Introduction

Phonological awareness (PA) refers to an individual's ability to analyze spoken language into smaller component sound units and to manipulate them mentally. This analysis and manipulation are conscious and explicit, thus constituting a form of metalinguistic knowledge not necessarily involved in natural speech perception or short-term memory processing (Content, Kolinsky, Morais, & Bertelson, 1986; Bertelson, & de Gelder, 1991). One theme of inquiry attracting considerable research concerns the correlation between phonological awareness and word reading. For example, the rime judgment and phoneme deletion abilities of English-speaking 7- to 10-year-olds positively correlate with their ability to read aloud (McDougall, Hulme, Ellis, & Monk, 1994). Gathercole, Willis, and Baddeley (1991) report similar findings with a group of 4- to 7-year-olds, while Cheung (1995) extends the inquiry to the second-script (L2) performance of 12- to 15-year-olds. Lundberg, Frost, and Petersen (1988), Cunningham (1990), Ball and Blachman (1991), and Hatcher, Hulme, and Ellis (1994) all find greater improvement in children's reading performance after explicit instruction in sound segmentation.

These studies are particularly successful in providing experimental evidence for a causal relationship between phonological awareness and reading. If enhanced sound segmentation skills can improve reading, then we may theorize phonological awareness to be necessary for reading, whether as a precondition or a precursor. Arguments for this view are based upon the concept of phonological recoding, i.e. the conversion of printed symbols into a phonological code based on script-specific correspondence rules for print and sound (Gathercole & Baddeley, 1993). A recent study of five European languages by Ziegler et al. (2010) points to phonological awareness as the main factor associated with reading in each language.

Few studies, however, have reported on the effects of phonological awareness training in adults. This study examines whether phonological awareness training can improve English word reading among adult participants literate in a logographic script. Positive results may point to the development of a new method for teaching reading skills to EFL learners in Taiwan, and perhaps other ESL/EFL learners.

Literature Review

Alphabetic L2 reading for learners with a non-alphabetic L1 background

Reading is a complex, cognitive activity. By fixating on a word, the reader transforms it

into its corresponding mental representation, and retrieves relevant semantic and syntactic information about it from either long-term memory or the lexicon. Subsequent words in the text are then perceived through the lens of information thus retrieved. “Bottom-up” (or “lower-order”) processing refers to this cognitive processing from the point of fixation to lexical access, and is considered to be one of the foundational components of reading (Gough, 1984; Stanovich, 1991). This basic processing is widely acknowledged to be as important as “top-down” (or “higher-order”) aspects of reading, such as appropriate utilization of background knowledge and reading strategies (Adams & Bruck, 1993).

Linguistic and orthographic differences among various languages and writing systems are well known to affect L2 reading acquisition in adults, who tend to transfer reading skills and strategies from the L1 to the L2 (Akamatsu, 1999; Haynes & Carr, 1990; Koda, 1994, 1999, 2000, 2007; Verhoeven, 1990; Wade-Woolley, 1999). The degree to which L1 decoding skills affect L2 reading varies according to the degree of similarity between the two writing systems. That is, “transfer” is more likely to occur between similar writing systems. When the two writing systems share little similarity, transferred skills are likely to be inefficient until sufficient modifications of processing strategies evolve through cumulative experience processing L2 print (Koda, 2007). Several adult-based studies describe the effects of such differences on L2 reading for learners with a non-alphabetic L1 background (Akamatsu, 1999; Haynes & Carr, 1990; Holm & Dodd, 1996; Jackson, Chen, Goldsberry-Shaver, Kim, & Vanderwerff, 1999; Jackson, Lu, & Ju, 1994; Koda, 1994, 1999, 2000, 2007; Wade-Woolley, 1999). These studies confirm that L2 English students coming from a logographic L1 place greater reliance on orthographic information to identify words than do L1 English readers.

Some educators have turned their attention to the effects of different writing systems on the processing of such distinctions (Koda, 2007; Hamada & Koda, 2008, 2010). The acquisition of decoding skills in each system requires different levels of phonological awareness: Chinese character recognition depends heavily on syllable awareness, while English word recognition relies primarily on phonemic awareness (McBride-Chang, Bialystok, Chong, & Li, 2004). Phonological awareness apparently helps students decode words, on the principle that identifying the internal sound structure of words aids them in mapping sounds to symbols. Furthermore, phonological awareness seems to help English word recognition, both for monolingual English speakers and for students of English as an L2 (Gottardo, Yan,

Siegel, & Wade-Woolley, 2001; McBride-Chang & Kail, 2002). A number of studies show phonological awareness to be a strong predictor of L2-English word reading skills in L1-Chinese speakers, among others (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Geva, Yaghoub-Zadeh, & Schuster, 2000; Gottardo, 2002; Muter & Diethelm, 2001; Gottardo et al., 2001; Linklater, O'Conner, & Palardy, 2009).

For languages where sound-symbol mapping occurs at the phonemic level, such as Italian (e.g. D'Angiulli, Siegel, & Serra, 2001), Turkish (e.g. Durgunoglu & Oney, 1999), and English (e.g. Wagner, Torgesen, & Rashotte, 1994), phonemic awareness has been found to be strongly predictive of difference in reading ability. By contrast, Chinese readers are better able to process syllable-level than phoneme-level phonological information (Newman, Tardif, Huang, & Shu, 2011). While the phoneme is important in English, the syllable is important to both spoken and written Chinese. Since the primary written unit (the Chinese character) completely overlaps with the basic pronunciation unit (the syllable) and meaning unit (the lexical morpheme), syllabic awareness becomes particularly important in Chinese reading acquisition (e.g. Ho & Bryant, 1997b; McBride-Chang & Ho, 2000). This is reinforced by a lack of grapheme-phoneme correspondence in written Chinese, which downplays the metalinguistic prominence of phonemes. Morphemes represent both meanings and pronunciations. However, the syllable is the basic unit of spoken Chinese (e.g. Ho & Bryant 1997b; Taylor & Olson, 1995). Reading Chinese generally sensitizes the readers to syllables, represented as characters, in much the same way that reading an alphabetic language sensitizes its readers to phonemic segments, represented as letters (Chow, McBride-Chang, & Burgess, 2005; Wagner et al., 1994). Thus, Chinese learners of English may well benefit from syllabic awareness training while learning English words.

Many studies in interlanguage phonology have shown that the complexities of English syllable structure present learning problems for ESL/EFL learners, especially when the syllable structure of the learner's native language is simpler than that of English (e.g. Anderson, 1983; Eckman, 1981, 1991). English has a relatively complex syllable structure, with a maximum of three consonants before a vowel and four consonants after (Abercrombie, 1967), viz.: (C)(C)(C)V(C)(C)(C)(C). For example, "strengths" is an English CCCVCCCC word. Mandarin Chinese, on the other hand, allows a maximum of four phonemes in a syllable, (C)(G)V(X) (Duanmu, 2000). Even though there are four tones in Mandarin Chinese, not all syllables have four tones; therefore, the total is not 1,600 syllables, as one might expect,

but closer to 1,300 (Duanmu, 2006). As a result, the total number of possible syllables is relatively small in Mandarin Chinese, compared with over 80,000 in English. A practical consequence, which many EFL learners in Taiwan may encounter, is the difficulty of transliterating words from languages with more complex syllable structures.

In Taiwan, many college students—even after many years of learning English—are unable to pronounce a new English word without first hearing the teacher read it aloud. Students are very familiar with learning characters (including orthography as well as semantic range) by rote. They need phonological awareness training in how to process English acoustically and analytically, so they can sound out new words, review the pronunciation of familiar words, and recall words they have already placed in their mental lexicon (Lin, 1995, 2010; Lin & Wu, 2006).

It is worth noting that strategies for teaching Chinese vary among Chinese-speaking populations. In both China and Taiwan, students learn to read Chinese via an auxilliary phonetic system—*hanyu pinyin* (a romanization system) for the PRC, and *zhuyinfuhao* (a.k.a. *bopomofo* or the Mandarin Phonetic Alphabet, a shorthand alphabet/syllabary derived from the Chinese script) in Taiwan. In China, children begin learning *hanyu pinyin* at the age of 6 or 7, during the first 10 weeks of the first grade, before proceeding to Chinese characters (Shu & Anderson, 1997; Shu, Anderson, & Wu, 2000). In Taiwan this role is filled by *zhuyinfuhao*, which is studied at approximately the same age (Hanley, Tzeng, & Huang, 1999). In Hong Kong, however, children are taught Chinese characters directly, using a whole character, rote learning approach, without the mediation of any phonetic system (Ho & Bryant, 1997a, 1997b). Phonological awareness is affected by different systems of Chinese phonetic transcription (Wang & Wang, 2013).

While written Chinese does code phonological information to some extent, and its readers are generally aware of this (Perfetti & Zhang, 1991, 1995; Ho & Bryant, 1997a, 1997b; Tan & Perfetti, 1997), the fact that the script does not represent phonemes discourages sub-syllabic phonemic analysis (Bertelson, Chen, & de Gelder, 1997). Holm and Dodd (1996) find that their Hong Kong Chinese participants continued to rely on non-alphabetic reading strategies, despite years of instruction in alphabetic reading. Can specialized segmentation training succeed in counteracting a hypothetical transfer effect, where other forms of instruction fail? Studies by Content, Kolinsky, Morais, and Bertelson (1986) and Morais, Content, Bertelson, Cary, and Kolinsky (1988) show that providing corrective feedback in

consonant deletion leads to rapid improvement in segmentation performance in preliterate children as well as illiterate adults. The question naturally arises as to whether focused segmentation training can effectively improve segmentation skills beyond what experience with the alphabetic system can provide, given an initial logographic reading background which might have established a dominant “whole-word” reading strategy as postulated by Holm and Dodd (1996).

This study was inspired by Holm and Dodd (1996), who compared English segmentation and reading/spelling performance among four groups of undergraduates: PRC Chinese (who had learned to read using an alphabetic script, *hanyu pinyin*), Hong Kong Chinese (who did not), Vietnamese (whose language has been written alphabetically for generations), and Australians. The Hong Kong group—the only group not to have learned to read using an alphabetic script—fared most poorly in English segmentation tasks, despite boasting the most experience reading English (an average of 15 years, compared to 10.4 for mainland Chinese, 4.9 for Vietnamese, and 14.4 for Australians). Holm and Dodd (1996) explain the obvious lack of sub-syllabic phonological awareness in the Hong Kong participants in terms of a “transfer” effect: they applied the non-phonemic strategy developed in the course of learning a logographic script (Chinese) to the later-learned English script.

Cheung (1999) examines trainability in phoneme awareness among adolescent Cantonese speakers, who started learning written Chinese around the age of four, and written English around the age of seven (and continued to study it up to the time of the research). The experimental group received two months of explicit instruction in phoneme manipulation, while the control group simply practiced reading the same material. The experimental group, but not the control group, experienced significant improvement. This shows that such training helps inculcate phoneme awareness among students with substantial practice in using an alphabetic second script. Morais et al. (1988) were able to use corrective feedback to dramatically increase the phoneme manipulation ability of illiterate adults, and concluded that there is no critical period for the development of explicit phonemic analysis.

Although previous research has shown positive effects for phonological awareness training on more than one age group, most use participants who are fairly close in age. The present study extends this research by recruiting participants who already have some reading proficiency in the target script (as opposed to illiterates). It examines L1 Chinese university readers of English to evaluate the hypothesis that among older learners, phonological

awareness is precursory to reading a later-learned script—i.e. whether the effect of phonological awareness training holds true for a wider age range.

The appropriate approach to acquiring frequently-used words in a second/foreign language

With the advent of the "communicative" approach to second/foreign language teaching and learning, methodological center stage has been given over to reading-driven, incidental vocabulary acquisition based on inference from context and implicit vocabulary teaching. However, research has drawn attention to various inadequacies of the communicative approach to the teaching and learning of second/foreign language vocabulary (Van de Poel & Swanepoel, 2003). A consensus has emerged that a wider approach to vocabulary (word) instruction is needed; that explicit/instructed teaching is the most appropriate method for acquiring the frequently-used words in a second/foreign language; and that for the rest, inference from context should be used together with other acquisition strategies (Robinson, 1997; Schmitt, 1997). There seems to be no absolutely "best" way to approach the teaching of second/foreign language vocabulary. In fact, best methods will be determined by such variables as the vocabulary developmental goals and needs of the learners, their proficiency in the target language, their learning styles, the nature of the lexical items to be learnt, and in general, the nature of the linguistic input (Watts, 1997).

Current trends in teaching second/foreign language vocabulary advocate the following basic design principles: add explicit vocabulary teaching to the usual inference activities in the L2 classroom; build a large sight-vocabulary to foster automatic lexical access; integrate new words with old; provide a number of encounters with words; promote a deep level of processing; facilitate imaging and concreteness; use a variety of techniques, and encourage independent learner strategies (Sökmen, 1997).

In accordance with the above discussion, the purpose of the present study is to examine whether phonological awareness training can improve English word reading among L2 English adult learners whose L1 is Chinese.

Methodology

Hypothesis

The research hypothesis was that phonological awareness training would improve English word reading in L1 Chinese university students.

Participants

Participants were 41 university freshmen studying in Hsinchu, Taiwan. Like all Taiwan students, they were taught *zhuyinfuhao* from the first grade, then gradually transitioned to logographic Chinese script. Their formal contact with the English writing system began in the third grade. Letter-sound correspondence is seldom taught explicitly in the classroom in Taiwan.

Materials and instruments

Phonological awareness is a multilevel ability, comprising various differentially-acquired subskills (Treiman, 1983) at the syllabic, intrasyllabic, and phonemic levels (Goswami & Bryant, 1990). The awareness of phonemes is associated with word recognition in English, while syllable awareness seems to be important for reading Chinese as well as English. This study measured phonological awareness through syllabification (syllabic awareness) and phoneme deletion (phonemic awareness) tasks.

This study identified 3 variables: (1) syllabification, (2) phoneme deletion, and (3) word reading. All the variables were measured in both the pretest and the posttest.

Syllabification (pre and posttest): Forty pseudowords (see Appendix 1 and 2) selected from the stimuli for Experiment 1 in Smith and Pitt (1999)—twenty for the pretest, and twenty for the posttest—were used to assess participants' ability to syllabify long words. Pseudowords were used instead of words in order to minimize lexical influences on their responses.

Phoneme deletion (pre and posttest): The Elision subtest from the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was used to assess participants' ability to delete phonemes in spoken English words. Participants were asked to repeat a spoken word, and then to say it again while omitting a sound (e.g. 'Say *cap*, now say *cap* without the [k]').

Word reading (pre and posttest): Forty words (see Appendix 3 and 4) selected from the Academic Word List (Coxhead, 2000) were used to assess participants' English word-level reading skills. Twenty words were used for the pretest, and twenty for the posttest. Most of

the words used in the word reading task have two syllables.

Procedure

The study consisted of a pretest, a training phase and a posttest.

Pretest: Syllabification, phoneme deletion, and word reading were measured in the pretest. In the syllabification task, participants were asked to syllabify twenty two-syllable pseudowords spoken by the researcher (see Appendix 1). In the phoneme deletion task, participants were asked to drop one phoneme of a certain test word spoken by the investigator, and say the rest of the word aloud. The Elision subtest from the CTOPP was administered to assess participants' ability to delete phonemes in spoken words. This task also consists of 20 items arranged in order of increasing difficulty. In word reading, 20 test words (see Appendix 3) were printed on a piece of paper and presented to the participant, who was asked to read them clearly aloud one by one at his/her own pace. Every correctly-read item was worth one point, for a maximum possible score of 20.

Training phase: Participants received four months of phonological awareness training. Each week, two 50-minute group training sessions were conducted. The program consisted of four parts. In the first part, all English phonemes (vowels and consonants) were taught. In the second part, participants were taught to syllabify polysyllabic words according to the generalizations of English syllabification proposed by Lin (2011). In the third part, participants were taught to analyze a given syllable into phonemes and count the number of phonemes. In the fourth part, participants were taught to extract segments from two different words, combine them, and orally produce the resulting syllable. An educational software program called TOEIC WordPower (Lin, 2009) was used during and after class to help participants practice word reading and spelling. Each polysyllabic word used in the software program was syllabified according to the generalizations proposed by Lin (2011).

Posttest: Syllabification, phoneme deletion, and word reading were administered in the posttest, using procedures identical to those of the pretest (but with different sets of test words).

Results and Discussion

Given the longitudinal design of the present study, one way to examine the relationship between phonological awareness and word reading is to correlate performance changes in the tasks over time. The relationship between phonological awareness and word reading was

examined by correlating improvement in the phonological awareness tasks with improvement in the word reading task from pre to posttest. Increased scores from pre to posttest represent improvement in the areas of syllabification, phoneme deletion, and word reading. As Table 1 shows, significant correlation was found between improvement in syllabification and word reading (r=.587, p< .001), as well as between improvement in phoneme deletion and word reading (r=.553, p< .001). Thus, improvement in word reading is linked with improvement in syllabification and phoneme deletion ability.

Furthermore, stepwise multiple regression was used to investigate the relative strength of these two independent variables, whether they indeed predict dependent variable, and how much they affect it. Stepwise multiple regression revealed that improvement in syllabification (β= .418, p< .05) and to a lesser extent, phoneme deletion (β= .354, p< .05) had a statistically-significant effect on improvement in word reading, as shown in Table 2. Altogether, approximately 44.1% of the variance in improvement in word reading could be explained by improvement in syllabification and phoneme deletion, F= 20.517 (p< .001), R^2 = .441.

Table 1.The Correlations among the Improvement

	Improvement in Syllabification	Improvement in Phoneme Deletion
Improvement in Word Reading	.587***	.553***

*** p< .001

Table 2. The Summary of Stepwise Multiple Regression Analyses

Dependent Variable	B	Std. Error	β	t
(Constant)	-1.838	1.185		-1.551
Improvement in Syllabification	.583	.192	.418	3.029*
Improvement in Phoneme Deletion	.436	.170	.354	2.562*
R		.664		
R^2		.441		
Adjusted R^2		.096		
F		20.517***		

* p< .05, *** p< .001, Dependent Variable: Improvement in Word Reading

Conclusion

This study analyzed the effects of phonological awareness training on the word-reading ability of a group of L1 Chinese university readers. Its major findings are as follows: The training did enhance syllabic and phonemic segmentation performance. Improved segmentation skills led in turn to improved performance in English word reading. These results were confirmed by statistical analysis. Improvements in syllabification and phoneme deletion skills from pre to posttest were both associated with corresponding improvements in English word reading. Increased segmentation skills did predict improvement in word reading in an alphabetic second script. This is consistent with the theory that phonological analysis is precursory to reading, presumably through the recoding mechanism. For newcomers to alphabetic languages, the ability to syllabify long words and break them down into phonemes is necessary for the development of initial reading skills; more experienced readers acquire a fine-tuned sensitivity to phonological construction to improve their reading skills.

These findings are consistent with those reported by Content et al. (1986), Morais et al. (1988), and Cheung (1999) for preliterate children, adult illiterate subjects, and literate adolescents, respectively. In those studies, participants were also given explicit phonological awareness training. Based on the rapid improvements in phonological skill performance due to phonological awareness training, it was concluded that with appropriate training, phonological skills can improve at any age. The findings of the present study may contribute to the development of a new method for teaching reading skills to EFL learners in Taiwan, and perhaps other ESL/EFL learners as well.

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Appendix 1. Pseudowords used in the syllabification task (pretest)

sɪgmɛt	baɪprɛs	rɛtlʌg
gɪtnɛl	nɐbrɪn	mɪdlɔm
mʌbdɪs	sɐtrɔb	vɔtlɪn
lʌtmə	dɨkrɪn	rɔdlaɪg
sudmʌp	baɪdrʌs	rɪtlɨb
mɛkniv	riklænt	kʌdlit
tɪgnɪs	mublaɪd	

Appendix 2. Pseudowords used in the syllabification task (posttest)

nʌbdəl	laɪbraʊt	pɔdlʌm
lʌbmət	vɐtrɔn	sʌtlɛk
vɪkʃən	mutræd	ɛætlʊk
fʌtmɛk	taɪklɪnt	rɛtlɐb
sɛknə	dokruʃ	zætlaɪk
rɪknɪt	daɪbrʌm	vɪdlɛs
væɛnɛp	zaɪɛrɛb	

Appendix 3. Words used in the word reading task (pretest)

issue	sector	complex	function	occur
approach	context	achieve	method	percent
vary	contract	evident	consist	concept
assess	create	export	involve	secure

Appendix 4. Words used in the word reading task (posttest)

assume	research	factor	issue	perceive
survey	define	normal	chapter	proceed
affect	derive	formula	imply	process
benefit	feature	journal	conclude	require