletion. Within the different levels, the first level syllable deletion test is similar to the syllable segmentation test. The phoneme recognition test is similar to segmental identification, which is the second level. The phoneme segmentation test and the phoneme deletion test are at the third level with segmentation preceding deletion. As mentioned above, phonemic awareness is a subpart of phonological
awareness. Further, phonological awareness is said to be important in reading achievement. Dixon, Stuart and Masterson (2002) pointed out that children who have more phonological awareness training acquired new vocabulary faster than children who had less phonological awareness training. In this study, phonological awareness encompasses various levels, including phonemic awareness, which is a more advanced level for learners to develop in both Chinese and English.

2.2 What is the role of phonological awareness in English, an alphabetic language?

Phonological awareness, according to Ehri (1997) is associated with the ability to read in various ways, which include sounding out, blending letters, and transforming graphemes into phonemes and blending these phonemes into pronunciations of real words. Bryant, MacLean and Bradley (1990) pointed out that phonological awareness is a requirement for alphabetic literacy. Relatively speaking, more development in literacy experience will help in phonemic manipulation skills. Adams (1990) pointed out three important component skills for learners to achieve their later reading skills, which are word attack, word identification and comprehension. Once the readers manipulate the letter-sound correspondence rules and phonological translations, they could decode words from print to meaning more effortlessly so they would be more familiar with the comprehension of the written text. In his further study, Adams (1991) defined phonological awareness as understanding the concept that syllables and words can be separated into smaller units (i.e., sounds); these phonemes correspond with graphemes. Some researchers (Lundberg et al., 1988; Chunningham, 1990) showed more advantage
in learning to read for the children who had been drilled on phonological awareness as opposed to the children without this training. It was observed that phonological awareness dominated the reading achievement in children’s learning to read English (Juel, Griffith, & Gough, 1986; Bryant et al., 1990).

Children have to be trained in both the phonemic knowledge and the skills of word components and word segmentation (Blachman, 1991; Bradley, 1988). Other researchers (Castle, Riach, & Nicholson, 1987) indicated that learners trained in phonemic awareness can promote reading skills, and alphabetic language training can improve the proficiency of phonological awareness. On the other hand, if students lack the knowledge of phonological awareness, they usually have difficulty in learning to read.

Without phonological awareness, learners would be unable to apply the letter-sound correspondence rule to read and spell unfamiliar words. Knowing that letter knowledge and phonological awareness are identified as two important prerequisites for later reading achievement, some researchers even suggested that there is a reciprocal relationship of phonological awareness within different language backgrounds.

### 2.3 What is the role of phonological awareness in the Chinese nonalphabetic language?

Several studies have shown that L2 learners, regardless of their various language backgrounds, can still demonstrate a similar developmental progress in learning to read English as native-speaking learners (Chiappe & Siegel, 1999; Chiappe, Siegel, & Wade-Woolley, 2002). There is evidence that people whose learning background is a
nonalphabetic language reading, such as Chinese, will suffer the problem of word segmentation (Mann, 1987; Read, Zhang, Nie, & Ding, 1987). It is obvious that the students who were trained with phonological awareness were more advanced than the students without phonological awareness training.

Mann (1985) examined the skills of American English and native Japanese speakers in phoneme and syllable proficiency. The result was that these two groups are experts at the deletion of syllables than deletion of phonemes. Furthermore, the Japanese speakers were more skilled than American English speakers in both syllable deletion and phoneme deletion manipulation. The dissimilar orthographic experiences in their language backgrounds caused the differences in the result: Japanese speakers learn syllabification skills since the first-grade, but American English speakers only learn an alphabet.

Learners with a logographic language background might have more difficulty in learning an alphabetic language. Holm & Dodd (1996) showed that L2 learners from nonalphabetic language backgrounds would encounter more problems in decoding unfamiliar words than learners from an alphabetic background. According to Ashmore, Ferrier, Paulson, and Chu (2002), training in phonemic awareness for students from Mainland China will help foster their abilities in phonological awareness and word reading in English.

2.4 Phonological Awareness Transfer from Chinese to English

Huang and Hanley (1997) indicated that the skill of phonological awareness will affect the ability of Taiwanese students in their later Chinese character-reading ability.
Phonological awareness enhanced both the alphabetic reading and the nonalphabetic Chinese prints. The smallest pronounceable unit in Chinese is the character. Each character relates to at least one phoneme. Over 80% of Chinese characters contain phonetic and semantic elements. According to Tzeng (1981), this feature of Chinese characters relies on a certain form of phoneme-sound correspondence and every character is composed of an compound sound of phonological recoding, although this compound does not operate at the phonemic level as in an alphabetic system. There are significant numbers of Chinese words that share the same pronunciation but have different characters and different meanings, depending on the context and usage. Based on the dissimilarity of languages, many researchers investigated whether the different first language with alphabetic and nonalphabetic backgrounds affects second language phonemic awareness and decoding skills. Koda (1998) pointed out that a disparate first language is not directly related to phonemic awareness in a second language.

2.4.1 The Chinese Phonological System Zhuyin Fuhao

In Chinese Zhuyin systems, there is no true alphabet for written Chinese. The smallest pronounceable unit in Chinese is the character. The system of phonemes (37 phonemes, which are similar to an alphabet) is called “Zhuyin Fuhao” (also known colloquially as "Bo Po Mo Fo"), which contains all the basic sounds associated with Mandarin Chinese. These Zhuyin Fuhao are also used in most dictionaries to locate a particular character as well as on computer keyboards to help find a particular Chinese character while typing. Every character can be pronounced by combining several
phonemes from “Zhuyin Fuhao.” Within a character structure, each character is associated with one or more than one compounds, which can be pronounced as a word sound. Seeing that one Chinese character is composed of between one and three phonemes (but never more than three), this compound sound, simply called “Zhuyin,” represents the pronunciation of the character. This pronounceable compound system is similar to English onset and rhyme.

One Chinese character has one syllable, but to identify the syllable with Zhuyin Fuhao within a Chinese character, that Chinese character has a completely different syllable structure from English words. English only has 26 letters, which comprise the Standard English alphabet, whereas Chinese has 37 phonemes. Table 1 shows how the 37 Chinese Zhuyin Fuhao characters correspond with the Standard English (Latin) alphabet.
Table 1. The Similarity of the Chinese Zhuyin Fuhao with the English Alphabet (He, 1989)

<table>
<thead>
<tr>
<th></th>
<th>Zu Yin Fu Hao(English)</th>
<th>Total numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consonant (C)</strong></td>
<td>ㄅ(b), ㄆ(p), ㄇ(m), ㄈ(f), ㄉ(d), ㄊ(t), ㄌ(l), ㄍ(g), ㄎ(k), ㄏ(h), ㄐ(j), ㄑ(q), ㄒ(x), ㄓ(j), ㄔ(ch), ㄕ(sh), ㄖ(r), ㄗ(z), ㄘ(c), ㄕ(s)</td>
<td>21</td>
</tr>
<tr>
<td><strong>Medial (M)</strong></td>
<td>ㄧ(i), ㄨ(u), ㄗ(u)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Nuclear vowel (V)</strong></td>
<td>ㄧ(i), ㄨ(u), ㄗ(u), ㄚ(a), ㄛ(o), ㄜ(e), ㄟ(ei), ㄞ(ai), ㄝ(e), ㄠ(au), ㄡ(ou), ㄢ(an), ㄣ(en), ㄤ(ang), ㄥ(eng), ㄦ(er/r)</td>
<td>16</td>
</tr>
<tr>
<td><strong>Ending (E)</strong></td>
<td>ㄞ(ai), ㄝ(e), ㄠ(au), ㄡ(ou), ㄢ(an), ㄣ(en), ㄤ(ang), ㄥ(eng), ㄦ(er/r)</td>
<td>8</td>
</tr>
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</table>

Examples:
CV: ㄅㄚ = pa
CVE: ㄅㄤ = bang
CMV: ㄅㄧㄝ = jie
CMVE: ㄅㄧㄢ = bian

He (1989) identified Chinese syllables as being in one of four distinct categories: Consonant (C), Medial (M), Nuclear Vowel (V) and Ending Vowel (E). Within the word structure, they can be formed as CV, CVE, CMV or CMVE. Except for some vowels that can stand individually as words, the basic structure of most words is the CV or VC phoneme form. Additionally, the most complicated form of a word is CMVE. Chart 1 and Chart 2 show the structures of English and Chinese.
According to previous research and Charts 1 and 2, it is clear that there are dissimilarities between the Chinese structure and the English structure. In English, one word can include one or several phonemes. Within an English word, many words could contain more than one vowel. Moreover, vowels can stand in any position of a word, such as V, VC, CVC, CCVCC etc. Nevertheless, in Chinese, only some vowels can stand individually; most vowels have to stand with one or two consonants to form the structures V or CV, VC. Comparing English words with Chinese words, English words can be formed from more than four phonemes; however, the most complicated form of a Chinese word is CMVE.

Chart 1. The English syllable structure (Giegerich, 1995).  
2.5 The Tasks for Measuring Phonological Awareness

Phonological awareness also shows the significance of comprehending the alphabetic principle that words are composed of letters and a letter represents a sound (Griffith, Klesius & Kromrey, 1992). Some researchers investigated subjects’ abilities to phonologically process spoken language by instructing subjects to name the letters, to segment the phonemes, to recode words, and to pronounce pseudo-words and so on (McBride-Chang, Wagner, & Chang, 1997). Several studies indicated that it is essential for learners to be informed that letters stand for the sounds, the differences of the sounds, and the blending of the sounds (Bradley & Bryant, 1991). Ashmore, Ferrier, Paulson, and Chu (2002) evaluated the ability of Chinese students’ phonological awareness in their comprehension by using many tasks: Elision, blending of words, segmentation of words, and word reading efficiency of phonological awareness process. Some studies consist of having children do tasks involving phonological skills of different levels, vocabulary tests or reading tests to investigate the relationship between phonological processing abilities. Adams (1990) pointed out five sections of phonological awareness ability: Rhymes awareness, rhymes and alliterations awareness, abilities of blending and splitting syllables, ability of segmentation, and the skill of deleting, inserting or phonemes of words.

2.5.1 Phoneme Recognition Test
Share, Jorm, Maclean & Metthew (1984) instructed kindergarten-age children to break off the first phoneme of a word or a syllable. For example, they gave students the word “cat” and then asked the subjects to pronounce the first or ending phoneme in isolation or say what sound remained after deleting one of the sounds.

2.5.2 Phoneme Segmentation Test

Phoneme segmentation is the ability to break words into their individual phonemes. Dechant (1993) introduced the concept that segmenting words into smaller units or individual phonemes of a word is the basic skill needed to learn the grapheme-phoneme correspondences, to synthesize individual phonemes and then to blend in order to form a total word. Lewkowicz (1980) identified that segmentation refers to breaking down a word into phonemes or syllables. An example question is “What are the sounds in *cat*?” and the correct answer is /kl/, /ə/, /t/.

2.5.3 Phoneme Deletion Test

Phoneme deletion is possible only after learners have learned to segment phonemes of a syllable or a word. Zhurova (1963, as cited in Lewkowicz 1980) had subjects listen to a pair of words, and then the test giver took away one sound of a word, and had subjects to identify the phoneme that was deleted. Some researchers indicated that
phoneme deletion involves having subjects pronounce a word after a sound has been removed, such as with the words “nest vs. net” (Bruck, 1990; Yopp, 1988).

### 2.5.4 Syllable Deletion Test

When performing the task, subjects, in addition to segmenting phonemes of a word and having to delete the initial and final phonemes, blend the phonemes back together to pronounce a new word. Fox and Routh (1975) instructed subjects to segment words into syllables or other units that are smaller than the words given. For instance, if “mother” is the given word, subjects may be asked to delete one of the syllables and then say either *mo and ther* or *moth and er.*

### 2.5.5 Pseudo-word Reading Test

Some researchers (Freebody & Byrne, 1988; Bruck & Treiman, 1992) pointed out that pseudo-words are used to make certain that subjects do not work correctly with words that they are familiar with, and to measure if the subjects are able to phonologically recode new words. In pseudo-word tasks, the spelling stimuli were either chosen or made up to investigate subjects’ knowledge of correspondences between single graphemes or the knowledge of correspondences between groups of graphemes and groups of phonemes.
2.6 The Purpose of This Study

With knowledge of previous research, (Lundberg, Frost and Petersen, 1998; Cunningham, 1990; Ball and Blachman, 1991; Hatcher, Hulme & Ellis, 1994) show more progress in their learning to read for the children who were drilled on phonological awareness than the children who lack this training. From the previous research, it is known that Taiwanese students who are from a nonalphabetic language background might display a handicap in English phonological awareness (Holm & Dodd, 1996). According to Huang (1997), Taiwanese students have been engaged in Zhuyin Fuhao since the age of six. This Zhuyin Fuhao system will positively influence their later education in Chinese phonological awareness. Similar findings of Ziegler and Goswami (2005) indicated that Taiwanese students have learned the Zuyin Fuhao system since being in the first grade or second grade. Hence, first grade and second grade students would have basic skills of phonological awareness. In order to know if this Chinese phonological awareness ability will also help in learning L2, the aim of this study is to investigate (1) if L1 intraword phonological awareness experience affects L2 phonological awareness among EFL learners with nonalphabetic L1 background; and (2) how L1 experience affects L2 phonological awareness among EFL students from nonalphabetic L1 orthographic backgrounds. If the correlations between L1 and L2 phonological awareness are positive, Chinese phonological awareness could serve as an accurate predictor of Taiwanese students’ English reading support. If we know how they are related, this study
could be used as reference material for the remedial instruction of phonological awareness for the Taiwanese students. These research questions will be answered in the current study:

1. Does Taiwanese students’ L1 intraword phonological awareness (Zhuyin Fuhao) affect L2 phonological awareness (English)?

2. How does L1 experience affect L2 phonological awareness among Taiwanese students with nonalphabetic L1 orthographic backgrounds?
Chapter 3

Methods

Although many studies have been conducted to investigate the relationship of L1 or L2 younger learners in phonological awareness, few investigate L2 adolescent or even adult participants. Generally, EFL learners will transfer their literacy processing skills from their first language to English. If the phonological awareness required in English had not been developed in their first language, they would encounter problems with decoding unfamiliar words (Holm & Dodd, 1996). According to Koda (1998), EFL readers with nonalphabetic L1 background will be handicapped in their phonemic manipulation skills in L2. Compared to young children, adults are more mature in their cognitive development and have been exposed to English for longer periods of time. This would develop their L1 and L2 language knowledge more fully. Therefore, L2 adult students have been selected to be the subjects of the study. On one hand, McBride, Chang, Shu, Zhou, Wat & Wagner (2003) pointed out that Chinese learners apply other skills more often than phonological awareness in reading Chinese and that morphological awareness is uniquely important for early Chinese character recognition. On the other hand, Huang & Hanley (1997) indicated that Zhuyin Fuhao instruction could improve the phonological awareness of Taiwanese learners. Few critical questions have been
deliberated; in order to investigate the relationship between Chinese phonological awareness (Zhuyin Fuhao) and English phonological awareness in EFL students, 25 Taiwanese students at Kent State University were selected as the sample for this study. This study will examine these questions. The extent to which Taiwanese students’ phonological awareness is developed and transferred to reading an alphabetic language is still unknown. The effect on Taiwanese students between their L1 and L2 should be explored. The aim of the study is to investigate whether Taiwanese students’ English phonological awareness would correlate with their Chinese phonological awareness of Zhuyin Fuhao, and, if so, how they are related. If the correlation between Chinese phonological awareness and English phonological awareness is positive, the current study conducted to answer the research questions that are mentioned above.

3.1 Subjects

Twenty five Taiwanese, twenty females and five males, were recruited from undergraduate and graduate academic levels at Kent State University. The reason for choosing Taiwanese students as participants in this study is based on the objective of exploring how the Chinese writing system (Zuyin Fuhao) affects English phonological awareness. The subjects needed to be familiar with both Chinese Zuyin Fuhao and English; as such, Taiwanese students were chosen for this study. In Taiwan, most of the students started to learn Chinese Zhuyin Fuhao in the first grade in elementary school, and they started to learn English in junior high school. Hence, this group of Taiwanese students in this study had similar starting points in educational background. The
participants lived in the United States for a mean length of 20.88 months and were an average of 27.12 years old. All the participants had been learning English for an average of 11.48 years, and had learned Chinese Zuyin Fuhao for a mean length of 2.6 years.

3.2 Materials

Five phonological awareness measures were used in English: phoneme recognition, phoneme segmentation, phoneme deletion, syllable deletion, and pseudo-word reading. Based on the Chinese orthographic system, various studies demonstrated that Chinese Zuyin Fuhao has completely different syllables for each single word; because of this, the syllable deletion test was not used in the current study. Four measures were used in Chinese phonological awareness tests: phoneme recognition, phoneme segmentation, phoneme deletion, and pseudo-word reading. The tests were presented orally by the author of this thesis, who was also the only test-giver in this study. Except for the pseudo-word reading tests, not all the tests were shown to the subjects. Completing the task of phonological awareness took about 40 to 50 minutes for each student. In order to reduce students’ anxiety levels and possibility of misunderstanding, all the phonological awareness test instructions were given in Mandarin Chinese, the subjects’ first language. The subjects’ responses were recorded, and only the accurate responses were scored as correct. Each test is described in further detail below.

3.2.1 The Phoneme Recognition Test
This section evaluated whether the participants were able to identify the beginning sounds and ending sounds. Twenty stimulus words in both Chinese and English were used for the tests. From the stimuli we used in the English tests, the twenty stimuli were of the CVC, CVCC, CCVC, and CCVCC phoneme forms. Appendix A-1 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is to recognize the individual sound. For example, if I say “bus,” please repeat it again. If I ask you, “What is the beginning sound?” your answer will be /b/. If I say “has,” please repeat it again, and when I ask you, “What is the ending sound?” your answer will be /s/. There are 20 words that I need you to do. Please follow the directions.

In addition, from the stimuli we used on the Chinese tests, the twenty stimuli were of the CV, CVE, CMV and CMVE\(^1\) phoneme forms. Appendix A-2 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is recognize the individual sound. For example, if I say “ㄆㄩ” /jü/ , please repeat it again. If I ask you, “What is the beginning sound?” your answer will be /j/. If I say “ㄅㄚ”/c b/, please repeat it again and when I ask you, “What is the ending sound?” Your answer will be /a/. There are 20 words that I need you to do. Please follow the directions.
Notes:

1. Consonant (C), Medial (M), Nuclear Vowel (V) and Ending Vowel (E). The Chinese word structure form had shown in Table 1. (Literature review)

3.2.2 Phoneme Segmentation Test

This section measured whether the subjects were able to break down the phonemes of a word sequentially. Ten stimuli were used for both the English test and the Chinese test. From the stimuli we used in the English tests, the ten stimuli were of the CVC, CVCC, and CCVC phoneme forms. Appendix B-1 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is divide word into sounds. I will say an English vocabulary word; when you hear the word, please repeat it again. I will ask you to split the word into individual sounds. For example, I give you the word “cat,” you have to repeat “cat” again for me. When I ask you to segment this word, you have to separate it into /k/, /æ/ and /t/. There are 10 words that I need you to do. Please follow the directions.

In addition, from the stimuli we used in the Chinese tests, the twenty stimuli were of the CV, CVE, CMV and CMVE phoneme forms. Appendix B-2 shows the detailed task instructions and test items. The English version of the instructions is as follows:
Now, what we will do is to divide word into sounds. I will say a Chinese vocabulary word; when you hear the word, please repeat it again. I will ask you to split the word into individual sound. For example, I give you the word “ㄅㄢ” /bəŋ/, and you have to repeat “ㄅㄢ” /bəŋ/ again for me. When I ask you to segment this word, you have to separate it into “ㄅ” /b/ and “ㄢ” /əŋ/. There are ten words that I need you to do. Please follow the directions.

3.2.3 Phoneme Deletion Test

This section measured whether the subjects were able to remove a phoneme from a word and pronounce the sound that remains after the sound was omitted. Twenty-five stimulus words in both Chinese and English were used for tests. From the stimuli we used in the English tests, the twenty stimuli were of the CVC, CVCC, CCVC, CCVCC, CVCCV and CCCVC phoneme forms. Appendix C-1 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is that I will say an English vocabulary word. When you hear the word, please repeat it again. I will ask you to remove one of the sounds, and then please tell me the rest of the sound. For example, if I say “Please say ‘cat,’” you have to repeat “cat” again for me. When I say, “Now, say it again, but don’t say the /k/ sound, your answer will be /æt/. There are 25 words that I need you to do. Please follow the directions.
In addition, from the stimuli we used on the Chinese tests, the twenty stimuli were of the CV, CVE, CMV and CMVE phoneme forms. Appendix C-2 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is that I will say a Chinese vocabulary word. When you hear the word, please repeat it again. I will ask you to remove one of the sounds, and then please tell me the rest of the sounds. For example, I will say “Please say ㄈㄚ/gb/,” you have to repeat “ㄈㄚ/gb/” again for me. When I say, “Now, say it again, but don’t say /g/, your answer will be /b/. There are 25 words that I need you to do. Please follow the directions.

3.2.4 Syllable Deletion Test

This section measured whether the subjects were able to remove an assigned syllable from a stimulus and pronounce the remaining part. Thirteen stimulus words were used on the English tests. From the stimuli we used in the English tests, the thirteen stimuli were in the form of two syllables and three syllables. Based on the Chinese orthographic system, the author judged that in the Chinese system, one character has one syllable, but within the Zhuyin system to identify the syllable, one character includes onset and rhyme and its syllable structure is dissimilar from English; because of this, the Chinese syllable deletion test was not considered. Appendix D-1 shows the detailed task instructions and test items. The English version of the instructions is as follows:
Now, what we will do is that I will say an English vocabulary word; when you hear the word, please repeat it again. I will ask you to remove one part of the word, and then please tell me the rest of the sound. For example, if I say “Please say ticket,” you have to repeat “ticket” for me. Then I will say to you, “please say it again, but don’t say /kit/”, your answer will be /trk/. There are 13 words that I need you to do. Please follow the directions.

3.2.5 Pseudo-word Reading Test

This section seeks to examine whether the subjects were able to handle the English grapheme-phoneme correspondence and to blend phonemes through reading the pseudo-words out aloud. Twenty stimulus words in both Chinese and English were used for tests. From the stimuli we used on the English tests, the twenty stimuli were of the CVC, CVCC, CVCV, CCCVC, CVCVC, CCVCV, and CVCVCVC phoneme forms. Appendix E-1 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is pronounce the words; they are not real vocabulary but they can be pronounced. We call these words pseudo-words. I need you to try to read these words out loud. I will record your answer. You can practice before being recorded; I will record you when you are ready.
From the stimuli we used in the Chinese tests, the twenty stimuli were of the CV, CVE, CMV and CMVE phoneme forms. Appendix E-2 shows the detailed task instructions and test items. The English version of the instructions is as follows:

Now, what we will do is to pronounce the words, they are not real vocabulary but they can be pronounced. We call these words pseudo-words. I need you to try to read these words out loud. I will record your answer. You can practice before being recorded; I will record you when you are ready.

3.3 Procedure

The author first explained to the twenty-five subjects that a test was to be conducted to investigate their Chinese Zuyin Fuhao and English phonological awareness. The author invited them to participate in this study and guaranteed that their performances in these tests would not influence their grades of their classes. Also, they were told that they would be informed of the rationale and the findings of the study in the future. The phonological processing tests were given to the subjects near the end of May 2009. The author was the only test giver and evaluator and all the tests were administered one after one to the subjects individually. Each test took the subjects between 40 and 50 minutes to complete. Each performance from the subjects was recorded. The subjects’ responses were scored by the author. Then, the data were keyed in, coded, and analyzed using SPSS program systems.
Chapter 4

Results and Discussion

In this section, the results and discussion of the tests will be presented. Twenty-five subjects were instructed to answer all the questions from separate English and Chinese phonological awareness tests. Except for the English and Chinese pseudo-word reading tests, all the subjects took the tests without practicing. The following information starts with an overall view of participants’ responses on the nine phonological awareness tests. The results are provided to answer research questions. Again, the questions are: (1) Does Taiwanese students’ L1 intraword phonological experience (Zhuyin Fuhao) affects L2 phonological awareness (English) among EFL learners with nonalphabetic L1 backgrounds? (2) How does L1 experience affect L2 phonemic awareness among EFL students with nonalphabetic L1 orthographic backgrounds?

This section is organized as follows. In Section 4.1, we will look at an overall view of the tests. Next, in Section 4.2, we will compare the test difficulty for both the Chinese and English tests. And then in section 4.3, the results of the individual tests will be discussed. In section 4.4, we will analyze the individual sub-tests. Finally, the correlation of phonological awareness between Chinese and English will be examined in Section 4.5.
4.1 An Overall View of the Tests

Twenty-five participants (twenty females, five males) took part in the phonological awareness tests. In order to test the subjects not only for their familiarity with the sounds of words, but also to measure the words that they are unfamiliar with, pseudo-words were used in a section of the Chinese and English tests. In the Chinese system, one Chinese character might have four tones. All of the Chinese stimuli used in the test were first tone/inflection. Some Chinese stimuli were pseudo-words when an individual pronounces a word with the first tone, but these first tone stimuli can form actual words when they are pronounced with the other tones. In these instances, we will not count these words as pseudo-words.

In this study, five English phonological awareness and four Chinese phonological awareness tests were used to measure the subjects’ ability in phonological awareness. Table 1 summarizes the subjects’ overall performances in each test. The data was analyzed by computing the minimum score, the maximum score, the mean score, and the standard deviation of each test; each is presented in Table 2. In the obtained results for English phonological awareness tests, the highest mean scores of the 25 students was phoneme recognition of 21.24 out of 25. The lowest mean scores of the 25 students was phoneme segmentation test 16.20 out of 25. In the results for the Chinese phonological awareness tests, the highest mean scores of the 25 students was phoneme segmentation of 19.44 out of 25. The lowest mean scores of the 25 students occurred on the pseudo-word reading test, where the mean was 16.24 out of 25.
Table 2. The Minimum Score, the Maximum Score, the Mean Score and the Standard Deviation of the Subjects’ Overall Performances in Each Test. (N=25)

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Converted Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Phoneme Recognition</td>
<td>25</td>
<td>20.00</td>
<td>22.00</td>
<td>21.24</td>
<td>0.77889</td>
</tr>
<tr>
<td>English Phoneme Segmentation</td>
<td>25</td>
<td>3.00</td>
<td>10.00</td>
<td>16.20</td>
<td>2.06155</td>
</tr>
<tr>
<td>English Phoneme Deletion</td>
<td>25</td>
<td>18.00</td>
<td>25.00</td>
<td>18.24</td>
<td>2.14631</td>
</tr>
<tr>
<td>English Syllable Deletion</td>
<td>25</td>
<td>10.00</td>
<td>13.00</td>
<td>19.57</td>
<td>0.67823</td>
</tr>
<tr>
<td>English Pseudo-Word reading</td>
<td>25</td>
<td>12.00</td>
<td>20.00</td>
<td>19.28</td>
<td>1.69607</td>
</tr>
<tr>
<td>Chinese Phoneme Recognition</td>
<td>25</td>
<td>15.00</td>
<td>20.00</td>
<td>18.80</td>
<td>1.29099</td>
</tr>
<tr>
<td>Chinese Phoneme Segmentation</td>
<td>25</td>
<td>8.00</td>
<td>10.00</td>
<td>19.44</td>
<td>0.54160</td>
</tr>
<tr>
<td>Chinese Phoneme Deletion</td>
<td>25</td>
<td>19.00</td>
<td>25.00</td>
<td>18.59</td>
<td>1.78606</td>
</tr>
<tr>
<td>Chinese Pseudo-Word reading</td>
<td>25</td>
<td>8.00</td>
<td>20.00</td>
<td>16.24</td>
<td>2.84722</td>
</tr>
</tbody>
</table>

4.2 Test difficulty

Because the numbers of items in each test are different, a comparison between tests could be made only by using “converted means” (Yopp, 1988). Therefore, the results of the English and the Chinese tests are compared by using converted means in this study,
and the converted means were obtained by averaging the correct rates for all participants in each test. As mentioned in the literature review section, a Chinese character has a totally different syllable structure from English words. Therefore, the Chinese syllable deletion (CSD) test was omitted from this study. Table 3 shows the difficulty of all the phonological awareness for the subjects performed. These converted means and ranks the tests from least to most difficult. Based on Dechant’s theory (1993), we would expect to see the rank of relative difficulty of these phonological awareness tests in the current study from the least difficult to the most difficult to be syllable deletion, phoneme recognition, phoneme segmentation, phoneme deletion, and pseudo-word reading. Nevertheless, the result of this study showed a distinction from previous research.

As the subjects took the tests, English phoneme recognition was the least difficult test, and phoneme segmentation was the most difficult for these participants. Compared with the Chinese phonological awareness test, the pseudo-word reading test is the most difficult. Conversely, phoneme segmentation is the least difficult.

Table 3. Test Difficulty of Phonemic Awareness Tests

<table>
<thead>
<tr>
<th>English tests / converted means</th>
<th>Chinese tests / converted means</th>
</tr>
</thead>
<tbody>
<tr>
<td>The least difficulty</td>
<td>The most difficulty</td>
</tr>
<tr>
<td>EPR :21.24</td>
<td>EPS: 16.20</td>
</tr>
<tr>
<td>ESD: 19.57</td>
<td>CPA: 16.20</td>
</tr>
<tr>
<td>EPW: 19.28</td>
<td>CPW: 16.20</td>
</tr>
<tr>
<td>EPD: 18.24</td>
<td>CPW: 16.20</td>
</tr>
<tr>
<td>CPS: 19.44</td>
<td>CPA: 16.20</td>
</tr>
<tr>
<td>------</td>
<td>CPA: 16.20</td>
</tr>
</tbody>
</table>
Another finding pointed out that the most difficult section experienced by the subjects was phoneme segmentation on the English tests, which was the least difficult section on the Chinese tests. This result indicated that the subjects’ Chinese language background might be the reason why the result showed a different rank when compared with Dechant’s study (1993), but this finding is similar to Mann’s (1987), which pointed out that people from language groups with nonalphabetic scripts have difficulty segmenting words into phonemes. When the subjects were interviewed, most of them thought that English phoneme segmentation was the most difficult test and then phoneme deletion far overtake to the other tests.

After interviewing the subjects, our study concerns the reasons why the ranks of difficulty for Chinese students are different from other research in which subjects are English native speakers. One of the reason might be that readers whose first language is Chinese, a language written in a writing system quite different from that used for learning L2 English; indeed, the type of writing system is often claimed as a major factor affecting the processing route that readers use. They need more time to transfer from L1 to L2.

The other reason to be intended in this study, for the subjects’ responses, the author considered that the word structure differences will cause problems for subjects when
taking the segmentation test. We analyzed the differences between the Chinese phoneme segmentation and the English segmentation. In terms of the word structure, Chinese is a logographic writing system; within a stimulus word structure there are one to three phonemes in either the V, CV, CVE, CMV or CMVE phonemic forms. Compared with English, English stimulus words were composed with anywhere from two to five phonemes in either the CV, VC, CCV, CVC, CCVC, CVCC, CCCVC or CCVCC, etc. phonemic forms. Nevertheless, Chinese has no consonant clusters; each consonant can only stand with one vowel. Rather dissimilarly, English has more complex word structures such as consonant clusters, linking, and blending. As the consonant clusters or complex structure words were encountered, the subjects whose language background is Chinese tended to segment a stimulus into an onset and rhyme as opposed to individual phonemes.

4.3 Results of Individual Sub-tests

4.3.1 The Phoneme Recognition Test

In this test, 25 subjects tried to recognize the phonemes either in the initial or ending sounds of a stimulus word. There were 20 stimulus words on both the Chinese and the English tests. Nine pseudo-words were used on the English test and eleven pseudo-words were used on the Chinese test. Without showing the subjects these 20 stimuli, the researcher read these words to them while they were taking the test. Table 4 and Table 5 summarize the subjects’ results on both the English and the Chinese tests.
Table 4. The Results of the English Phoneme Recognition (EPR) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>thus</th>
<th>car</th>
<th>qose</th>
<th>broock</th>
<th>greet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>1 (4.0) a</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>plash</th>
<th>pour</th>
<th>shink</th>
<th>sleep</th>
<th>rame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (8.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>23 (92.0)</td>
<td>25 (100)</td>
<td>25 (100)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>truit *</th>
<th>vlaig</th>
<th>choick</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>10 (40.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>15 (60.0)</td>
<td>25 (100)</td>
<td>24 (96.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>hard</th>
<th>vonge</th>
<th>five</th>
<th>warm</th>
<th>talk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (8.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>23 (92.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ball</th>
<th>rosh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

Notes:

i: means the initial phoneme of the words listed is to be read out loud

f: means the final phoneme of the words listed is to be read out loud

a: “1” is the number of subjects who answered incorrectly on this stimulus and “4.0” is the percentage

*: means the word that caused the most difficulty for the participants than other words

As shown in table 4, all the subjects had fewer problems in this section. Most problems come to the word “truit” /tru:t/. When subjects are told to recognize the initial
sound /t/ for this word, ten subjects (40%) identified the wrong answer. Nine subjects (36.0%) gave /ʃ/ sound as the initial phoneme; one (4%) responded with the /tr/ sound. It seems that some subjects had difficulty with consonant clusters or were bothered from liquids /r/. Further information will be discussed below.

Table 5. The Results of the Chinese Phoneme Recognition (CPR) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄍㄧ</th>
<th>ㄊㄨㄝ</th>
<th>ㄑㄢ</th>
<th>ㄉㄧㄆ</th>
<th>ㄐㄧㄣ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/g/</td>
<td>/twɛ/</td>
<td>/ʃ/</td>
<td>/dɪo/</td>
<td>/dʒɪɛ/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>2 (8.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>23 (92.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄗㄧㄣ</th>
<th>ㄕㄨㄟ</th>
<th>ㄆㄧㄚ</th>
<th>ㄖㄧㄤ</th>
<th>ㄎㄧㄝ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/dʒɪəŋ/</td>
<td>/swe/</td>
<td>/pɪa/</td>
<td>/ʒɪəŋ/</td>
<td>/kɪɛ/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>13 (52.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>8 (32.0)</td>
<td>3 (12.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>12 (48.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>17 (68.0)</td>
<td>22 (88.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄊㄧㄚ</th>
<th>ㄈㄨㄢ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/tia/</td>
<td>/twaŋ/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄋㄛ</th>
<th>ㄘㄨㄛ</th>
<th>ㄕㄣ</th>
<th>ㄏㄨㄣ</th>
<th>ㄖㄟ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/ŋo/</td>
<td>/tswe/</td>
<td>/səŋ/</td>
<td>/hwəŋ/</td>
<td>/ze/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (8.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>23 (92.0)</td>
</tr>
</tbody>
</table>
As shown in Table 5, most problems come from “ㄓㄧㄣ” and “ㄖㄧㄤ”. Thirteen subjects (52%) identified the wrong answer in the stimulus “ㄓㄧㄣ” (similar to /dʒɪəŋ/ in IPA and two vowels with no break) and eight subjects (32%) gave incorrect answer for “ㄖㄧㄤ” (similar to /ʒɪəŋ/ in IPA and two vowels with no break). As for identifying the initial sound of the stimulus “ㄓㄧㄣ” /dʒɪəŋ/ the answer was supposed to be “ㄓ” /dʒ/ (like “j” in “judge” with tongue curled back). All of them gave /z/ as the initial phoneme instead of /dʒ/. For another problem in the stimulus “ㄖㄧㄤ” /ʒɪəŋ/, eight subjects
(32.0%) responded with the wrong answer. To identify the initial sound of this stimulus, the answer was supposed to be “ㄖ”/ʒ/ (like “s” in “pleasure”). Five subjects (20.0%) gave /z/ as the initial phoneme; the other three (12.0%) had /l/ instead of /ʒ/ as the answer. It seems that retroflection sounds such as “ㄓ” and “ㄖ” are difficult for some subjects to differentiate.

4.3.2 The Phoneme Segmentation Test

This test had the subjects divide the phoneme of each stimulus. Ten stimuli were used for both the English test and the Chinese test. Six pseudo-words were used in the English test but only one pseudo-word was used in the Chinese test. Without showing the subjects these 10 stimuli, the researcher read these words to them while they were taking the test. Table 6 and Table 7 summarize the subjects’ performances in the English and the Chinese tests.

Table 6. The Results of the English Phoneme Segmentation (EPS) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>fine</th>
<th>have</th>
<th>stop</th>
<th>grap</th>
<th>vooz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>5 (20.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>4 (16.0)</td>
<td>3 (12.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>20 (80.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>21 (84.0)</td>
<td>22 (88.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>quack *</th>
<th>theap</th>
<th>rasht *</th>
<th>shouge *</th>
<th>chooth *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>11 (44.0)</td>
<td>1 (4.0)</td>
<td>7 (28.0)</td>
<td>6 (24.0)</td>
<td>7 (28.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>14 (56.0)</td>
<td>24 (96.0)</td>
<td>18 (72.0)</td>
<td>19 (76.0)</td>
<td>18 (72.0)</td>
</tr>
</tbody>
</table>
Notes:

a: “5” is the number of subjects who answered incorrectly on this stimulus and “20.0” is the percentage.

*: means the word that caused the most difficulty

As shown in Table 6, many subjects had difficulty in the stimuli “quack” /kwæk/, “rasht” /ræʃt/, “shouge” /ʃəʊʒ/ and “chooth” /ʃθʊ/. As for the word “quack,” when subjects were told to segment the word “quack” into its individual phoneme as /kw-æ-k/ (three phonemes), eleven subjects (44.0%) changed the /kr/ sound into /kw/ sound as answer /k-r-æ-k/ (four phonemes). As for the word “rasht,” when subjects were asked to segment the word “rasht” into its individual phoneme /r-æ-ʃ-t/ (four phonemes), seven subjects (28.0%) answered incorrectly; most of them answered /ræ/ as one phoneme. As for the consonant digraphs word “shouge” and “chooth,” six subjects (24.0%) responded with the incorrect answers for the word “shouge” /ʃəʊʒ/ (three phonemes), three subjects (12%) transformed /ʃ/ into two phonemes, sounding like /ʃ/ and /ʊ/ or /ʃ/ and /u/, they responded the answer as /ʃʊəʊʒ/ or /ʃəʊʒ/, which is four phonemes. As for the stimulus “chooth” /ʃθʊ/, seven subjects (28.0%) gave the incorrect answer. All the subjects answered similar to the manner in which they answered “shouge”; they inserted a vowel followed by /ʃ/ sound and turned this three phonemes stimulus into four phonemes. To sum up this section, the subjects were confused with these phonemes /t/, /ʃ/ and /θ/. It
seems that some subjects are bothered by the liquids “r” and consonant digraphs words “sh” and “ch.”

Table 7. The Results of the Chinese Phoneme Segmentation (CPS) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄇㄟ</th>
<th>ㄉㄞ</th>
<th>ㄎㄨ</th>
<th>ㄌㄧ</th>
<th>ㄊㄧㄠ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar sound to IPA</td>
<td>/me/</td>
<td>/daI/</td>
<td>/ku/</td>
<td>/l/</td>
<td>/tual/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>1 (4.0)*</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>ㄐㄧㄤ</td>
<td>ㄔㄨㄣ</td>
<td>ㄖㄨㄢ</td>
<td>ㄒㄧㄢ</td>
<td>ㄗㄨㄞ</td>
</tr>
<tr>
<td>Similar sound to IPA</td>
<td>/tiaŋ/</td>
<td>/tuaŋ/</td>
<td>/zwan/</td>
<td>/meŋ/</td>
<td>/zuŋ/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>4 (16.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>21 (84.00)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

Notes:
a: “1” is the number of subjects who answered incorrectly on this stimulus and “4.0” is the percentage.
p: The pronunciation of the Chinese stimuli are similar to IPA and two vowels with no break.

The data in Table 7 reveals that there were fewer problems in this section. Most subjects can manipulate Chinese phoneme segmentation fairly well. One item is worth mentioning in regard to the stimulus “ㄖㄨㄢ” (similar to /zwan/ in IPA): when subjects
were instructed to segment the stimulus into “ㄖ” /z/ -“ㄨ” /u/ -“ㄢ”/n/, four subject answered /ʃ/ or /z/ as the initial sound.

4.3.3 The Phoneme Deletion Test

In this section, the subjects were told to remove a phoneme from a word and speak out loud the sounds that remain after the sound was omitted. Twenty-five stimuli were used for both the Chinese and English tests. Twelve pseudo-words were used on the English test and three pseudo-words were used on the Chinese test. Without showing the subjects these 25 stimuli, the researcher read these words to them while they were taking the test. Table 8 and Table 9 summarize the subjects’ performances on the phoneme deletion test.

Table 8. The Results of the English Phoneme Deletion (EPD) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>near-n&lt;sup&gt;b&lt;/sup&gt;</th>
<th>jam-m</th>
<th>hand-d</th>
<th>start-t(ending)</th>
<th>frock-f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>5 (20.0)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>20 (80.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>nice-ce</td>
<td>stop-st</td>
<td>stand-s</td>
<td>monkey-ey</td>
<td>think-n *</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>3 (12.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>5 (20.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>22 (88.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>20 (80.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>prate-te</td>
<td>bring-ng</td>
<td>pink-p</td>
<td>qesk-k(ending)</td>
<td>zarm-m *</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>4 (16.0)</td>
<td>0 (0.0)</td>
<td>3 (12.0)</td>
<td>6 (24.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>21 (84.00)</td>
<td>25 (100.0)</td>
<td>22 (88.0)</td>
<td>19 (76.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>Crood-d</td>
<td>thent-t(ending)</td>
<td>groupe-g</td>
<td>seter-s</td>
<td>sproon-n *</td>
</tr>
<tr>
<td>Incorrect</td>
<td>2 (8.0)</td>
<td>0 (0.0)</td>
<td>4 (16.0)</td>
<td>2 (8.0)</td>
<td>8 (32.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>23 (92.0)</td>
<td>25 (100.0)</td>
<td>21 (84.00)</td>
<td>23 (92.0)</td>
<td>17 (68.0)</td>
</tr>
</tbody>
</table>
As shown in the data, many subjects had difficulty with the stimuli “sproon” /sprʊŋ/, “tream” /trim/, “zarm” /zɑrm/ and “think” /θɪŋk/. For the word “sproon” /sprʊŋ/, when asking the subjects to delete the ending sound /n/ for the stimulus, eight subjects (32.0%) responded with incorrect answers; all of them omitted not only the final phoneme /n/ but also the /r/ sound for this stimulus, and responded with the answer /spʊ/ instead of the correct answer /sprʊŋ/. As for the word “tream” /trim/, eight subjects responded with incorrect answers while deleting the initial sound /t/. Seven subjects (28.0%) deleted the whole cluster /tr/ and replied with the answer /im/. One (4.0%) had no answer.

These answers seem to suggest that subjects had trouble with consonant clusters such as “spr”, “tr” and so on. Moreover, liquid r still stymied the subjects; as for the stimulus “zarm” /zɑrm/, six subjects (24%) responded incorrectly when they were told to
delete the final sound /ŋ/. All of the subjects omitted the /r/ sound after deleting the /ŋ/ sound. Instead of the correct answer /zar /, they responded with the answer /zal/.

Another finding in this section is also interesting. As for the stimulus “think” /θŋk/, five subjects (20%) responded with incorrect answers. When the subjects were asked to delete the /ŋ/ sound, the correct answer being /θtk/, three of them omitted not only the /ŋ/ sound but also the final sound /k/ and then answered /θk/ instead. Two subjects had no answer for this stimulus; they were unable to recognize the /ŋ/ sound.

Again, liquids /r/ is hard to differentiate for the subjects, especially when it appears with consonant clusters. Besides, the nasals /ŋ/ also bothered some subjects in this section when they appear in the middle of a word.

Table 9. The Results of the Chinese Phoneme Deletion (CPD) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄖㄠ-ㄠ</th>
<th>ㄢㄚ-ㄚ</th>
<th>ㄆㄢ-ㄆ</th>
<th>ㄈㄟ-ㄈ</th>
<th>ㄘㄡ-ㄡ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/ʒaʊ/</td>
<td>/tʃa/</td>
<td>/pəŋ/</td>
<td>/fe/</td>
<td>/tsʊ/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (8.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>23 (92.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>マー-メ</td>
<td>ラー-ラ</td>
<td>チュ-チュ</td>
<td>フへ-フ</td>
<td>ロフ-フ</td>
</tr>
<tr>
<td>Similar</td>
<td>/wɔŋ/</td>
<td>/ŋaʊ/</td>
<td>/dai/</td>
<td>/ʃe/</td>
<td>/tʃan^p/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>ユーム-ム</td>
<td>テー-ㄚ-ㄚ</td>
<td>ウー-ዎ</td>
<td>マー-ㄠ</td>
<td>ロメフ-ㄠ</td>
</tr>
<tr>
<td>Similar sound to IPA</td>
<td>/bɪŋ/</td>
<td>/ʃə/</td>
<td>/dɪəʊ/</td>
<td>/dʒɪə/</td>
<td>/kwai/</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>Incorrect</td>
<td>4 (16.0)</td>
<td>0 (0.0)</td>
<td>2 (8.0)</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>21 (84.00)</td>
<td>25 (100.0)</td>
<td>23 (92.0)</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>ㄑㄧㄝ-ㄝ ㄐㄩㄝ-ㄝ ㄖㄨㄛ-ㄛ ㄍㄨㄚ-ㄚ ㄗㄨㄛ-ㄛ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Similar sound to IPA</th>
<th>/ʃɪə/</th>
<th>/dʒʊə/</th>
<th>/ʒʊə/</th>
<th>/ɡwa/</th>
<th>/zwɔ/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>6 (24.0)</td>
<td>0 (0.0)</td>
<td>3 (12.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>19 (76.0)</td>
<td>25 (100.0)</td>
<td>22 (88.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>ㄒㄩㄣ-ㄣ ㄕㄧㄠ-ㄠ ㄖㄧㄢ-ㄢ ㄘㄨㄛ-ㄛ ㄍㄩㄝ- האש</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Similar sound to IPA</th>
<th>/ʃʊə/</th>
<th>/ʃəʊ/</th>
<th>/ʒʊə/</th>
<th>/tswɔ/</th>
<th>/ɡʊə/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
<td>13 (52.0)</td>
<td>1 (4.0)</td>
<td>5 (20.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
<td>12 (48.0)</td>
<td>24 (96.0)</td>
<td>20 (80.0)</td>
</tr>
</tbody>
</table>

**Notes:**

**a:** “1” is the number of subjects who answered incorrectly on this stimulus and “4.0” is the percentage.

**b:** “-” means the phoneme which showed follow by “-” was told to be deleted during the test.

***:** means the word that caused the most difficulty.

**p:** The pronunciation of the Chinese stimuli are similar to IPA and two vowels with no break.
The data in Table 9 pointed out that some subjects had problems in the stimuli “ㄖㄧㄢ” (similar to /3ıɛŋ/ in IPA and two vowels with no break) and “ㄖㄨㄛ” (similar to /3wɔ/ in IPA). As for the word “ㄖㄧㄢ”/3ıɛŋ/, the subjects were told to delete the final sound “ㄢ”/bO/; the correct answer was supposed to be ”ㄖㄧ”/3ı/. Thirteen subjects (52.0%) gave incorrect answers for this stimulus; eleven subjects (44.0%) responded /2ı/ instead of the correct answer /3ı/ after deleting the final sound. Two subjects (8.0%) omitted not only the final sound “ㄢ”/bO/, but also the vowel /t/ sound and then responded with only “ㄖ”/3/. As for the word “ㄖㄨㄛ”/3wɔ/, when subjects were told to delete “ㄛ”/ɔ/ sound, the correct answer should have been “ㄖㄨ”/3u/. Six subjects (24%) responded with incorrect answers. All of them pronounced /3u/ as /2u/. In this section, it seems that the retroflection “ㄖ”/3/ sound still causes problems for some subjects.

4.3.4 Syllable Deletion Test

In this test, the subjects were told to remove an assigned syllable from a stimulus word and pronounce the remaining part. Based on the Chinese orthographic system, the author judged that in the Chinese system, one character has one syllable, but within the Zhuyin system, in order to identify the syllable, one character includes onset and rhyme and its syllable structure is dissimilar from English; therefore, the syllable deletion test was not considered. Only the English syllable deletion was analyzed. Thirteen English
stimuli were used and four of them were pseudo-words. Without showing the subjects these 13 stimuli, the researcher read these words to them while they were taking the test. Table 10 shows the result of subjects’ performance.

Table 10. The Results of the English Syllable Deletion (ESD) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>cucumber –c</th>
<th>decision –de</th>
<th>birthday –day</th>
<th>saturday –sa</th>
<th>complain-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>u^b</td>
<td></td>
<td></td>
<td></td>
<td>com</td>
</tr>
<tr>
<td>Incorrect</td>
<td>0 (0.0)^a</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>customer -to</th>
<th>classmate-mate</th>
<th>december-cem</th>
<th>basketball-ba</th>
<th>throupra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>2 (8.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>23 (92.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>raisharem-sha</th>
<th>vanpin -pin</th>
<th>qauthran-ran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>3 (12.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>22 (88.0)</td>
</tr>
</tbody>
</table>

Notes:

a: “0” is the number of subjects who answered incorrectly on this stimulus and “0.0” is the percentage.

b: “-” means the syllable that was shown followed by “-” was asked to be deleted during the test.
As the Table shows, this section for all subjects was easier than other sections. For the participants in this study, comparing the position and deleting the “middle” sound are more difficult than deleting the initial and final sounds.

4.3.5 The Pseudo-Word Test

This section seeks to examine the subjects’ ability of English grapheme-phoneme correspondence and the knowledge of blending phonemes through reading the pseudo-words out loud. Twenty stimuli were used on both the English and Chinese tests. The subjects were allowed to practice in this section; 20 stimuli were shown to the subjects for them to practice before the test commenced. After practicing, the subjects were asked to read these 20 stimuli out loud. Table 11 and Table 12 present the subjects’ performances on these tests.

Table 11. The Results of the English Pseudo-Word Reading (EPW) (N=25)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Jaong</th>
<th>nox</th>
<th>thaision</th>
<th>Yuper</th>
<th>shoit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incorrect</strong></td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>2 (8.0)</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td><strong>Correct</strong></td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>23 (92.0)</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>roizer</td>
<td>jouge</td>
<td>stroock</td>
<td>Qouris</td>
<td>whasher</td>
</tr>
<tr>
<td><strong>Incorrect</strong></td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Correct</strong></td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
</tr>
<tr>
<td>Stimulus</td>
<td>theng</td>
<td>chong</td>
<td>racho</td>
<td>Voage</td>
<td>drayer</td>
</tr>
<tr>
<td><strong>Incorrect</strong></td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>zamch</td>
<td>larision</td>
<td>wition</td>
<td>vrut *</td>
<td>thorush</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>Stimulus</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
<td>25 (100.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
</tr>
<tr>
<td>Incorrect</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
<td>6 (24.0)</td>
<td>1 (4.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
<td>19 (76.0)</td>
<td>24 (96.0)</td>
</tr>
</tbody>
</table>

Notes:

a: “1” is the number of subjects who answered incorrectly on this stimulus and “4.0” is the percentage.

*: means the word that caused the most difficulty.

As the table shows, English pseudo-words offer the least difficulty for subjects compared with other sections. The most significant problem comes from the stimulus “trut” /vrʊt/. The results indicate that either the consonant cluster or the retroflex confused some subjects. As for the stimulus “vrut” /vrʊt/, six subjects (24.0%) gave incorrect answers. Among these subjects, three of them (12.0%) pronounced the consonant /r/ as the retroflection vowel /ɜ/, and then responded with the answer /vɜːt/; they changed the word structure from CCVC into CVC for the stimulus “vrut.” Three subjects (12.0%) inserted a vowel such as /ə/ or /u/ followed by /v/ (e.g., /vəɾət/ or /vəɾət/). They also changed the word structure from CCVC into CVCVC. All of the
subjects pronounced the word “vrut” as a two-syllable word. This issue might be caused by the consonant cluster problem, liquid sounds, or syllable structure problems.

Table 12. The Results of the Chinese Pseudo-Word Reading (CPW)

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄓㄟ</th>
<th>ㄆㄩ *</th>
<th>ㄗㄛ</th>
<th>ㄍㄩ *</th>
<th>ㄏㄣ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/ʒe/</td>
<td>/pü/</td>
<td>/zü/</td>
<td>/gü/</td>
<td>/hæŋ/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>3 (12.0)</td>
<td>12 (48.0)</td>
<td>2 (8.0)</td>
<td>9 (36.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>22 (88.0)</td>
<td>13 (52.0)</td>
<td>23 (92.0)</td>
<td>16 (64.00)</td>
<td>25 (100.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄅㄩ</th>
<th>ㄕㄦ</th>
<th>ㄊㄟ</th>
<th>ㄐㄧㄤ</th>
<th>ㄖㄧㄚ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/cü/</td>
<td>/ʃu/</td>
<td>/te/</td>
<td>/ʃiŋ/</td>
<td>/ʃia/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>10 (40.0)</td>
<td>0 (0.0)</td>
<td>1 (4.0)</td>
<td>1 (4.0)</td>
<td>8 (32.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>15 (60.0)</td>
<td>25 (100.0)</td>
<td>24 (96.0)</td>
<td>24 (96.0)</td>
<td>17 (68.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄈㄨㄠ</th>
<th>ㄗㄨㄞ</th>
<th>ㄎㄧㄤ</th>
<th>ㄙㄧㄡ</th>
<th>ㄆㄨㄤ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/gx/</td>
<td>/x/</td>
<td>/lx/</td>
<td>/t/</td>
<td>/q/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>10 (40.0)</td>
<td>0 (0.0)</td>
<td>3 (12.0)</td>
<td>6 (24.0)</td>
<td>5 (20.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>15 (60.0)</td>
<td>25 (100.0)</td>
<td>22 (88.0)</td>
<td>19 (76.0)</td>
<td>20 (80.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>ㄌㄧㄟ</th>
<th>ㄇㄨㄚ</th>
<th>ㄎㄨㄧ</th>
<th>ㄉㄧㄤ</th>
<th>ㄕㄩㄝ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar</td>
<td>/MJ/</td>
<td>/N/</td>
<td>/lx/</td>
<td>/e/</td>
<td>/ü/</td>
</tr>
<tr>
<td>Incorrect</td>
<td>4 (16.0)</td>
<td>5 (20.0)</td>
<td>1 (4.0)</td>
<td>5 (20.0)</td>
<td>9 (36.0)</td>
</tr>
<tr>
<td>Correct</td>
<td>21 (84.00)</td>
<td>20 (80.0)</td>
<td>24 (96.0)</td>
<td>20 (80.0)</td>
<td>16 (64.0)</td>
</tr>
</tbody>
</table>

Notes:
a: “3” is the number of subjects who answered incorrectly on this stimulus and “12.0” is the percentage.

*: means the word that caused the most difficulty.

p: The pronunciation of the Chinese stimuli are similar to IPA and two vowels with no break.

As the data shows in Table 12, this section is the most difficult section on the Chinese tests. Many subjects had difficulty with the stimuli “ㄆㄩ”, “ㄍㄩ”, “ㄅㄩ”, “ㄕㄩㄝ”, “ㄖㄧㄚ”, and “ㄈㄨㄠ”. Twelve subjects (48.0%) had difficulty with pronouncing the word “ㄆㄩ” (similar to /pü/). Among the twenty five subjects, seven of them (28.0%) pronounced the word as /pju/; four of them (16.0%) pronounced it as /pju/; one of them (4.0%) pronounced it as /pt/. Nine subjects (36.0%) had difficulty in pronouncing the word “ㄍㄩ” (similar to /gʊ/). All of them pronounced this stimulus as /gʊ/. Ten subjects (40.0%) had trouble in pronouncing “ㄅㄩ” (similar to /byʊ/). Seven of them (28.0%) pronounced it as /byʊ/; three of them (12.0%) pronounced it as /bju/. Nine subjects (36.0%) had difficulty with pronouncing the word “ㄕㄩㄝ” (similar to /juə/ in IPA and two vowels with no break). These nine pronounced this stimulus as /jʊə/. These four words have same phoneme as the “ㄩ” sound (similar to /yu-/ ü). The Zhuyin Fuhao sound “ㄩ” /ü/ either stands individually or is followed by a consonant. In the latter example, the word structure is followed by the CV structure,
and it seems to have intimidated the subjects. Moreover, eight subjects (32.0%) had problems pronouncing the word “ㄖㄧㄚ” (similar to /ʒa/ in IPA and two vowels with no break). Seven of the subjects (28.0%) pronounced the sound as /ʒa/, and one of the subjects (4.0%) pronounced it as /ʤa/. It must be noted again that retroflection sounds gave the subjects some level of difficulty. Furthermore, ten subjects (40.0%) had difficulty with pronouncing the word “ㄈㄨㄠ” (similar to /fɯə/ in IPA and two vowels with no break); they missed the “ㄨ” (similar to /u/ in IPA) sound while pronouncing this word (e.g., /fɯə/).

4.4 Analysis of Individual Sub-tests

The results of the subjects’ performances on individual tests should be discussed. As noted previously, the subjects’ first language background affects their second language in phonological awareness performance. Some specific sounds, such as consonant clusters, consonant digraphs, retroflection, rhotacized, liquid and nasals caused the 25 subjects to encounter problems while taking the tests. In further sections, these difficulties will be discussed.

4.4.1 The Results of the Test Difficulty and the Influence from Language Background
Table 13 indicates the significant correlation of the more difficult stimuli contained in the Chinese and English phonological awareness tests for these 25 subjects. To summarize the results, the stimulus “ㄖㄧㄤ”/3iæŋ/ had significant correlations with the English stimuli “truit” (r = .490, p < .05), and “vrut” (r = .418, p < .05). The Chinese stimulus “ㄖㄨㄢ”/3wəŋ/ had significant correlations with the English stimuli “chooth” (r = .457, p < .05) and “sproon” (r = .402, p < .05). The Chinese stimulus “ㄖㄧㄢ”/3iæŋ/ had a significant correlation with the English stimulus “think” (r = .480, p < .05). The Chinese stimulus “ㄖㄧㄚ”/3iɑ/ had a significant correlation with English stimuli “truit” (r = .490, p < .05), “shouge” (r = .490, p < .05) and “sproon” (r = .449, p < .05).

Table 13. The Significant Correlation of More Difficult Stimuli Contained in the Chinese and English Phonological Awareness Tests (N=25)

<table>
<thead>
<tr>
<th></th>
<th>CSR17</th>
<th>CPS8</th>
<th>CPD18</th>
<th>CPD23</th>
<th>CPW10</th>
</tr>
</thead>
<tbody>
<tr>
<td>ㄖㄧㄤ</td>
<td>.490(*)</td>
<td>.089</td>
<td>-.076</td>
<td>.294</td>
<td>.490(*)</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.013</td>
<td>.672</td>
<td>.716</td>
<td>.153</td>
<td>.013</td>
</tr>
<tr>
<td>ㄖㄨㄛ</td>
<td>.083</td>
<td>.053</td>
<td>.068</td>
<td>.045</td>
<td>.083</td>
</tr>
<tr>
<td>ㄖㄧㄢ</td>
<td>.694</td>
<td>.802</td>
<td>.747</td>
<td>.830</td>
<td>.694</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>-.046</td>
<td>.214</td>
<td>.275</td>
<td>.243</td>
<td>.145</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.828</td>
<td>.305</td>
<td>.183</td>
<td>.243</td>
<td>.489</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.016</td>
<td>.266</td>
<td>.123</td>
<td>-.022</td>
<td>.418(*)</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.939</td>
<td>.199</td>
<td>.559</td>
<td>.915</td>
<td>.038</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.145</td>
<td>.457(*)</td>
<td>.275</td>
<td>.064</td>
<td>.145</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.489</td>
<td>.022</td>
<td>.183</td>
<td>.760</td>
<td>.489</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>-.129</td>
<td>.055</td>
<td>.187</td>
<td>.480(*)</td>
<td>.086</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.540</td>
<td>.796</td>
<td>.370</td>
<td>.015</td>
<td>.684</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.217</td>
<td>.010</td>
<td>.123</td>
<td>.165</td>
<td>.016</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td>.298</td>
<td>.961</td>
<td>.559</td>
<td>.431</td>
<td>.939</td>
</tr>
</tbody>
</table>
The results demonstrated that for native Chinese speakers, L1 background affects the L2 phonological awareness experience. As can be realized from the table, most of the subjects have difficulty with the Chinese phoneme “ㄖ” (similar to /ʃ/ in IPA) as a retroflection. In Taiwan, most students had been taught that the “ㄖ/ʃ/” sound is similar to /s/ as in the word red in English; seeing this, in some situations, the subjects will treat the “ㄖ” sound as the /s/ sound while taking the test. Obviously, if the subjects have problems with pronouncing the “ㄖ/ʃ/” sound, they easily encountered the problems in pronouncing certain English stimuli, as *truit, shouge, think, sproon, and vrut*. One of the possible reasons for this difficulty is that in Chinese, the “ㄖ/ʃ/” sound can only be situated at the beginning of a word. When subjects treat the “ㄖ/ʃ/” sound as /s/ in the words *truit, sproon,* and *vrut*, it is hard for them to recognize that the /s/ sound is in the second or third positions of a word.

The other possible cause of this difficulty is that the “ㄖ/ʃ/” sound is a fricative in phonetic systems. It is as the same as the “sh /ʃ/” sound in *shouge* and the “th /θ/” sound in *think*. In the same oral positions from where this phonetic sound emanates, subjects
who have problems with pronouncing the “ㄖ /z/” sound would have a higher possibility of encountering some level of difficulty with pronouncing the /ʃ/ sound, as in the word *shoug* and /θ/ as in the word, *think*.

### 4.4.2 The Consonant Clusters Difficulty

It is important to note that no consonant clusters are contained in the Chinese system’s sound structure. Based on this background language, the Chinese retroflection sound “ㄖ” /z/ led to some problem for the subjects when they worked with the English consonant clusters “tr”, “vr” and “spr”. Table 14 shows the significant correlation of consonant clusters of the difficult stimuli for the 25 subjects.

**Table 14. The Significant Correlation of Consonant Clusters**

<table>
<thead>
<tr>
<th></th>
<th>truit /�� /zɪən/</th>
<th>Vrut /ㄩ /zɪa/</th>
<th>sproon /ㄫ /zɪan/</th>
</tr>
</thead>
<tbody>
<tr>
<td>ㄖㄧㄤ</td>
<td>.490(*)</td>
<td>.418(*)</td>
<td></td>
</tr>
<tr>
<td>ㄖㄧㄚ</td>
<td></td>
<td>.490(*)</td>
<td>.449(*)</td>
</tr>
<tr>
<td>ㄖㄨㄢ</td>
<td></td>
<td>.402(*)</td>
<td></td>
</tr>
</tbody>
</table>

- p < .05

Table 14 shows that the consonant cluster stimulus “truit” had significant correlation with the stimuli “ㄖㄧㄤ” /zɪən/ and “ㄖㄧㄚ” /zɪa/. The stimulus “vruit” had significant correlation with “ㄖㄨㄢ” /zɪa/. The stimulus “sproon” had significant correlation with
“ㄖㄧㄚ” /3ɑ/ and “ㄆㄢㄢ” /3waŋ/. In Chinese, students have been taught that only one Zhuyin Fuhao (phoneme) sound is similar to the English liquid /t/ sound, which is the retroflection sound “ㄖ”; thus, when the subjects worked with English stimuli related to the liquid /t/, they usually understood it as the Zhuyin Fuhao sound “ㄖ”. However, this retroflection is only located at the initial word position and is always associated with a vowel. Bruck (1990) discussed the characteristic of the first phoneme effects on multiple clusters. The second phoneme is more easily ignored than the initial one, and the third phoneme is omitted with even less difficulty than the previous two. Based on Bruck’s study and the effects of learning the Chinese language for the subjects, when the subjects worked with the English liquid “r” sound in the second or third position of a word, they easily failed to answer correctly.

Another factor that caused some difficulty with these words for the subjects in this study might be the English consonant cluster. Stemberger and Treiman (1986) investigated this concept and found that native English-speaking children, and even adults on occasion, encounter difficulties with consonant clusters. Snowling (1994) pointed out that the problem with consonant clusters not only occurred in two-phoneme clusters, but also in three-phoneme clusters. The English phoneme recognition test, phoneme deletion test, and pseudo-word test showed that these subjects had difficulty with the second phoneme of two-phoneme consonant clusters as well as with the third phoneme of three-phoneme consonant clusters. In Chinese, consonant clusters do not exist, so in this study, the subjects obviously had difficulty with consonant clusters. They
tended to treat the consonant cluster (e.g., “tr”) as one phoneme. In an example from the phoneme recognition test, when subjects were asked to identify the initial sound of the stimulus “truit,” the correct answer was supposed to be /t/. Instead, many subjects responded with /ʃ/ or /tr/ as the answer. In sum, the dissimilarity of the retroflection “ㄖ” /ʒ/ and the liquid “r,” the position of “ㄖ” and the lack of a consonant cluster all caused the subjects to have some degree of difficulty with this part of the study. For instance, on phoneme deletion test, when subjects were asked to pronounce “sproon” after deleting the final sound /ŋ/, most of them responded as “spoo” (the /r/ sound was missing); additionally, when the subjects were asked to pronounce the stimulus “tream” after deleting the initial sound /t/, they responded “eam” (the /r/ sound was again omitted). Another example was observed in the pseudo-word reading section: their difficulty in reading the stimulus “vrut.” These examples again provided an illustration that all pronunciations were influenced by the subjects’ first language and had an effect on the English consonant cluster and the liquid “r.”

4.4.3 Difficulty with Consonant Digraphs

On the English phoneme segmentation test, the subjects had difficulty with two consonant digraph stimuli: “shouge” and “chooth.” Six subjects (24.0%) responded with the incorrect answers for the word “shaoge” /ʃ-aʊ-ʒ/. Seven subjects (28.0%) gave the wrong answer for “chooth” /ʃ-tθ/. These two stimuli were composed of the consonant digraphs “sh” /ʃ/ and “ch” /ʃ/ as the initial sound. The fact that the subjects had difficulty
with this test might stem from Chinese Zhuyin Fuhao. In Chinese Zhuyin Fuhao, there are not any phonemes that can exactly represent these consonant digraphs. Similarly, some subjects use “ㄒㄩ” (similar to the /jü/ sound in IPA) to represent the sound “sh” /ʃ/ and use “ㄑㄩ” (similar to /fu jü/ in IPA) to represent the sound “ch” /ɻ/. So when the subjects encounter the word related to “sh” or “ch,” they will pronounce these sounds as “ㄒㄩ” /ʃu/ or “ㄑㄩ” /fu jü/. Nevertheless, within the syllables of “ㄒㄩ” and “ㄑㄩ,” there are two phonemes that follow the structure of CV phoneme form, which is a consonant with a vowel. Compared with “sh” /ʃ/ and “ch” /ɻ/ in English, they are consonant digraphs that are pronounced simply as one phoneme. For this dissimilarity, some subjects segment the stimulus “shouge” /ʃ-ʊ-ɡ/ (three phonemes) into /ʃ-ʊ-ʊ-ɡ/ (four phonemes) and segment the stimulus “chooth” /ɻ-ʊ-ʊ-θ/ (three phonemes) into /ɻ-ʊ-ʊ-θ/ (four phonemes).

4.4.4 The Rhotacized Difficulty

In this study, some subjects failed to perceive the /r/ sound at the end of a syllable. As for the word “zarm” in the phoneme deletion test, when the subjects were asked to delete the ending sound /m/ and pronounce the remaining sound “zar,” some subjects responded /za/ instead of the correct answer, /zar/. One could say that the omission of the final sound /r/ is caused by the subjects’ first language background. No Chinese phoneme sounds like the /r/ sound after a vowel. According to the pronunciation, this /r/ sound is similar to the rhotacized vowels “/ɻ/” (similar to the /s/ or /ʃ/ sounds in IPA) in Chinese
Zhuyin Fuhao. This Chinese rhotacized vowel “(`/\`)”/3/ never stands in the final or initial position of a syllable; instead, it only occurs individually as a syllable. Therefore, when the subjects worked on the sound /zar/, the final /r/ sound is less sensitive. This is the reason why some subjects failed to respond with the correct answer for the stimulus “zarm.”

### 4.4.5 The Nasal Problem

In the English phoneme deletion test, some subjects had difficulty with nasal sounds. In Chinese Zhuyin Fuhao, there are the “ㄢ” (similar to /aN/ in IPA), “ㄣ” (similar to /aN/ in IPA), “ㄤ” (similar to /aŋ/ in IPA), and “ㄥ” (similar to /oŋ/ in IPA) sounds that relate to the nasal sound. These Chinese nasal sounds are composed of two phonemes in English. When the subjects encounter English nasals /n/, /ŋ/ and /ŋ/ in everyday conversation, they might pronounce them as “ㄢ” /aN/, “ㄣ” /aN/, “ㄤ” /aŋ/, and “ㄥ” /oŋ/ in Chinese. However, all the nasal phonemes in Chinese are vowels, they can stand individually as the V phoneme form, or stand as a rhyme as the CV form, but they never come before a consonant or are considered to be an onset phoneme. Based on the dissimilar phoneme structure of Chinese nasals, the subjects had difficulty when they encountered English nasals that are not in the final phoneme. The word “think” /θŋk/ in the English phoneme deletion test is a good example. When subjects were asked to delete the third phoneme /ŋ/ sound from “think,” some of the subjects had problems recognizing the /ŋ/ sound or responded with /θŋ/, and both /ŋ/ and /k/ were omitted.
4.4.6 Further Difficulties

Another point that was found in this study concerned the word “vrut” on the English pseudo-word reading test. Some subjects pronounced the word “vrut” /vət/ (one syllable) as /vəɾt/ or /vʊɾt/ (two syllables). They inserted a vowel after the consonant /v/. From this viewpoint, we could say this finding might originate from the educational background in Taiwan. Taiwanese students are usually taught to make an epenthesis of the schwa /ə/ to an isolated consonant to help in pronouncing “manifestly” and to be heard clearly. This instruction might lead the subjects to insert one vowel after the consonant /v/.

Another possible factor could be Chinese syllable structures. With Chinese syllable structures, one syllable can be composed of the structure as any of the V, CV, CVE, CMV, or CMVE phoneme forms. Except for the fact that some vowels can stand individually, consonant always follow a vowel; they cannot stand individually to build a word. Moreover, Chinese has no consonant clusters, no syllable structure as the stimulus “vrut,” which is CCVC phoneme forms. Therefore, when the subjects encounter the structure as CCVE phoneme forms in English, a “schwa” /ə/ is simply inserted within a word, followed by a consonant to build the word structure in the CV phoneme form.

4.5 The Correlations of the Tests

4.5.1 Relative Overall View of the Chinese Phonological Awareness Test and the English Phonological Awareness Test
Knowing that a learner’s L1 background might affect L2 acquisition, this study provides the data to show the relationship between the Chinese phonological awareness test and the English phonological awareness test. This result for the Chinese and the English phonological awareness tests was intended to answer the first research question: Does L1 intra-word phonological awareness experiences affect L2 phonological awareness among EFL learners with nonalphabetic L1 backgrounds? As the results show, the answer should be yes. Table 15 concludes that Chinese phonological awareness has an effect on English phonological awareness. The total Chinese phonological awareness score has a highly significant correlation with the total English phonological awareness score ($r = .672, p < .01$). This is again conducted that for Taiwanese students, their L1 phonological experiences do have an effect on their L2 phonological awareness with their non-alphabetic L1 backgrounds. That means that if Taiwanese students perform well with Chinese phonological awareness, this ability will have some positive benefits on acquiring English phonological awareness.

**Table 15. The Significant Correlations between the English and Chinese Phonemic Awareness Tests**

<table>
<thead>
<tr>
<th></th>
<th>TC</th>
<th>TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>1.000</td>
<td>.672</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.000</td>
</tr>
</tbody>
</table>

Moreover, the subjects’ performances on the English phonological awareness tests and the Chinese phonological awareness tests, and the results analysis of the test
difficulty and the influence from language background, assist in addressing and answering the second research question: How do L1 experiences effect L2 phonological awareness among EFL students with nonalphabetic L1 orthographic backgrounds? In addition, Table 16 shows that the entire Chinese phonological awareness test is positively correlated with English. All of the Chinese tests show a significant correlation with the English phoneme deletion test and the English pseudo-word test. Because of this, the test correlations will be discussed below.

The interrelations between the various phonological processing tests are presented in Table 16. Some show greater correlations than the others. The results show that each test of Chinese phonological awareness has a positive relationship with both the English phoneme deletion test and the English pseudo-word reading test. As for the significant correlation of English pseudo-word reading test, the tests that correlate highest do so with the Chinese phoneme recognition test (r = .674, p<.01). The second highest are with the Chinese pseudo-word reading test (r = .667, p< .01). The third highest are with the Chinese phoneme deletion test (r = .555, p<.01). The fourth highest are with the Chinese phoneme segmentation test (r = .487, p<.05).

As for the significant correlation of English phoneme deletion test, the tests that correlate highest are with the Chinese phoneme recognition test (r = .463, p <05.).The second highest are with the Chinese pseudo-word (r = .439, p< .05). The third highest are with the Chinese phoneme deletion (r = .407, p < .05.) and the fourth highest are with the Chinese phoneme segmentation test. Each of the Chinese phonological awareness tests
showed a higher correlation with the English pseudo word reading test than with the English phoneme deletion test.

Table 16. The Significant Correlations for both English and Chinese Phonemic Awareness

<table>
<thead>
<tr>
<th></th>
<th>EPD</th>
<th>EPS</th>
<th>EPW</th>
<th>EPR</th>
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<tbody>
<tr>
<td>CPD</td>
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<td>.394</td>
<td>.555**</td>
<td>.226</td>
</tr>
<tr>
<td></td>
<td>.043</td>
<td>.051</td>
<td>.004</td>
<td>.276</td>
</tr>
<tr>
<td>CPS</td>
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<td>.313</td>
<td>.497*</td>
<td>.265</td>
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<tr>
<td></td>
<td>.044</td>
<td>.127</td>
<td>.011</td>
<td>.201</td>
</tr>
<tr>
<td>CPW</td>
<td>.439*</td>
<td>.346</td>
<td>.667**</td>
<td>.274</td>
</tr>
<tr>
<td></td>
<td>.028</td>
<td>.090</td>
<td>.000</td>
<td>.186</td>
</tr>
<tr>
<td>CPR</td>
<td>.463*</td>
<td>.391</td>
<td>.674**</td>
<td>.215</td>
</tr>
<tr>
<td></td>
<td>.020</td>
<td>.053</td>
<td>.000</td>
<td>.301</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed).

According to Huang and Hanley (1994), Chinese Zuyin Fuhao is recognized as a basic alphabetic phonic system. They pointed out that Chinese is a simple syllable language system; children whose first language is Chinese are less sensitive to English rhyme than children whose native languages have an alphabetic system. According to previous research (Mann, 1987; Read, Zhang, Nie, & Ding, 1987), we know that for Taiwanese students, learning English is complicated. As for the results in this study, the first language background for the Taiwanese students has an effect on some parts of their English phonological awareness. Knowing the correlation between Chinese and English
could help Taiwanese students avoid the difficulty in learning English when they are older.

Ziegler and Goswami (2005) indicated that Taiwanese students have learned the Zuyin Fuhao system when they were in the first grade and the second grade. Hence, first grade and second grade Taiwanese students are provided with a basic phonological awareness ability. In accordance with these circumstances, the subjects in this study have an average English education length of 11.48 years and an average Zhyin Fuhao education length of 2.6 years. Therefore, all the subjects have basic phonological awareness ability even though they have never been trained in English phonological awareness. As the result shown in Table 16, the Chinese phonological awareness tests (phoneme deletion, phoneme segmentation, pseudo-word reading, and phoneme recognition) are significantly correlated with the English phoneme deletion test and the English pseudo-word test. In summary, for Taiwanese learners, knowing the correlation with the English phoneme deletion and the pseudo-word reading can be enhanced by using their Chinese language background as support when learning English phoneme deletion and pseudo-word reading. Accordingly for the native English speakers, knowing the correlation with the Chinese phonological awareness test, they also can use their abilities of English phoneme deletion and the pseudo-word reading as a reference when learning Chinese.

Yopp (1988) concluded that phoneme recognition includes the ability of phoneme deletion or phoneme segmentation. This helps the learner to succeed in his or her future efforts to read pseudo-words. Moreover, by obtaining the skill of phoneme deletion,
learners are able to segment the phonemes of a stimulus, which is like the ability in phoneme segmentation. To be able to obtain the skill of phoneme segmentation, learners need to recognize the individual phoneme of a stimulus, which is like the ability of phoneme recognition. Table 17 shows the significant correlation of the English phonological awareness tests. The data indicates that English phoneme deletion has a significant relationship to the phoneme segmentation test \((r = .699, p < .01)\) and the pseudo-word reading test \((r = .408, p < .05)\). The phoneme segmentation test is highly correlated to the pseudo-word reading test \((r = .400, p < .05)\).

Table 17. The Significant Correlation of English Phonological Awareness Tests

<table>
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<tr>
<th></th>
<th>EPD</th>
<th>EPS</th>
<th>EPW</th>
<th>EPR</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td>.047</td>
<td>.272</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

This data seems to verify the correlation between the abilities of English phoneme deletion, phoneme segmentation, and pseudo-word reading. This result is similar to Yopp’s study, which showed that in order to be able to handle pseudo-words, the abilities in English phonological awareness tests are indispensable for native Chinese speakers.

Knowing phonological awareness has substantial influences in both the Chinese and English languages. People who have learned Chinese “Zhuyin Fuhao” can help in
developing their phonological awareness ability (Huang & Hanley, 1997). Consequently, enhancing Chinese phonological awareness will help the improvement of some parts of English phonological awareness. Furthermore, knowing how to enhance Chinese phonological awareness by understanding the relationship of the Chinese phonological awareness tests is needed.

Table 18 shows the significant correlation of the Chinese phonological awareness tests. The phoneme deletion test is highly correlated with the pseudo-word reading (r = .521, p < .01) and phoneme recognition test (r = .763, p < .01). The phoneme segmentation test is significantly related to the pseudo-word reading test (r = .505, p < .05) and the phoneme recognition test (r = .512, p < .01). The pseudo-word reading test shows a significant relationship to the phoneme recognition test (r = .660, p < .01).

Table 18. The Significant Correlation of Chinese Phonological Awareness Tests

<table>
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<th>CPD</th>
<th>CPS</th>
<th>CPW</th>
<th>CPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPD</td>
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<td>.245</td>
<td>.521</td>
<td>.763</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.239</td>
<td>.008</td>
<td>.000</td>
</tr>
<tr>
<td>CPS</td>
<td>.245</td>
<td>1.000</td>
<td>.505*</td>
<td>.512**</td>
</tr>
<tr>
<td></td>
<td>.239</td>
<td></td>
<td>.010</td>
<td>.009</td>
</tr>
<tr>
<td>CPW</td>
<td>.521*</td>
<td>.505*</td>
<td>1.000</td>
<td>.660</td>
</tr>
<tr>
<td></td>
<td>.008</td>
<td>.010</td>
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</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*
. Correlation is significant at the 0.05 level (2-tailed).
This result suggests that among the Chinese phonological awareness tests, each of them are significantly related to each other. According to view from the research by Gottardo, Siegel, and Stanovich (1997), not only does English phonological processing administer principle effects on English word reading, but Chinese phonological awareness does so as well. Again, more competent Chinese phonological processing skills can improve reading performance in English as a foreign language. As a result, learners with a higher Chinese phonological awareness ability help in manipulating English phonological awareness, especially for achieving the accuracy of English phoneme deletion and pseudo-word reading. Furthermore, the understanding that all of the Chinese phonological awareness tests are significantly connected requires all of the Chinese phonological awareness skills: phoneme deletion, phoneme segmentation, pseudo-word reading and phoneme recognition.
Chapter 5

Conclusion

This chapter involves three sections. The first section describes the limitations of this study and provides some suggestions for further study. In the second section, an overview of the major findings of the study will be discussed. Finally, suggestions will be made in the third section regarding the teaching implications for helping Taiwanese students when learning English.

5.1 Limitations

The tentative results of the current study require future research to confirm the findings. The phonological awareness tests in this study contained five subtests in English: phoneme recognition, phoneme segmentation, phoneme deletion, syllable deletion, and pseudo-word reading. Four subtests were used in Chinese: phoneme recognition, phoneme segmentation, phoneme deletion, and pseudo-word reading. Two limitations of this study are acknowledged. The first limitation is the small number of subjects, which in turn limits the generalizability. In this study, only 25 Taiwanese subjects were used, and all were students from Kent State University. The second limitation is that, perhaps, this study would have had different results if a native speaker of English would have helped in administering the tests. Also, if a greater number of
subjects had participated, or if their length of English education were significantly different, the outcome of this study could have been changed drastically.

5.2 Summary of the Major Findings

Similarly, the subjects’ performances indicated the influence by their first language background, Mandarin Chinese. The finding of this study indicates that the Chinese phonological awareness (phoneme recognition, phoneme deletion, phoneme segmentation and pseudo-word reading) of EFL Taiwanese students is strongly related to the skills of the English phoneme deletion and phoneme pseudo-word reading.

We should answer research question one, “Does L1 intraword phonological experience have any influence in their processing of L2 phonological awareness?” The results of multiple analyses indicate that the answer should be yes. It can be pointed out that Taiwanese learners can enhance their Chinese phonological awareness (Zhuyin Fuhao) as a support to increase the success in their later learning of English phoneme deletion and pseudo-word reading. Betourne and Frie-Petti (2003) demonstrated that phonological awareness could be a rather useful tool to help less-advanced readers of Chinese to be more advanced readers in English. It follows, then, that for the native-English speakers, if they know the correlations between Chinese and English, they also can use their abilities in English phoneme deletion and pseudo-word reading as a utilitarian method of support when learning Chinese.

In terms of the difficulties of Chinese phoneme recognition, phoneme segments, phoneme deletes, pseudo-word reading, and their knowledge of Chinese syllable structure,
these skills proved to have a positive contribution to the subjects’ phonological process of English.

Another concern is found in answering the second research question: “How does L1 experience affect L2 phonemic awareness among EFL students with nonalphabetic L1 orthographic backgrounds?” The results showed that among these 25 subjects, if there is one who has a difficulty in dealing with the retroflexion sound “ㄖ /y/”, the individual will easily encounter the problems of the consonant cluster “tr, spr…etc.” and the consonant digraphs “sh, ch,…etc.” Moreover, based on the subjects’ Chinese-language background and the dissimilarity of the Chinese and English syllable structures, they are prone to have difficulties with the rhotacized “ㄖ” /r/ and /l/ sounds, the liquid /r/ sound and the nasal /m/ and /n/ sounds. From this phenomenon, we could conclude that the subjects’ dissimilar native language led to these difficulties.

The study of Iversen and Tunmer (1993) emphasized that specific grapheme and phoneme correspondences and the recoding skills training are more significantly correlated to enhancing the knowledge of the phonological awareness than circumstantial instruction. In order to help Taiwanese students improve their skills of phonological awareness, teachers should notice the students’ learning background and then set up an advantageous teaching system to support that specific grapheme and phoneme correspondence training skills. Since Taiwanese students learn the Zhuyin system in the first and second grades, they already have a basic knowledge of phonological awareness before they begin learning English. Some studies have shown that L1 phonological awareness may limit the abilities of L2 learners in learning a non-native phonetic contrast.
It could be interesting and important for further studies to investigate whether the learners with the abilities of Chinese phonological awareness would have a direct affect their performance in pronouncing English words accurately.

Obviously, Chinese phonological awareness has positive effects on English phonological awareness; seeing the difficulty of the EFL Taiwanese students in learning English, we can imply that for learners to succeed in phonological processing tasks, an explicit instruction of phonological awareness training is needed.

5.3 Implications for Teaching

Ashmore, Ferrier, Paulson and Chu (2002) found that phonological awareness developed in the learners not only the acquisition of phonological awareness, but it also helped in their reading and spelling. Pedagogically, training in phonemic awareness, the correspondences of letter name and sounds, the knowledge of consonants, and the rules of vowel sounds are essential for the beginner when learning English, just as it is in learning their first or second languages (Moats, 2001).

As for the twenty-five subjects in this study, even though about one-third are majoring in TESL (Teaching English as a Second Language), only eleven subjects have basic ideas about phonological awareness. Most of them have never heard about the concept. It can be considered that lacking the sufficient knowledge for the instructors in Taiwan impeded Taiwanese students from acquiring the knowledge of English phonological awareness. To enhance students’ ability of English phonological awareness,
English teachers who instruct Taiwanese students need to consider the contrast between the Chinese and English linguistic structures.

On the other hand, according to the finding of this study, Chinese Zhuyin Fuhao will help Taiwanese students in learning English phoneme deletion and pseudo-word reading. Thus, there is no doubt that in order to strengthen the language skills of Taiwanese students, the Chinese Zhuyin system should be conscientiously considered as a support for their later English education. A teacher should conduct a systematic pedagogy to reinforce the Zhuyin system and notice that some specific sounds such as “ㄖ /ʒ/”, “ㄓ /ʒ/”, “ㄤ /ʊ/” and so on, which were mentioned in the Results and Discussion section, will cause a student whose language background is Chinese more difficulty in performing some English stimuli. Further, Students who have lower phonological awareness and lower alphabetic knowledge need to be provided with extra intensive phonological awareness instruction. As this study showed, Taiwanese students can become easily confused with irregular words, consonant clusters, consonant digraphs and the basic phoneme rules. In order to avoid having the students encounter as much perplexity in these structure words, teachers should pay more attention to implementing a remedial course for the students.

Zapparoli (2006) suggests that a story based phonological awareness curriculum would be of great advantage to help learners acquire phonological awareness skills. Nevertheless, English is still not in widespread use in Taiwan. As students’ exposure to English may come only from an hour of daily instruction in English class or perhaps even less, it is difficult for a teacher to use a story-based curriculum to teach students both
phonological awareness skills and daily conversation with regulations contained in an English textbook during only one hour. Most teachers in Taiwan use phonics to train students to acquire the ability of phonological awareness. Based on Stahl (1992), phonics is an approach used for coding the grapheme-phoneme correspondences and the spelling patterns for orthographic language reading. Understanding that words are composed of graphemes and phonemes, the instruction that the teacher uses should be designed to raise learner’s awareness of phonemes. Due to the orthographic differences between Chinese and English and the transfer process from these two languages, the use of the textbook could incorporate some phonological awareness knowledge for students in helping EFL students to decode English words with more proficiency and accuracy. However, no research can tell exactly about the order skills that should to be used and which strategy is the most effective for the students in learning L2 phonological awareness. This could be explored through further studies.

To sum up this study, L1 intraword phonological awareness experience (Chinese Zhuyin Fuhao) shows the positive effect on L2 phonological awareness (English) among EFL learners with nonalphabetic L1 background (Taiwanese students). These effects obviously occur in the English phonemes deletion skills and the English pseudo-word reading. Moreover, when Taiwanese students are learning English phonological awareness, they are quick to encounter the problems of English consonant clusters, consonant digraphs, retroflection, rhotacized words, liquids and nasals. To help Taiwanese students in enhancing their English-speaking abilities, knowing the
relationship between Chinese phonological awareness and English phonological awareness is necessary to conduct and implement an efficient curriculum.
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The English Phoneme Recognition Test

Now, what we will do is to recognize the individual sound. For example, if I say “bus,” please repeat it again. If I ask you, “What is the beginning sound?” your answer will be /b/. If I say “has,” please repeat it again, and when I ask you, “What is the ending sound?” your answer will be /s/. There are 20 words that I need you to do. Please follow the directions.

The List of Words for the English Phoneme Recognition Test

1. ar-b
2. hard-e
3. qose-b
4. five-e
5. greet-b
6. warm-e
7. pour-b
8. talk-e
9. sleep-b
10. ball-e
11. thus-b
12. vonge-e
13. broock-b
14. plash-b
15. shink-b
16. rame-b
17. truit-b
18. vlaig-b
19. choick-b
20. rosh-e
Appendix B-1

**The English Phoneme Segmentation Test**

Now, what we will do is divide word into sounds. I will say an English vocabulary word; when you hear the word, please repeat it again. I will ask you to split the word into individual sounds. For example, I give you the word “cat,” you have to repeat “cat” again for me. When I ask you to segment this word, you have to separate it into /k/, /æ/ and /t/. There are 10 words that I need you to do. Please follow the directions.

**The List of Words for the English Phoneme Segmentation Test**

1. fine
2. have
3. stop
4. grap
5. vooz
6. qack
7. theap
8. rasht
9. shaoge
10. chooth
Appendix C-1

The English Phoneme Deletion Test

Now, what we will do is that I will say an English vocabulary word. When you hear the word, please repeat it again. I will ask you to remove one of the sounds, and then please tell me the rest of the sound. For example, if I say “Please say ‘cat,’” you have to repeat “cat” again for me. When I say, “Now, say it again, but don’t say the /k/ sound, your answer will be /æt/. There are 25 words that I need you to do. Please follow the directions.

The List of Words for the English Phoneme Deletion Test

1. stand
2. jam
3. hand
4. start
5. frock
6. nice
7. stop
8. near
9. monkey
10. think
11. prate
12. bring
13. pink
14. qesk
15. zarm
16. crood
17. thent
18. grouge
19. seter
20. sproon
21. forsh
22. choat
23. blamd
24. tream
25. vonss
 Appendix D-1

The English Syllable Deletion Test

Now, what we will do is that I will say an English vocabulary word; when you hear the word, please repeat it again. I will ask you to remove one part of the word, and then please tell me the rest of the sound. For example, if I say “Please say ticket,” you have to repeat “ticket” for me. Then I will say to you, “please say it again, but don’t say /kɪt/”, your answer will be /tɪk/. There are 13 words that I need you to do. Please follow the directions.

The List of Words for the English Syllable Deletion Test

1. Say cucumber        Now say it again, but don’t say “cu”
2. Say decision         Now say it again, but don’t say “de”
3. Say birthday         Now say it again, but don’t say “day”
4. Say Saturday        Now say it again, but don’t say “sa”
5. Say complain        Now say it again, but don’t say “com”
6. Say customer        Now say it again, but don’t say “to”
7. Say classmate        Now say it again, but don’t say “mate”
8. Say December        Now say it again, but don’t say “cem”
9. Say basketball       Now say it again, but don’t say “ball”
10. Say throupra        Now say it again, but don’t say “pra”
11. Say raisharem       Now say it again, but don’t say “sha”
12. Say vanpin          Now say it again, but don’t say “pin”
13. Say qauthran        Now say it again, but don’t say “ran”
Appendix E-1

The English Pseudo-word Test

Now, what we will do is pronounce the words; they are not real vocabulary but they can be pronounced. We call these words pseudo-words. I need you to try to read these words out loud. I will record your answer. You can practice before being recorded; I will record you when you are ready.

The List of Words for the English Pseudo-word Test

1. nox 11. theng
2. jaong 12. chong
3. thaison 13. racho
4. yuper 14. voage
5. shoit 15. drayer
6. roizer 16. zamch
7. jouge 17. larision
8. stroock 18. wition
9. qouris 19. vrut
10. whasher 20. thorush
Appendix A-2

The Chinese Phoneme Recognition Test

Now, what we will do is recognize the individual sound. For example, if I say “ㄌㄩ” /lü/, please repeat it again. If I ask you, “What is the beginning sound?” your answer will be /l/. If I say “ㄅㄚ” /b a/, please repeat it again and when I ask you, “What is the ending sound?” Your answer will be /a/. There are 20 words that I need you to do. Please follow the directions.

The List of Words for the Chinese Phoneme Recognition Test

1. ㄘㄨㄛ
2. ㄍㄧ
3. ㄏㄨㄣ
4. ㄉㄧㄡ
5. ㄐㄧㄣ
6. ㄔㄨㄢ
7. ㄕㄨㄢ
8. ㄋㄛ
9. ㄊㄨㄝ
10. ㄕㄣ
11. ㄌㄧㄣ
12. ㄆㄧㄚ
13. ㄌㄧㄣ
14. ㄕㄨㄢ
15. ㄋㄨ
16. ㄓㄧㄣ
17. ㄖㄧㄤ
18. ㄊㄧㄚ
19. ㄈㄨㄢ
Appendix B-2

The Chinese Sound Segmentation Test

Now, what we will do is to divide word into sounds. I will say a Chinese vocabulary word; when you hear the word, please repeat it again. I will ask you to split the word into individual sound. For example, I give you the word “ㄅㄢ /bn/”, and you have to repeat “ㄅㄢ /bn/” again for me. When I ask you to segment this word, you have to separate it into “ㄅ /b/ and “ㄢ /n/”. There are ten words that I need you to do. Please follow the directions.

The List of Words for the Chinese Phoneme Segmentation Test

1. ㄇㄟ
2. ㄉㄞ
3. ㄎㄨ
4. ㄌㄧ
5. ㄊㄧㄠ
6. ㄐㄧㄤ
7. ㄔㄨㄣ
8. ㄖㄨㄢ
9. ㄒㄧㄢ
10. ㄗㄨㄞ
Appendix C-2

The Chinese Phoneme Deletion Test
Now, what we will do is that I will say a Chinese vocabulary word. When you hear the word, please repeat it again. I will ask you to remove one of the sounds, and then please tell me the rest of the sounds. For example, I will say “Please say ㄈㄚ /fəl/,” you have to repeat “ㄈㄚ /fəl/” again for me. When I say, “Now, say it again, but don’t say /f/, your answer will be /a/. There are 25 words that I need you to do. Please follow the directions.

The List of Words for the Chinese Phoneme Deletion Test
1. ㄆㄢ 14. ㄓㄨㄚ
2. ㄔㄚ 15. ㄑㄨㄠ
3. ㄖㄠ 16. ㄑㄨㄛ
4. ㄘㄡ 17. ㄑㄨㄝ
5. ㄨㄤ 18. ㄒㄧㄚ
6. ㄋㄠ 19. ㄕㄨㄚ
7. ㄆㄧㄥ 20. ㄕㄨㄛ
8. ㄉㄧㄠ 21. ㄒㄩㄣ
ten. ㄇㄢ 22. ㄕㄚ
11. ㄉㄨㄥ 23. ㄕㄧㄠ
12. ㄒㄧㄚ 24. ㄕㄨㄛ
13. ㄕㄧㄠ 25. ㄍㄩㄝ
Appendix E-2

The Chinese Pseudo-word Test

Now, what we will do is to pronounce the words, they are not real vocabulary but they can be pronounced. We call these words pseudo-words. I need you to try to read these words out loud. I will record your answer. You can practice before being recorded; I will record you when you are ready.

The List of Words for the Chinese Pseudo-word Test

1. ㄓㄟ
2. ㄆㄩ
3. ㄗㄛ
4. ㄍㄩ
5. ㄕㄣ
6. ㄅㄩ
7. ㄕㄦ
8. ㄊㄟ
9. ㄐㄧㄛ
10. ㄖㄧㄚ
11. ㄈㄨㄠ
12. ㄓㄨㄢ
13. ㄎㄧㄤ
14. ㄕㄧㄡ
15. ㄆㄨㄤ
16. ㄉㄧㄝ
17. ㄇㄨㄚ
18. ㄎㄨㄧ
19. ㄉㄧㄝ
20. ㄆㄩ
Appendix F
Test Answer Sheet and Questionnaire

### English phonemic awareness Task

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### Chinese phonemic awareness task

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Name: ___________________________ Sex: □ male □ female Age: ____________
How long do you learn English? ___________________________ years.
How long have you been in USA? ___________________________
Are you interested in learning English? □ Yes □ No
How long have you been learning KK? _______________________
How long do you learn Chinese Zu Yin Fu Hao: ___________________________ years.
Do you know what **Phonemic awareness** is? □ Yes □ No