LEARN Journal: Language Education and Acquisition Research Network
(ISSN: 2630-0672 (Print) | ISSN: 2672-9431 (Online)
Volume: 15, No: 1, January – June 2022
Language Institute, Thammasat University
https://so04.tci-thaijo.org/index.php/LEARN/index

The Relationship Between Metalinguistic Knowledge and the Identification of Thai Vowel Length by Chinese Learners Before and After Praxis Intervention

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APA Citation:
Shengnan, Z. (2022). The relationship between metalinguistic knowledge and the identification of Thai vowel length by Chinese learners before and after praxis intervention. *LEARN Journal: Language Education and Acquisition Research Network, 15*(1), 91-123.

Received
22/05/2021

Received in revised form
28/08/2021

Accepted
06/09/2021

Keywords
Metalinguistic Knowledge, Identification, Thai Vowel Length, Praxis Intervention, Chinese Learners

Abstract

As there is no vowel length contrast in Chinese, Chinese learners of Thai (CLTs) often have difficulty distinguishing between short and long vowels, especially when the same vowel grapheme in Thai orthography can be pronounced as both a short and a long vowel. This study examined the importance of metalinguistic knowledge (MLK) used by CLTs before and after praxis intervention with the aim of providing insight into the relationship between MLK and L2 acquisition. Twenty CLTs and ten Thai native speakers were tested for their ability in identifying Thai vowel length. The CLTs were divided into two subject groups following the pre-test. The first group (CH1) was given only exercises, while those in the second group (CH2) were also taught rules. The two groups were tested for accuracy and reasoning behind a given identification. Two-tailed t-test results show statistically significant differences in scores of CH1 and native speakers and a positive relationship between accuracy in identification and L2 learners' MLK, including the

	ability to identify, describe, and explain L2 vowel length. Importantly, CH2 performed better in the post-test than those in CH1, suggesting that MLK helps enhance L2 acquisition. In addition, the results of a mixed-effect regression model show that four factors (group, stimuli type, tone, and structure) influenced the identification scores of CLTs.

Introduction

The distinction between implicit knowledge and explicit knowledge is crucial to second language acquisition. According to Ellis (2004), 'implicit knowledge' refers to the nonverbal knowledge that extends from intuition or the memories of past experiences without analysis or awareness. As such, it can be retrieved and accessed faster (Ellis, 2009; Hulstijn, 2005; Sándor, 2015). Conversely, 'explicit knowledge' refers to knowledge that can be explained by means of verbal language and depends on conscious analysis. While explicit knowledge can be tested by requiring participants to name parts of speech, make judgements on or correct ungrammatical utterances in terms of a set of rules, etc., implicit knowledge may only be reflected in grammaticality judgements or error repair tasks, without any accompanying explanation (Ellis, 2005)

Metalinguistic knowledge (MLK) is a type of explicit knowledge, such as that involving analysis or summarization of rules for language use, which employs language itself in explaining language phenomena in order to help learners more easily acquire various facets of the target language (structure, function, syllables, phonemes, etc.) (Andrews, 2005; Bialystok & Miller, 1999). In this way, its findings benefit L2 learners in various aspects of the target language, such as syntax, phonetics, and function. For instance, Ellis (2005, 2008) concludes that explicit form-focused instruction promotes acquisition of L2, especially for simpler features, and that it can be converted to implicit knowledge via practice. Furthermore, according to DeKeyser (2003), such explicit knowledge is especially beneficial for adults. On the other hand, Krashen (1982) suggests that MLK mastered by L2 learners can reach no further than the level of simple rules, such as, in English, adding '-s' to mark the third person singular. Krashen also points out that learning cannot be equated to acquisition. That is, a particular learner may study various rules, but this does not necessarily mean that they will be able to accurately apply them.

Acquisition of Thai vowels among CTLs provides an interesting case study on the relationship between MLK and L2 acquisition. That is, as shown in Table 1, there are five monophthongs in the Chinese vowel system with no distinction between short and long vowels. Vowel duration only varies at the phonetic level due to the influence of stress, syllable structure, and tone. Vowels in stressed syllables, for example, have greater duration than those in unstressed syllables (Lin & Yan, 1988; Wu & Kenstowicz, 2015), vowels in open syllables have greater duration than those in closed syllables (Duanmu, 2007), and vowels of the third tone show greater duration than those of other tones (Ho, 1976; Shih, 1987, Xu, 1997; Yip, 2002).

Table 1

Chinese Vowel Inventory (Duanmu,2007)

	Front	Mid	Back
High	i y		u
Mid		ə	
Low		a	

However, as shown in Table 2, vowel length is contrastive for all monophthongs in the Thai vowel system, so that vowel length distinguishes the meanings of words. Many scholars have investigated vowel length acoustically, finding that the durations of long vowels are at least twice those of short vowels (Abramson, 1962; Roengpitya, 2001); though, the contrasts among low vowels (/ɛ/-/ɛː/ and /ɔ/-/ɔː/) are less robust than those of the three vowels, /a/-/aː/, /i/-/iː/, and /u/-/uː/, distinguishing between very few minimal pairs (Nacaskul 2008; Pittayaporn et al., 2016). In addition, by way of the Thai writing system, short vowels and long vowels are generally encoded by different graphemes. For example, ◌ิ and เ-ะ represent /i/ and /e/, respectively, while ◌ี and เ- represent /iː/ and /eː/, respectively. In other words, every vowel grapheme has a default phonemic value. Those that are not encoded in this way employ the vowel shortening symbol ◌็ to make this distinction. However, there are, in some cases, discrepancies between the vowel grapheme and the vowel phoneme, such as when the three long vowel

graphemes *เ-, แ-, and -อ* are combined with a final consonant and tonal marker. When this is the case, it is not possible to determine from the spelling whether the word is pronounced with a short or long vowel (Danvivathana, 1981; Haas, 1943). Pittayaporn (2016) also claims that the vowel graphemes of many words, such as *แล้ง* /lɛːŋ^{4}/ "dry", *แผ่น* /pʰɛŋ^{2}/ "piece", *หอย* /tʰɔːŋ^{4}/ "clam", *กล่อง* /klɔŋ^{2}/ "box", could be pronounced as short or long, but no reasons were posited.

Table 2

Thai Vowel Inventory (Abramson, 1962)

	Front	Mid	Back
High	i iː	ɯ ɯː	u uː
Mid	e eː	ɤ ɤː	o oː
Low	ɛ ɛː	a aː	ɔ ɔː

Focusing on three pairs of short and long vowels (*เ-/e ~ eː/, แ-/ɛ ~ ɛː/, -อ/ɔ ~ ɔː/*), this paper examines the knowledge used by CLTs in identification of vowel length before praxis intervention, as well as whether or not MLK provides an advantage in such identification after intervention. To this end, I compared groups of informants subjected to different teaching methods. The first group (CH1) only completed exercises, while the second group (CH2) were taught rules in addition to completing exercises.

This paper is structured as follows. In Section 2, I review the literature on metalinguistics in L2 acquisition. In Section 3, I show the methodology and outline experimental procedures. In Section 4, I report the results regarding the identification of vowel length by CLTs by means of a pre-test, exercises, and a post-test. In Section 5 and 6, I discuss and conclude the results of the current experiments as well as provide possible explanations.

Presently, the relationship between MLK and L2 acquisition remains controversial, though much research has shown that MLK plays an essential role in L2 acquisition (Lima Jr & Mangueira, 2017; Roehr, 2007; White et al.,2007; White & Ranta, 2002). Several researchers have compared MLK in different levels of L2 learners or between L2 learners and native speakers. Among these are Gass and Selinker (1983) who suggest that learners' MLK, gauged by examining their grammaticality judgements, may serve as an indicator of the development of L2 competence, with advanced learners able to correct and explain incorrect sentences better than intermediate learners. Isarankura (2008) found the same trend in the acquisition of the English article system by Thai learners and presented a metalinguistic view of article usage employed by speakers of varying levels of proficiency: native speakers of English and Thai learners of high and low proficiency levels. Here, the high-proficiency group achieved greater accuracy in their use of articles than the low-proficiency group, and notably, their explanations, in the same way as the native speakers, were based on pragmatic context while those of the low-proficiency group were mostly based on syntax. Ngarmwirojkit (2012) explored a similar tendency in the proficiency and MLK of Japanese students regarding spacing in Thai writing.

Additionally, MLK may address aspects of phonetics and phonology. Similarly to some of the work mentioned above, within this area, certain studies have examined the performance of groups taught using different methods before and after praxis intervention. For example, Saito (2007), exploring the production of Japanese English learners exposed to explicit phonetic instructions, such as tongue position in pronunciation as well as F1 and F2 acoustics as demonstrated by visual feedback, found that these learners improved their pronunciation dramatically in comparison with the control group who were not given any explicit rules. Duan (2017) also examines the effectiveness of explicit phonetic instruction. The author compared the performances of Chinese learners of French, as gauged by a pre-test and post-test, finding that learners first instructed on prosody patterns within different types of sentences significantly outperformed the control group on the post-test for both trained and untrained sentences (Rauber, 2006; White & Ranta, 2002).

Though most scholars agree on the role of metalinguistic instruction, there is disagreement about the effectiveness of metalinguistic explanations. Seliger (1979), for example, did not find a positive relationship between MLK and L2 proficiency. More specifically, despite being able to explain rules for use "a" and "an" in testing, L2 learners often applied rules inappropriate to use of determiners or even incorrect rules. Green and Hecht (1992) demonstrated that, though students who studied explicit rules improved their accuracies in error correction, they tended to employ the wrong rules or did so without any rules at all. That is, the proportional accuracy in applying rules and error correction did not trend in the same direction. Therefore, rules may help learners to correct some errors, but this does not necessarily mean that accuracy in error correction results from learning rules. For this reason, Serrano (2011) claims that MLK cannot be considered as having a crucial effect on L2 learners' knowledge and performance. The author supports this with findings indicating that, though learners who had been taught explicit knowledge showed more accuracy in using possessive determiners than did the control group, their accuracy was not statistically significant. She also argues that the positive relationship found by White and Ranta (2002) may stem from many factors, such as the length of the study period and whether study was intensive.

Regarding orthography, Nimz and Khattab (2019) show that explicit orthography could help Polish learners of German produce the short-long contrast more natively. More specifically, when learners encountered words containing *"h"*, they were more likely to employ a long vowel than with words containing a non-transparent grapheme. As such, the contrastiveness of *fühlen /fyːlən/ 'feel'* was much greater than that of *Boden /boːdən/ 'floor'*. They also argued that similarities between the writing system of one's mother tongue and the L2 impact pronunciation (Escudero et al., 2012). Contrastively, Nimz and Khattab (2015) did not find that orthography plays a role in Polish learners' perceptual abilities. Here, whether words were explicitly marked graphemically for vowel length did not influence discrimination and judgement of vowel length among Polish learners. In addition, the reaction times of Polish learners in judgement tests did not show a significant difference between explicit orthography and implicit orthography.

Given the gap in our understanding of Thai vowel length for CLTs, this study concentrates on whether and how MLK affects Chinese learners' identification of vowel length in Thai.

Methodology

Experiment

The identification experiment proceeded for 2.5 weeks between the 10th and the 27th of October 2020 and contained three sections: a pre-test, teaching and exercises, and a post-test. All sections were conducted online through the Tencent meeting platform due to health risks related to the Covid-19 pandemic. In each section of the tests, participants were required first to provide a classification of the vowel length of monosyllabic words, followed by an explanation. This method was adopted from Isarankura (2008) who tested use of articles and accompanying explanations among Thai learners of English. In addition, this study also adopted the teaching and exercise methods of Lambacher (1999) and Saito (2007) in which participants are provided with target patterns for practice as well as ether explicit or implicit teaching and exercise feedback, depending on the group. In the current experiment, following the pre-test, the twenty CLTs were randomly divided into two groups with no significant statistical difference in the mean scores for each group. There were 3 rounds of exercises between the pre-test and post-test, each taking 65 minutes. For group CH1, this 65-minute period included 5 minutes of introduction or Q&A, 30 minutes of exercises, and another 30 minutes for feedback regarding what the participant did or did not do correctly. For group CH2, the 65-minute period included 5 minutes of instruction on the relevant rules, 30 minutes of exercises, and another 30 minutes for feedback regarding the accuracy of the learners' answers as well as which rules were applied in classification.

I hypothesized that, before praxis intervention, CLTs would apply the default phonemic value to identify the vowel length; whereas, after praxis intervention, both groups would achieve higher accuracy in identification and improved adherence to rules. However, the group that had been taught orthographic rules and taken exercises would outperform the group that had only done exercises.

Participants

Among the participants were twenty Chinese participants divided into two groups, with each group subjected to different a teaching method. All were students in their second year at Yunnan University or Yunnan Minzu University majoring in Thai. To avoid variation in Mandarin pronunciation resulting from dialect differences that may impact L2 acquisition, Chinese students were required to have passed the level 2 grade B of the National Proficiency Test of Putonghua, the standard minimum level for teachers. Tai and Zhuang students were excluded from the study, as their mother tongues have vowel length contrast. In addition, ten native speakers of central Thai, each born in Bangkok and studying at the undergraduate level at Chulalongkorn University in Bangkok, comprised a control group. The participants were aged 19-21 years. A summary of the groups and relevant teaching methods is given in Table 3.

Table 3

Participant Groups

Nationality	Group	Teaching method
Chinese	CH1	- Introduction or Q & A (5 minutes) - Exercises on vowel length identification (30 minutes) - Feedback (30 minutes): CTLs listen to each word pronounced by the Thai native speaker 3 times before they are given the correct answers.
	CH2	- Rules regarding Thai orthography (5 minutes) - Exercises on vowel length identification (30 minutes) - Feedback (30 minutes): CTLS are given the correct answers with explanations based on the rules they had learned.
Thai	TH	- No teaching (Control group)

Stimuli

Both tests contained 3 parts, each consisting of 10 target words and 20 control words, with an equal number of short and long vowels (see Appendix A). Additionally, there were 3 exercises between the pre-test and the post-test, each of which had 30 words, 12 target words, and 18 control words, with, again, an equal number of short and long vowels, some of

which were minimal pairs (see Appendix B). All participants were asked to complete the same stimuli.

Target words were words not mapped at the grapheme-phoneme level, so that the default phonetic values for vowel length did not correspond to the grapheme. All words were collected from the Royal Institute Dictionary (2011), and words unknown to additional set of ten native speakers were excluded. Further, due to the high variation in the actual pronunciations of the three pairs of vowels *เ-/e~ e:/*, *แ-/ɛ~ ɛ:/* and *-อ/ɔ~ɔ:/*, it was required that five Thai language instructors (two current Ph.D. students in the Department of Linguistics, Chulalongkorn University and three instructors from the Center for Thai as a Foreign Language, Chulalongkorn University) be unanimous in their determinations of vowel length for all target words. The opinions of the 5 instructors were then confirmed by 136 native speakers (https://forms.gle/WkEFVnNc5Tq8amYbA).

Furthermore, target words were required to satisfy the following three conditions:

(1) Target words must contain one of the three vowel graphemes (*เ-/e~ e:/, แ-/ɛ~ ɛ:/,* or *-อ/ɔ~ɔ:/*), as their frequencies are higher than other vowels with inconsistent grapheme-phoneme pairs.

(2) Target words must have a C(C)V(V)C syllable structure in which the final consonant is a nasal (/n, m, ŋ/) or a glide (/w, j/), as tone is more likely to influence vowel length in this structure.

(3) Target words must have a tonal marker (◌่, ◌้, ◌๊, or ◌๋). As Danvivathana (1981) has discussed, the shortening symbol ◌็ would not appear when the three short vowels (/e/, /ɛ/, and /ɔ/) are combined with a final consonant and tonal marker.

In contrast, control words were words mapped at the grapheme-phoneme level. They were high frequency words with no conditions regarding their vowels, syllable structures, or tones. Sporadic patterns, such as *ท่าน* /t^{h}an^{3}/ “a respectful pronoun”, *ช่าง* /c^{h}a^{3}ŋ / “craftsman, specialist, repairman”, and *แรด* /rɛt^{3}/ “(a person) is pretentious”, were not selected.

Teaching Rules

Most of the rules used in this study were gathered from Danvivathana (1981) and Haas (1943). To define the variant vowel length tendency of words with falling tones, 88 words were collected from the Royal Institute Dictionary (2011) and labeled by 136 native Thai speakers and 5 Thai instructors. The results show that only 17 of the 88 words were pronounced with long vowels. This is reflected in Rule 4.2 which states that the vowel lengths of these words are dependent on the class of the onset consonant. The rules are divided with respect to four factors:

1. Presence of the shortening symbol: according to the Thai writing system, the symbol ็ indicates a short vowel length. It may only occur when the vowel graphemes เ-, แ-, and -อ are followed by a final consonant and have no tonal marks.

2. Vowel grapheme: The graphemes เ-, แ-, and -อ often involve discrepancies between the vowel grapheme and the vowel phoneme that are rarely found with other vowel graphemes. For instance, เน้น /nen^{4}/ “emphasize”, แน่น /nɛn^{3}/ “tight”, and ห้อง /hɔŋ^{3}/ “room” are pronounced as short vowels, while บ้าน /baːn^{3}/ “home” and ชื้น /cʰɯːn^{4}/ “moist” are pronounced as long vowels.

3. Syllable structure: Unchecked syllables with final consonants may make the vowel short, as with เก่ง /keŋ^{2}/ “superbly performed” and หน่อย /nɔj^{2}/ “a little bit”. The vowel length is not impacted in open or checked syllables, as with แก่ /kɛː2/ “old, for” and แบบ /bɛːp2/ “type”.

4. Tone: Tones influence the lengths of the vowels เ-/*e~ eː/*, แ-/*ɛ~ ɛː/*, and -อ/*ɔ~ɔː/* when they occur in unchecked syllables with final consonants, according to the following:

4.1 With low or rising tones, vowels are pronounced as short, with the exception of those in ก่อน /kɔːn^{2}/ “first, before”, and อ่อน /ʔɔːn^{2}/ “soft, young”.

4.2 With falling tones and low-class consonant onsets, vowels are pronounced as short, with the exception of แย่ง */jɛːŋ^{3}/* “catch, seize” and ซ่อน */sɔːn^{3}/* “hide”. With mid and high-class consonants, เ- is always pronounced as short, with the exception of those in เก้ง /keːŋ^{3}/ “barking deer” and เป้ง /beːŋ^{3}/ “the name of tree”. In this case, แ- is pronounced as short. These are แป้น /pɛn^{3}/ “keyboard”, แอ้ม /ʔɛm^{3}/ “take, eat”, แผ้ว /phɛw^{3}/

"clean", แข้ง */khɛŋ³/* "front part of the leg", and แห้ว */hɛw³/* "disappoint". Lastly, with these consonants, -อ is pronounced primarily as short.

4.3 With high tones, เ- is always pronounced as short, with the exception of those in เควิ้ง /kʰweːŋ⁴/ "drift" and เท้ง /tʰeːŋ⁴/ "float, drift". For the vowels แ- *and* -อ, no short vowels were found.

After finishing all test sections, the two groups were shown a short, three-minute video by the researcher which detailed the above rules. The CH2 group, who had learned the rules, were allowed to review as needed, and the CH1 group, who did not learn the rules, were also given the opportunity to study the metalinguistic knowledge by themselves after data collection.

Results

Before Intervention

Classification scores before intervention are displayed in Table 4 and Figure 1. All participants classified the control words correctly and received the full 60 points (100%). On the other hand, CLTs were categorically unable to classify target words correctly, resulting in no points given for this part among those participants. However, most native speakers were able to classify these correctly, earning an average of 29.9 points (99.67 %, SD = 1.05). The average scores for CLTs and native speakers for the test as a whole were 60 points (66.67%) and 89.9 points (99.89%, SD = 0.35), respectively.

In order to see more clearly the difference in scores between the two groups, a two-tailed t-test was introduced. The results show statistically significant differences in the mean scores for the target words and totals between native speakers and Chinese learners, at the alpha .05 level ($t = -30$, $P < 0.001$).

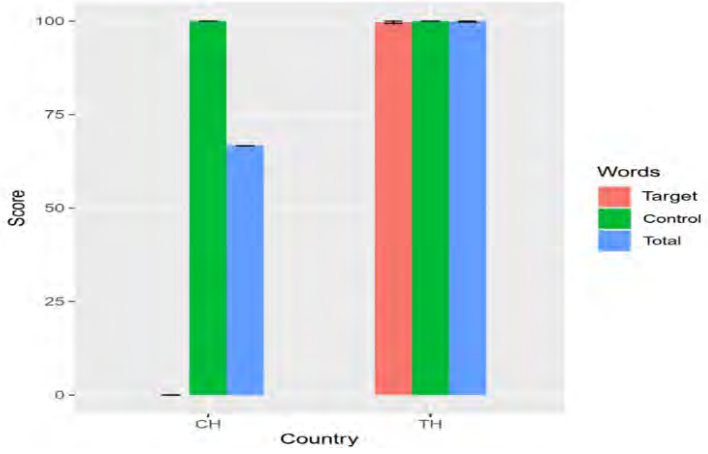
Table 4

Comparisons of Mean Scores on the Classification Test for Chinese Learners and Native Speakers

Word set	CH		TH		t	df	Sig (two-tailed)
	Score (%)	SD	Score (%)	SD			
Control	60 (100%)	-	60 (100%)	-	-	-	-
Target	0	-	29.9 (99.67%)	1.05	-30	9	< 0.001
Total	60 (66.67%)	-	89.9 (99.89%)	0.35	-30	9	< 0.001

Figure 1

Mean Scores on the Classification Test for Chinese Learners and Native Speakers



The scores for control words and target words illustrate the point that CLTs classify vowel length depending on the default phonemic value of a grapheme, their classification reasons further supporting this result, as shown in Table 5.

Table 5

Classification Reasoning of Chinese Learners and Native Speakers

Word set	Control		Target	
Reason	Chinese	Thai	Chinese	Thai
1.Default phonemic value of grapheme	✓	✓	✓	-
2.Intuition	-	✓	-	✓
3.Contrast (minimal pairs)	-	✓	-	-
4.Rules of phonetics	-	✓	-	✓
5.Rules of orthography	-	-	-	✓
6.Non-verbal	-	-	-	✓

✓: cited reason

Both the target words and control words were only explained by CLTs in terms of the default phonemic value of the grapheme. Thai is, the target words were all classified as long vowels, given that they contained the vowels เ- /eː/, แ- /ɛː/, or -อ /ɔː/ without the shortening marker ็. As an example, CHS1 explains:

> "The words with the short vowels ิ, ึ, ุ, เ-อะ, แ-ะ, เ-าะ, โ-ะ, or the shortening marker ็ have short pronunciations, such as in *กิน, เฉอะ, รุ้ง, คึก, แตะ, เพราะ,* and *เหม็น*. The words with the long vowels -า, โ-, ู, เ-, แ-, and -อ have long pronunciations, such as in *หาด, บ้าง, ช้าง, โฉม, โง่, กู้,* ***เข่ง, เก๋ง,*** *เก้ง,* ***เจ๋ง, เม้ม, เส้น, เล่ม,*** *เลข, เขต,* ***แก่น, แบ่ง,*** *แท้ง,* ***แห่ง,*** *แก้ม, ค้อน, อ้อน,* ***ร่อง, บ่อน,*** and ***จ๋อย***"

Note that target words are underlined, and if the classification is wrong, the word is marked in bold.

Unlike the CLTs, native speakers provided many different reasonings. For control words, this group largely employed the default phonemic value of the grapheme. For example, THS3 wrote:

> "Words which contain a short vowel must be pronounced as short, such as is the case with *ศึก, เพราะ,* and *แตะ*. Words which

> contain a long vowel must be pronounced as long, such as is the case with *คีบ, เก้ง, เกณฑ์, แป้ง, เทอม,* and *ป้อน.*"

To explain the patterns present in the control words, they provided reasons such as intuition, as exemplified by THS1 who explains:

> "The words *คีบ, เก้ง, เกณฑ์, แป้ง, แบบ, เชิญ, เทอม, ป้อน, กอง, โหลด, โหด,* and *บ้าง,* are classified as long, and the words *ศึก, เพราะ,* and *แตะ* are classified as short. This I know because I learned the pronunciation from my family, and all my family members were born in Bangkok. Also, the words have minimal pairs, such as *หัด-หาด*, in which there is a contrast in vowel length. If หาด was produced with a short vowel, it would give rise to a different meaning."

Considering contrasts of vowel length or rules of phonetics, THS10 says:

> "The words containing a long vowel in an unchecked syllable, such as *เก้ง, เกณฑ์, แป้ง, เชิญ, เทอม, ป้อน, กอง,* and *บ้าง,* are classified as long." And "The words, such as *หาด*, containing a long vowel in a checked syllable are classified as long."

Native speakers used intuition for target words as well. For instance, THS9 explains:

> "I classify *เก๋ง, เจ๋ง, เม้ม, เส้น,* and *เด้ง* as having short vowels, because I have perceived the pronunciation from other Thai speakers."

Additionally, these speakers used rules of phonetics or orthography to explain the target words, as illustrated by this explanation from THS2:

> "The words which have short vowels and the second or third tone are pronounced as short, even though the grapheme is that of a long vowel, such as in *เข่ง, แก่น, แบ่ง, แห่ง, แกร่ว, ปล่อย, หย่อน เด้ง, ร่อง, ต้อง, ป้อง, ร่อน, ห้อย, เจ๋ง,* and *เก๋ง.*

However, in many cases native speakers could not easily provide their reasonings. An example involves the difference between *เก้ง*, which is

pronounced as a long vowel, and *เด้ง*, which is pronounced as a short vowel.

Most importantly, even though many native speakers referred to the rules of phonetics or orthography, from the interviews, it appears that they depended most heavily on their intuitions to classify the vowel length and then proceeded to consideration of the many rules for these patterns.

Exercises

In the first exercise, CH1 and CH2 received full marks for the control words, totaling 18 points (100%), but zero points for the target words. In both the second and third exercises, scores for the two groups for control words decreased slightly, while target word scores increased, especially for CH2, as shown in Tables 6 and 7.

Table 6

Comparisons of Mean Scores on the Classification Tests of CH1 and CH2 in the Second Exercise

Word set	CH1		CH2		t	df	Sig (two-tailed)
	Mean	SD	Mean	SD			
Control	16.4 (91.11%)	7.94	16.6 (92.22%)	10.54	-0.27	16.73	> 0.05
Target	2.6 (21.67%)	20.86	8.9 (74.17%)	19.82	-5.77	17.95	< 0.001
Total	19 (63.33%)	6.67	25.5 (85%)	11.57	-5.13	14.38	< 0.001

In the second exercise, control word scores for CH1 decreased more than for CH2, with the former group receiving 16.4 points (91.11%, SD = 7.94) and the latter receiving 16.6 points (92.22%, SD = 10.54), respectively. Target word scores for the two groups, on the other hand, increased, especially among CH2 who received 8.9 points (74.17%, SD = 19.82). CH1 received only 2.6 points (21.67%, SD = 20.86).

Table 7

Comparisons of Mean Scores on the Classification Tests of CH1 and CH2 in the Third Exercise

Word set	CH1		CH2		t	df	Sig (two-tailed)
	Mean	SD	Mean	SD			
Control	15.9 (88.33%)	10.62	16.4 (91.11%)	9.18	-0.63	17.61	> 0.05
Target	5.5 (45.83%)	31.49	10.3 (85.83%)	13.64	-3.69	12.26	< 0.01
Total	21.4 (71.33%)	13.98	26.7 (89%)	9.94	-3.26	16.25	< 0.01

The scores on the third exercise patterned similarly to those of the second exercise. Control word scores declined slightly, with CH1 receiving 15.9 points (88.33%, SD = 10.62) and CH2 receiving 16.4 points (91.11%, SD = 9.18). However, target word scores increased noticeably, with CH1 receiving a still low 5.5 points (45.83%, SD = 31.49) and CH2 receiving 10.3 points (85.83%, SD = 13.64).

Tables 6 and 7 show that, regardless of the exercise, there was no significant difference between the scores of the two groups for control words. Conversely, for the target words, scores for CH2 were 3.4 times as high as those of CH1 in the second exercise ($t=-5.77$, $P<0.001$), and those of CH2 were almost 2 times as high as those of CH1 in the third exercise ($t= -3.69$, $P < 0.01$).

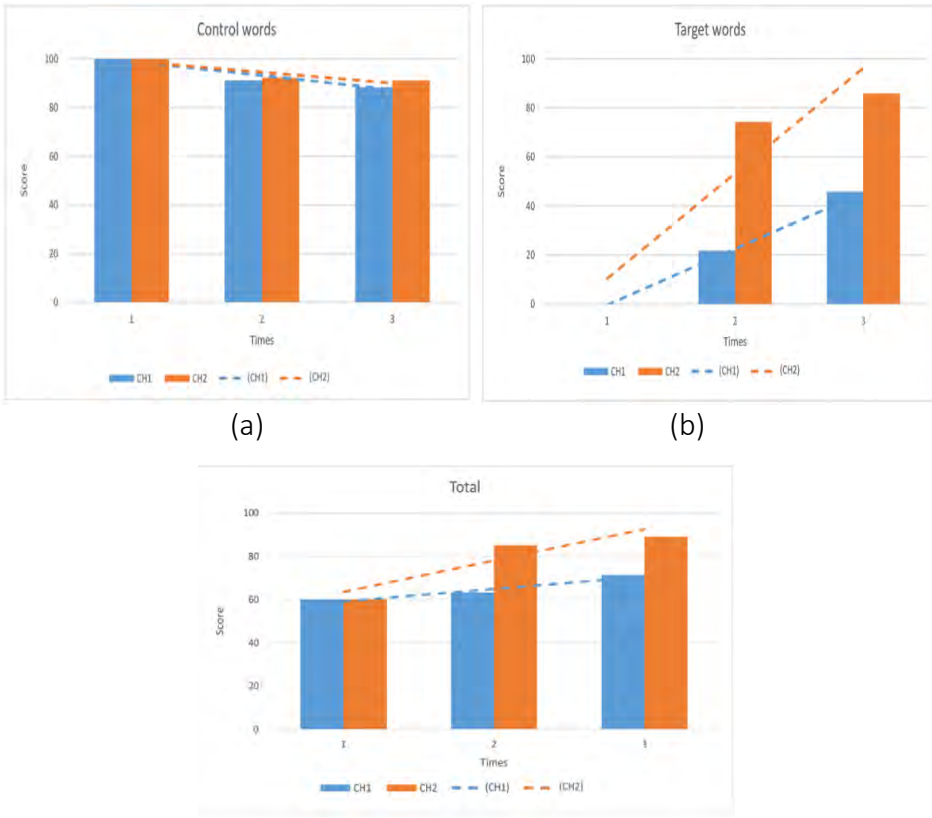
Regarding SD (score distribution), on the one hand, the performances of the two Chinese groups resulted in a higher SD for target words than for control words, meaning the variability or diversity of classification for the target words was much greater than that of the control words. As such, the score distribution of target words was wider. This reflects the increased difficulty in accurately classifying the target words as compared to the control words. Notably, for both target words and control words, SD increased in CH1, but decreased in CH2, an observation that reflects greater uncertainty among CH1 learners, likely due to the fact that they were not taught rules. Furthermore, when comparing the SD between the two groups, we find that the SD of control words for CH2 is higher than CH1 in the second exercise, but lower in the third exercise. This demonstrates how rules being taught in the beginning

may initially negatively affect certainty in classification of control words, before achieving a positive effect in the following stage.

The scores shown in Figure 2 demonstrate upward progress in the for target words and the totals, especially among CH2 learners for whom the capacity for accurate target word judgement was higher and more rapid than CH1 learners. Scores are shown in Figure 2 (b). However, the scores for control words among the two groups were slightly reduced in the practices, as shown in Figure 2 (a).

Figure 2

Score Tendencies in the Classification Tests of CH1 and CH2 during the Exercises



(a) (b)

(c)

After Intervention

After intervention, the mean scores for control words within the two Chinese groups were lower than those prior to intervention, particularly within CH1 which received a mere 53.3 points (88.83%, SD = 4.58), while CH2 received 58.5 points (97.5% SD = 1.18). In contrast, the mean scores for target words were higher than previous rounds, especially within CH2 which received full marks in the same way as the native speakers. CH1, on the other hand, received only 18.5 points (61.67%, SD = 23.96). The total means of CH1 and CH2 were 71.6 points (79.67%, SD = 9.16) and 88.5 points (98.33%, SD = 0.79), respectively. From this data, we see that, regardless of word type or test phase, CH2 learners achieved scores closer to those of the native speakers than did CH1. Furthermore, the SD for CH1 was consistently higher than for the other groups, particularly for the target words, meaning there was greater variation in the classification scores among those in this group. From this, it may be interpreted that CH1 was less consistent in classifying the length of target words, as shown in Table 8 and Figure 3.

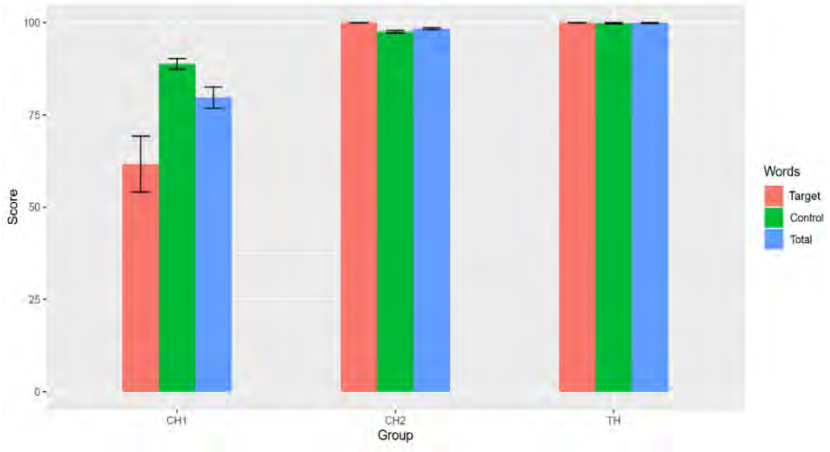
Table 8

Mean Scores on the Classification Tests for the Two Chinese Groups and the Native Speakers

Word set	CH1		CH2		TH	
	Score	SD	Score	SD	Score	SD
Control	53.3 (88.83%)	4.58	58.5 (97.5%)	1.18	59.9 (99.83%)	0.53
Target	18.5 (61.67%)	23.96	30 (100%)	-	30 (1007%)	-
Total	71.7 (79.67 %)	9.16	88.5 (98.33%)	0.79	89.89 (99.89%)	0.35

Figure 3

Mean Scores on the Classification Tests for the Two Chinese Groups and the Native Speakers



The differences among the three groups are displayed in Table 9. Here, we see that the differences between the mean scores of CH1 and the native speakers for control words and target words, as well as their totals were statistically significant, at the alpha .05 level ($t = -7.54$, $P < 0.001$; $t = -5.07$, $P < 0.001$; $t = -6.97$, $P < 0.001$ respectively), while there were no significant differences between the scores of native speakers and CH2 after intervention.

Table 9

Comparisons of Mean Scores on the Classification Tests for the Two Chinese Groups and the Native Speakers

Word set	Participant group	t	df	Sig (two-tailed)
Control	CH1 vs. TH	-7.54	9.24	< 0.001
	CH2 vs, TH	-0.27	16.7	> 0.05
Target	CH1 vs. TH	-5.07	9	< 0.001
	CH2 vs, TH	-	-	-
Total	CH1 vs. TH	-6.97	9.03	< 0.001
	CH2 vs, TH	-0.27	16.7	> 0.05

Focusing on the target words scores of CH1, we see that scores for words containing the vowel graphemes เ-, แ-, or -ย scores were not consistent. Specifically, scores for words containing เ- were almost 2 times as high as those for the others, a result not found in the other groups. This is shown in Table 10 and Figure 4. This may be due to effects from certain factors, such as group, stimuli type (target or control words), syllable structures, or tone.

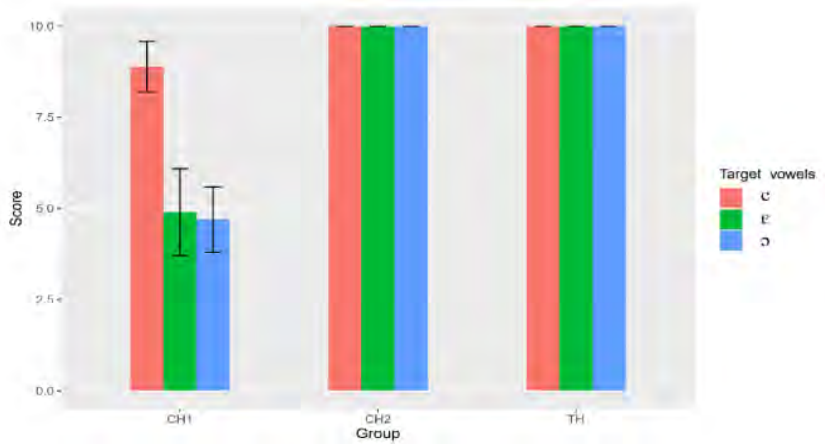
Table 10

Comparisons of Mean Scores in Target Words for the Two Chinese Groups and the Native Speakers

Target word vowel	CH1	CH2	TH
e	8.9 (SD = 2.18)	10	10
ɛ	4.9 (SD = 3.75)	10	10
ɔ	4.7 (SD = 2.83)	10	10

Figure 4

Comparisons of Mean Scores in Target Words for the Two Chinese Groups and the Native Speakers



In order to explore interactions among these factors, a mixed-effect regression model was introduced which uncovered four types of interaction that influenced scores.

First is the interaction between group and stimuli type. The top two rows of Table 11 show that the scores for CH1 were significantly different than those of the other two groups for target words containing /ɛ/ or /ɔ/. Table 10 supports this result, demonstrating that scores for target words containing /e/ were close to those of CH2 and the native speakers. Scores for CH1 were also significantly different than those of the other two groups for control words containing of /ɛː/, as shown in the third row.

Second is the interaction between group, stimuli type, and tone. As shown in the fifth row, for example, CH2 learners' classifications of control words containing /ɔː/ and tone 3 were significantly different than those of CH1 learners and the native speakers. This may stem from the rule that words containing the grapheme -ơ and a nasal final of the third tone are typically short vowels. As shown in the fourth and sixth rows, respectively, CH1 learners' classifications of target words containing /ɔ/ and tone 2 as well as control words containing /eː/ and tone 3 were significantly different from those of the other two groups.

Table 11

Integration between the Variables Affecting Vowel Length Identification

No.		Estimate	Std. error	df	t value	Pr (>|t|)
	(Intercept)	10	1.24	156	8.06	<0.001***
1	CH1:ɛ	5.25	2.46	104	2.13	0.035*
2	CH1:ɔ	4.00	1.71	104	2.42	0.018*
3	CH1:ɛː	<0.001	1.08	104	-4.15	<0.001***
4	CH1:ɔ:Tone 2	-4.58	1.60	104	-2.86	0.005**
5	CH2:ɔː:Tone3	-9.67	1.35	104	-7.15	<0.001***
6	CH1:eː: Tone3	5.50	1.53	104	3.59	<0.001***
7	CH1:ɛ: Structure nasal	-4.42	1.96	104	-2.25	0.026*
8	CH1:Tone3: Structure nasal	-3.42	1.05	104	-3.25	0.002**

The last two interactions are those between groups, stimuli type, and syllable structure, as well as group, tone, and syllable structure. Both interactions demonstrate the differences between CH1 and CH2 or the native speakers.

Regarding reasoning in classification, after intervention, CH1 not only continued to use the default phonemic values of graphemes, but also used rules they had devised themselves. CH2, on the other hand, accurately applied the rules taught in exercises. However, both groups tended to hypercorrect, overusing the rules to which they had access.

For CH1, the lowest score, the highest score, and the average score were 6 points (20%), 28 points (93.33%), and 18.5 points (61.67%), respectively. This group can be divided into 3 subgroups according to each learner's mean scores for target words.

Within CH1, there was positive relationship between scores for target words and learner explanations demonstrating systematic use of complicated rules. As shown in Table 12, there was marked variation in participant scores in terms of the types of rules they used. More specifically, learners who relied on only the default phonemic value or intuition tended to receive lower scores than those relying on more

complicated rules. Examples of reasons provided for classification of target words are given below, with incorrect classifications marked in bold.

Table 12

Reasons for Target Word Classifications for CH1

CH1		Reason						
		Default Phonemic Value of grapheme	Intuition	Phonetic Rules			Orthography	Non-Verbal
				Vowel	Syllable Structure	Tone	Tone Makers	
Low	S1	✓	✓					
	S3	✓	✓	✓̸				
	S4	✓	✓	✓̸	✓̸	✓̸		
Mid	S16		✓	✓	✓̸			✓
	S2			✓	✓̸		✓	
	S5			✓	✓̸	✓		
High	S19			✓	✓	✓	✓	
	S20			✓	✓	✓		✓
	S13			✓	✓	✓	✓	✓
	S17			✓	✓	✓		

Note. Low-scoring group: 6-11 points Mid-scoring group: 19-20 points
High-scoring group: 23-28 points ✓: cited reason ✓̸: cited some patterns

Learners in the low-scoring group cited only the default phonemic value of the grapheme and intuition as reason for their classifications, as exemplified by CHS1 who explains:

> "I felt that I pronounced the vowel longer than the final consonant, so I classified them as having a long vowel, as with ***เผ่น, เปล่ง, เป่ง, แต่ง, แข่ง,*** and ***คล่อง***. Words containing the long vowel *-อ,* such as ***หน่อย ก้อง น่อง ย่อย,*** are classified as having long vowels, because I felt that it sounded better"

The mid-scoring group used rules in an effort to explain some patterns. For example, CHS2 explains:

> "Words containing the vowels เ-, แ-, or -อ and tone markers are pronounced with a short vowel, such as with ***เคว้ง,*** *เผ่น, เน้น , เล่น, เข้ม, เต้น, เปล่ง, แจ๋น, แช่ง, แพ่ง, แต่ง,* ***แจ้ง,*** *ก้อง,* and *น่อง*. In addition, words, such as *แจ๋ว*, containing the vowel *แ-*, a tonal marker, and the final consonant /-w/ are pronounced as short."

Lastly the high-scoring group depended solely on rules without using the default phonemic values of graphemes or intuition regarding the aspect of vowels, syllable structure, or tone. For example, CHS17 states:

> "Words containing the vowel เ-, a nasal final consonant, and the second or third tone are always pronounced with a short vowel, such as in *เผ่น เล่น เต้น เน้น* ***เคว้ง***. Words containing the vowel *แ-,* a nasal or glide final consonant, and the second, third, or fifth tone are always pronounced with a short vowel, such as in *แต่ง แพ่ง แช่ง* ***แจ้ง แก้ว แต้ม*** *แจ๋ว แจ๋น*. Words containing the vowel -*อ*, a nasal or glide final consonant. and the second or third tone are always pronounced with a short vowel, such as in *หน่อย น่อง ย่อย ป้อม ก้อง* ***อ้อม***."

The bold words demonstrate that some control words were judged wrongly due to use of participant-devised rules, which then resulted in a decline in the scores for control words. The same phenomenon occurred with CH2 judgements of control words. For instance, the word *อ้อม* was classified incorrectly by all learners in CH2, as they relied on the rule that words containing -*อ*, a nasal or glide final consonant, and the third tone were mostly pronounced as short. As such, hypercorrection stemming from overapplication of the rules was a crucial factor behind incorrect classification of control words.

Discussion

Due to negative transfer of their mother language, Chinese speakers did not tend to establish a distinction between short and long vowels in their mental representations. Furthermore, it has been observed that Chinese teachers of Thai usually instruct their students to distinguish long and short vowels by relying on corresponding grapheme-phoneme

pairs, which may gradually solidify as a defect in their MLK. As such, the results before praxis intervention show that all CLTs used the default phonemic value of the grapheme as MLK in identifying vowel length, and following this, if the graphemes were not those of short vowels or if no shortening marker was present, the word was identified as containing a long vowel, an observation reflected in the participants' explanations.

Therefore, it can be argued that MLK of orthography influenced L2 acquisition in this case. This is in keeping with the suggestions of previous research that the degree of complexity of grapheme-phoneme correspondence is important to L2 pronunciation, reading strategies, recognition, and phonological awareness (Goswami, 1999; Widjaja & Winskel, 2004), where transparent or shallow orthographies, such as those of Italian, Spanish, or German, are more highly consistent and predictable than deep orthographies within which spelling does not clearly convey pronunciation, including those of irregular word and other exceptions, as is the case in English (Aro & Wimmer, 2003; Goswami et al., 2003). Therefore, the target words, being deep orthographic words, were consistently classified incorrectly. Conversely, the control words, being shallow orthographic words, were consistently classified correctly.

In this way, as was shown in the above section regarding intervention, greater advantage in building and adjusting MLK leads to better L2 acquisition. This is supported by the lower accuracies and lower progress of CH1 learners as compared to CH2 learners, who were also taught rules in addition to completing exercises.

After taking into account interactions, the two groups of CLTs both demonstrated progress in identification of target words, especially those in CH2, who received full marks in the same way as the native speakers. Scores for CH1, though, did not converge with those of the native speakers at a statistically significant level. In sum, the performances among the CH2 learners were higher than those among the CH1 learners, which extends, conceivably, from the use of different teaching methods and can be argued as proof of benefits of MLK. In other words, teaching MLK may enhance L2 acquisition. (Lima Jr & Mangueira, 2017; White et al.,2007; White & Ranta, 2002).

Moreover, an analysis of classification reasonings among both groups also reveals a positive relationship between MLK and proficiency in L2 acquisition. It was found that CH2, who had been provided with rules beforehand, could use these rules more accurately than CH1, whose

learners could only devise their own rules, possibly containing errors or paradoxes, by observing patterns in the exercises. Not only this, but the explanations of CH1 learners who received higher scores also support this relationship. That is, these learners summarized rules in more detail or applied rules more systematically than their counterparts. (Gass & Selinker, 1983; Isarankura, 2008; Nimz & Khattab, 2019)

In addition, classification reasonings also demonstrated that MLK can be enhanced without explicit instruction by observation on the part of L2 learners. More specifically, learners provided with rules will, in all, progress more rapidly; however, given that rules may have varying levels of difficulty or complexity, those that are easier to observe would be acquired faster and more accurately than those that are more complicated (Ellis, 2008; Krashen, 1982).

Aside from this, explanations among CH1 learners show that the capacities of L2 learners in MLK construction were influenced by many factors, such as learning experience, language exposure, etc. More experienced learners may perform better than those with less experience. (Bialystok & Miller, 1999; Ellis, 2004; Roehr, 2007).

However, hypercorrection among participants of both Chinese groups did seemingly lead to incorrect classification, at times. This is supported by declining scores for control words among both groups, particularly within CH1, where the difference between CH1 and native speakers was statistically significant.

Although this research focuses solely on the identification of vowel length in Thai, it may serve as guidelines for further research regarding the MLK of identification, and benefit research on production and perception among Chinese learners. Additional factors may also be considered in further research, such as testing CLTs with different levels of learning experience, proficiency levels, or linguistic backgrounds, as well as examining the effects of delayed post-tests on MLK.

Conclusion

This study has demonstrated that MLK helps Chinese learners of Thai in identifying vowel length more accurately, breaking the perception of one-to-one correspondence between graphemes and phonemes. There is no doubt that orthography has an effect in L2 acquisition, but MLK plays a more important role in L2 phonological representation (Derwing et al.,

1988; Escudero et al., 2015). This acknowledgement is vital to the advancement of both theoretical models and pronunciation training in Thai.

Acknowledgements

This research is supported by Yunnan University, the Scientific Research Foundation Project of Educational Commission of Yunnan Province (No.2019JS011) and the International Area Studies and Foreign Language High-Level Talents Training Project of China Scholarship Council. This paper is a part of the dissertation titled "The relationship between metalinguistic knowledge and the pronunciation of Thai vowel length by Chinese learners before and after praxis intervention". We are greateful to all the participants in this experiment for their valuable contribution to this reasearch.

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References

Abramson, A. S. (1962). *The vowels and tones of standard Thai: Acoustical measurements and experiments*. Bloomington: Indiana University Research Center in Anthropology, Folklore, an Linguistics, Pub. 20. [= International Journal of American Linguistics, 28, No.2, Part III]

Andrews, S. (2005). Professional standards in TEFL: A challenge for Asia. *Journal of Asia TEFL*, *2*(2), 2-22.

Aro, M., & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics*, *24*(4), 621-635.

Bialystok, E., & Miller, B. (1999). The problem of age in second-language acquisition: Influences from language, structure, and task. *Bilingualism: Language and Cognition*, *2*(2), 127-145.

Danvivathana, N. (1981). *The Thai writing system.* Ph.D. dissertation, University of Edinburgh.

DeKeyser, R. (2003). Implicit and explicit learning. In C. Doughty & M. Long (Eds.), *The Handbook of second language acquisition*, 313-348. Blackwell.

Derwing, T. M., Munro, M. J., & Wiebe, G. (1998). Evidence in favor of a broad framework for pronunciation instruction. *Language Learning*, *48*(3), 393-410.

Duan, W. (2017). *Teaching French pronunciation to Chinese adult learners in communicative language classrooms: Examining the effectiveness of explicit phonetic instruction.* McGill University Libraries.

Ellis, R. (2004). The definition and measurement of L2 explicit knowledge. *Language Learning*, *54*(2), 227-275.

Ellis, R. (2005). Measuring implicit and explicit knowledge of a second language: A psychometric study. *Studies in Second Language Acquisition*, *27*(02), 141-172.

Ellis, R. (2008). Explicit form-focused instruction and second language acquisition. In B. Spolsky & F. M. Hult (Eds.), *The handbook of educational linguistics*, 437-455. Blackwell.

Ellis, R. (2009). *Implicit and explicit knowledge in second language learning, testing and teaching* (Vol. 42). Multilingual Matters.

Escudero, P. (2015). Orthography plays a limited role when learning the phonological forms of new words: The case of Spanish and English learners of novel Dutch words. *Applied Psycholinguistics*, *36*(1), 7.

Escudero, P., Simon, E., & Mitterer, H. (2012). The perception of English front vowels by North Holland and Flemish listeners: Acoustic similarity predicts and explains cross-linguistic and L2 perception. *Journal of Phonetics*, *40*(2), 280-288.

Gass, S. M., & Selinker, L. (1983). *Language transfer in language learning*. Newbury House.

Goswami, U. (1999). The relationship between phonological awareness and orthographic representation in different orthographies. In M. Harris & Hatano (Eds.), *Learning to read and write: A cross-linguistic perspective*, 134-156. Cambridge University Press.

Goswami, U., Ziegler, J. C., Dalton, L., & Schneider, W. (2003). Nonword reading across orthographies: How flexible is the choice of reading units? *Applied Psycholinguistics*, *24*(2), 235-247.

Green, P. S., & Hecht, K. (1992). Implicit and explicit grammar: An empirical study. *Applied Linguistics*, *13*(2), 168-184.

Haas, M. R. (1943). *The Thai system of writing*. American Council of Learden Societies.

Ho, A. T. (1976). The acoustic variation of Mandarin tones. *Phonetica*, *33*(5), 353-367.

Hulstijn, J. H. (2005). Theoretical and empirical issues in the study of implicit and explicit second-language learning: Introduction. *Studies in Second Language Acquisition*, *27*(2), 129-140.

Isarankura, S. (2008). *Acquisition of The English article system by Thai learners: An analysis of metalinguistic knowledge in English article use.* Ph.D. dissertation, Chulalongkorn University.

Krashen, S. (1982). *Principles and practice in second loanguage acquisition*. Pergamon.

Lambacher, S. (1999). A call tool for improving second language acquisition of English consonants by Japanese learners. *Computer Assisted Language Learning*, *12*(2), 137-156.

Lima Jr, R., & Mangueira. (2017). The influence of metalinguistic knowledge of segmental phonology on the production of English vowels by Brazilian undergraduate students. *Ilha do Desterro A Journal of English Language, Literatures in English and Cultural Studies*, *70*(3), 117-130.

Lin, M., & Yan, J. (1988). The characteristic features of the final reduction in the neutral-tone syllable of Beijing Mandarin. *Phonetic laboratory annual report of phonetic research*, 37-51. Phonetic Laboratory, Institute of Linguistics, Chinese Acadamy of Social Sciences.

Nacaskul, K. (2008). *Thai sound system.* Publication of Academic Works of Faculty of Arts, Chulalongkorn University.

Ngarmwirojkit, C. (2012). *A metalinguistic study of spacing in Thai writing by Janpanese students*. M.A. Thesis, Chulalongkorn University.

Nimz, K., & Khattab, G. (2015). L2 sound perception: Does orthography matter? In The Scottish Consortium for ICPhS 2015 (Ed.), *Proceedings of the 18th International Congress of Phonetic Sciences*. The University of Glasgow.

Nimz, K., & Khattab, G. (2019). On the role of orthography in L2 vowel production: The case of Polish learners of German. *Second Language Research*, *36(4)*, 623 –652.

Pittayaporn, P. (2016). *Sound changes in Thai vowel length: the significance with respect to modern spelling*. Chulalongkorn University.

Pittayaporn, P., Maspong, S., Iamdanush, J., Laimanoo,P., & Lorattanachaiyong,I. (2016). Dating vowel lengthening in Thai. *Humanities Journal*, 23(1),70-102.

Rauber, A. S. (2006). *Perception and production of English vowels by Brazilian EFL speakers.* Ph.D. dissertation, Universidade Federal de Santa Catarina, Florianópolis, Brazil.

Roehr, K. (2007). Metalinguistic knowledge and language ability in university-level L2 learners. *Applied Linguistics*, *29*(2), 173-199.

Roengpitya, R. (2001). *A study of vowels, diphthongs, and tones in Thai.* Ph.D. dissertation, Departmemt of Linguistics, UCLA.

Saito, K. (2007). The influence of explicit phonetic instruction on pronunciation in EFL settings: The case of English vowels and Japanese learners of English. *Linguistics Journal*, *2*(3), 16-40.

Sándor, K. (2015). Implicit knowledge, explicit knowledge and their relation to general language proficiency. *The Publications of the MultiScience – XXIX. microCAD International Multidisciplinary Scientific Conference*, 1-14. Miskolci Egyetem.

Seliger, H. W. (1979). On the nature and function of language rules in language teaching. *TESOL Quarterly*, *13(3)*, 359-369.

Serrano, R. (2011). From metalinguistic instruction to metalinguistic knowledge, and from metalinguistic knowledge to performance in error correction and oral production tasks. *Language Awareness*, *20*(1), 1-16.

Shih, C. (1987). *The phonetics of The Chinese tonal system*. Technical memorandum. AT&T Bell Laboratories.

White, J., Muñoz, C., & Collins, L. (2007). The his/her challenge: Making progress in a 'regular' L2 programme. *Language Awareness*, *16*(4), 278-299.

White, J., & Ranta, L. (2002). Examining the interface between metalinguistic task performance and oral production in a second language. *Language Awareness*, *11*(4), 259-290.

Widjaja, V., & Winskel, H. (2004). Phonological awareness and word reading in a transparent orthography: Preliminary findings on Indonesian. *Proceedings of the 10th Australian International Conference on Speech Science and Technology*, 370-375. Macquarie University, Sydney. 378-310 December. Sydney:

Australian Speech Science & Technology Association.
Wu, F., & Kenstowicz, M. (2015). Duration reflexes of syllable structure in Mandarin. *Lingua*, *164*, 87-99.
Xu, Y. (1997). Contextual tonal variations in Mandarin. *Journal of phonetics*, *25*(1), 61-83.
Yip, M. (2002). *Tone*. Cambridge University Press.

Appendix A

Thai Vowel Length Identification Test (Examples)

Tasks and instruction: For each identification question, participants were required to classify 30 words into two boxes according to the vowel length (one white box for short vowels and one white box for long vowels) and then provide their reasonings for classification. If they were unable to provide an explanation for a particular word, they were prompted to include it in the gray boxes (one for short vowels and one for long vowels). Each correct classification earned 1 point and no points were earned for the reasoning.

เบ่ง กิน หาด เข่ง หมี ทึม เก๋ง คีบ ทน เก้ง เจ๋ง เกณฑ์ แป้ง เม้ม แบบ เชิญ เส้น เทอม ป้อน กอง โหลด เล่ม โหด เฉอะ เร่ง เด่น บ้าง เด้ง เหมื่น รุ้ง

Words having short pronunciations:

Reasons:

Words having short pronunciations without ready explanation:

Words having long pronunciations:

Reasons:

Words having long pronunciation without ready explanation:

Appendix B

Thai Vowel Length Identification Exercise (Examples)

Please identify whether the following words are pronounced as short or long and provide reasonings for identification.

1. เก้ง
□ short □ long
Reasons:
2. เก๋ง
□ short □ long
Reasons:
3. เท้ง
□ short □ long
Reasons:
4. เค้น
□ short □ long
Reasons:
5. เพ่ง
□ short □ long
Reasons:
6. แห่ง
□ short □ long
Reasons:
7. แคล้ว
□ short □ long
Reasons:
8. แกล้ว
□ short □ long
Reasons:
9. แท่ง
□ short □ long
Reasons:
10. อ๋อง
□ short □ long
Reasons:
11. ช่อง
□ short □ long
Reasons: