

Chinese as a Foreign Language (CFL) Students’ Lexical Tonal Development: An Investigation of Tonal Production and Awareness of Tonal Categories

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Abstract

This paper reports on an empirical study examining the relationship between beginning-level CFL students’ tonal production and their awareness of lexical tonal categories. Additionally, it investigated CFL learners’ views about the relationship. A mixed method approach was adopted to collect and analyze both quantitative and qualitative data from 23 beginning-level English-speaking adult CFL learners. The quantitative results show that the participants’ accuracy of lexical tonal production was statistically significantly correlated to their awareness of tonal categories and their tonal production was statistically more accurate than their awareness of tonal categories. The qualitative findings show that the participants didn’t rely on their awareness of tonal categories when conducting the production task. However, the participants stressed the importance of awareness of tonal categories in their tonal production, particularly when producing unfamiliar characters. Based on the discovered unique relationship, pedagogical suggestions for beginning-level CFL tonal development are offered.

Introduction

Mandarin Chinese (MC) is a tonal language in which each morpheme is distinguished by both the phonetic feature and the fundamental frequency (F0) contour pattern. Due to the acoustic differences between MC and non-tonal languages (e.g. Shen, 1989; Sun, 1998), accurate tonal production is a daunting task for English-speaking learners of MC in a non-Chinese environment, particularly after their adolescence. In recent years, there have been an increasing number of college-level learners of Chinese as a foreign language (CFL) (Asia Society, 2010). An urgent issue facing CFL educators and researchers is how best to help adult CFL learners overcome the phonological barrier and build a solid foundation from which they can develop a more advanced speaking proficiency.

A number of studies (e.g. Leather, 1990; Shen, 1989; Wang, Spence, Jongman & Sereno, 1999; Wang, Jongman, & Sereno, 2003) have been conducted in the past decades to uncover various factors that may influence CFL adult learners' production of lexical tones. One line of inquiry (e.g. Chen, 1997; Guo, 1993; Miracle, 1989; White, 1981) has investigated how the differences between MC and learners' native languages are responsible for the consequent difficulties in producing Mandarin tones. It has also claimed that non-tonal learners, such as English-speaking learners, lack the knowledge of, and exposure to, tonal variances. Another line of research (e.g. Broselow, Hurtig, & Ringen, 1987; Lee, Tao, & Bond, 2010; Nguyen & Macken, 2008; Zhang, 2010) has focused on the effects of contextual factors, such as adjacent tones, positions of tones, and speaking tasks, on non-tonal learners' tonal perception and production. Drawing on general second language (L2) phonology acquisition theories that claim that learners' L2 perception precedes their production, many Chinese phonology researchers (e.g. Leather, 1997; Wang, et al, 1999; Wang, et al, 2003) believe that training on non-tonal speakers' perceptual sensitivity to MC's lexical tonal differences can lead to accurate tonal production. Wang et al's study (2003), in particular, indicates that non-tonal speakers' awareness of lexical tonal categories as a result of the perception training is instrumental to their tonal production accuracy.

An incongruity has long existed between many language

educators and CFL researchers. Language educators usually believe in explicit teaching of Mandarin tonal orthography whereas researchers (e.g. Sun, 1998) question the importance of learners' explicit knowledge of Mandarin orthography at the beginning phase of CFL learning. Up to today, very few empirical studies have been conducted to investigate the relationship between CFL adult learners' tonal production and their awareness of lexical tonal categories. Employing a mixed-method approach (Tashakkori & Teddlie, 1998), this study investigated the relationship between beginning-level CFL adult learners' production of monosyllabic lexical tones and their awareness of lexical tonal categories. It also analyzed the relationship from the learners' perspective. In this study, awareness of lexical tonal categories refers to CFL learners' conscious awareness of the categorical types rather than the specific acoustic features of Chinese character's standard or most commonly used tones. For example, the standard tonal category of 好hao is 3 (the 3rd tone).

Literature Review

MC Tonal System

Before reviewing the studies investigating CFL learners' tonal production, it is worth introducing the MC tonal system. MC tones are manifested by the fundamental frequency (F0) values such as F0 pitch and contour (Howie, 1976; Wu, 1986) as well as amplitude and duration (Lin, 1965; Chuang, Hiki, Sone, & Nimura, 1971; Jongman & Moore, 1997). In general, due to the variety of these characteristics, MC tones are comprised of five tones, 1st tone (the level tone, high-level), 2nd tone (the rising tone), 3rd tone (the dipping tone, low-dipping), 4th tone (the falling tone, high-falling), and the neutral tone which is pronounced neutrally with no apparent F0 values. Research (e.g. Francis, Ciocca, Ma, & Fenn, 2008; Lee, Tao, & Bond, 2010) has shown that native speakers of tonal languages can differentiate tones based on the various characteristics of each tone whereas non-tonal language speakers have difficulty to do so.

Factors Influencing Non-tonal Learners' Tonal Production

According to the first language (L1) phonology acquisition theory, a phonology develops in its function as mediator between speech perception and production. Many Chinese phonology researchers (e.g. Sun, 1998; Wang et al, 2003) assume that this also holds true in L2 phonology acquisition. However, L2 learners generally lack the opportunities to be exposed to a vast amount of language input as well as to practice the language. This stands in sharp contrast to L1 children who develop their native phonology subconsciously. The limited amount of language input and output inhibits a majority of adult CFL learners from achieving quasi-native phonological proficiency, particularly in production. Thus, L2 phonology acquisition is usually more prolonged and poses a greater challenge. The developmental process is, therefore, bound to be more complex.

In the past few decades, a number of empirical studies have focused on possible factors influencing the MC tonal production of non-tonal language speakers, which stem from both interlanguage and intralanguage difficulty. In terms of interlanguage difficulty, researchers (e.g. Chen, 1997; Guo, 1993; Leather, 1987, 1990; Miracle, 1989; Shen, 1989; White, 1981) have discovered that: (1) CFL learners make either pitch or contour errors in production due to the lack of lexical contour in English and the wider pitch range in MC; and (2) the falling tone is especially difficult because it is prosodically less marked in English. Regarding intralanguage difficulty, research findings (e.g. Broselow, Hurtig, & Ringen, 1987; Lee et al, 2010; Shen, 1989; Zhang, 2010) have shown that: (1) American students acquire the rising and dipping tones more slowly because of the acoustic-phonetic similarity between the two tones; and (2) there is significant interaction between variables, such as the markedness of tonal category, position of tones in a phrase, and speaking task types. In general, there exists a consensus that non-tonal speakers of MC consider lexical tones as auxiliary features to internalize and are less sensitive to tonal categories even though they are more sensitive to acoustic changes. Native speakers of MC, on the other hand, consider tonal patterns to be an integral facet of each character.

Another line of research (e.g. Leather, 1990; Wang et al, 1999; Wang et al, 2003) focuses on the influence of non-tonal speakers'

perception on their production. These researchers believe that the perception and production of tones are interrelated. A positive correlation exists between training in lexical tonal perception and tonal production. In other words, the results of perceptual training can be transferred to learners' production. Based upon her research with 72 first-year American learners of Mandarin Chinese, Winke (2007) disputes the widely accepted assumption that students' L1 backgrounds significantly influence their tonal production and proposes that learners' familiarity with the tonal system is more consequential for their tonal production. With American listeners rather than learners of MC as research subjects, Wang et al (1999, 2003) discover that after receiving perception training, non-tonal listeners' competence in identifying MC lexical tonal categories when receiving audio stimuli improves. The same results hold true with regards to their competence in producing MC tones when provided with lexical tonal categories.

Research Methods and Tasks in CFL Phonology Acquisition Research

The research methods and tasks adopted in existing empirical studies regarding CFL learners' phonology acquisition is another area of disagreement within the field. Sato (1987) has argued that the assessment of pronunciation in a longitudinal study could vary significantly with the types of learning tasks and the unit of data analysis. Many early MC phonology studies (e.g. Miracle, 1989; Shen, 1989) focused on statistical analysis of the effects of variables on students' eventual achievement in production. These were carried out through the collection of students' scores on different tests and then conducting various ANOVA analyses to prove the statistical significance of hypotheses. Researchers (e.g. Sun, 1998) later pointed out that the research methods and task types in earlier studies made the findings controversial. For example, among the longitudinal studies (e.g. Lu, 1992; Miracle, 1989; Shen, 1989) on the MC tonal acquisition process, students' production data are usually solicited from one single stimulus task such as read aloud words or text printed in MC pinyin (Romanized spelling). This methodology may not elucidate a comprehensive understanding of tonal production. In

her own study (Sun, 1998), Sun discovered that students' production accuracy of the rising tone and dipping tone varies depending upon whether it is a translation task, a repetition, or read aloud task. The kind of characters researchers choose to include in the task can also influence students' production performances. Students score higher with common words than they do with uncommon words, as demonstrated by Lu's (1992) study.

In sum, the findings of existing research on tonal production and development are inconclusive. Many of the previous studies focus on non-tonal speakers' MC tonal production patterns compared with MC native speakers' rather than CFL learners' own tonal developmental process. Despite the common pedagogical practice of explicitly teaching tonal categories, it is still empirically little known as to how CFL learners manifest the awareness of lexical tonal categories in both their tonal production and eventual development. Non-tonal CFL learners' MC tonal development is still far from being understood. More research is needed to uncover how non-tonal learners learn and produce tones in various production tasks. In addition, there has been little investigation of MC learners' own views regarding the relationship between their tonal production and the awareness of tonal categories. The process of MC tonal development merits further investigation from a qualitative perspective.

This study attempts to uncover the relationship between beginning-level CFL learners' lexical tonal production and their awareness of lexical tonal categories in order to develop a better understanding of CFL learners' tonal production and development. Additionally, it investigates how the participants view the relationship.

The Study

Two primary research questions were answered during this study: (1) What is the relationship between beginning-level CFL students' lexical tonal production of monosyllabic words and their awareness of the respective tonal categories? (2) How do beginning-level CFL students perceive the relationship between their tonal production and the awareness of lexical tonal categories? The study's focus is on learners' monosyllabic lexical tonal production

because it helps the participants focus on producing and recognizing monosyllabic tones without worrying about tonal changes caused by adjacent tones and the position of a particular tone in a phrase. Considering the complexity of L2 phonology development, the current study adopted a mixed-method approach (Tashakkori & Teddlie, 1998). Both quantitative (correlation and paired samples t-tests) and qualitative (interviews) research methods were employed to articulate a more comprehensive understanding of the relationship between learners' tonal production and their awareness of tonal categories.

Participants

The participants of the study included students enrolled in two beginning-level CFL classes in a teaching-oriented private university in the Midwest of the U.S. In both classes, students were expected to develop all four Mandarin skills necessary for participation in meaningful social interactions. The researcher taught both classes. The textbook used in the classes was *Integrated Chinese Level 1, Part 1* (3rd Ed) published by the Cheng & Tsui Company in 2009. Thus, both classes learned the same content at a similar pace. Before the autumn quarter (early September) started, IRB approval was obtained from the university's IRB board. On the first day of the class, the students enrolled in both classes were informed of the study's purpose and procedure. It was explained that their participation in the study would not affect their regular grades and that the study results would be used solely for research purposes. 23 out of 30 enrolled in both classes volunteered as participants in the study.

Study Context

During the quarter, the researcher/instructor provided explicit perception and production training for each tone in class so as to help participants accurately produce lexical tones. For perception training, the researcher/instructor demonstrated the production of each tone, which was followed by explicit explanation of how the pitch and contour of each tone were produced, using both the materials provided in the textbook and online video clips

which show X-ray animations of tongue and mouth movements for each tonal production. Similar sounding tones, such as the 2nd and 3rd tones, were paired together to show tonal differences. Participants were required to practice differentiating and identifying the tonal categories of various monosyllabic words, such as 1st versus 2nd, and 2nd versus 3rd. Participants were then required to practice producing each monosyllabic word. Particular tonal production strategies were offered explicitly, such as how to use different hand gestures and head movements to assist tonal production. This procedure was repeated in each lesson when participants learned new characters. The data collection portion of the study was conducted during the 10th week, which was the final week of the autumn quarter.

Data Collection

The data collection was divided into two sections. The quantitative section contained one oral test (Appendix A) and one written test (Appendix B). Both tests contained the same 50 monosyllabic Chinese characters placed adjacent to their respective pinyin but without tonal marks which indicate tonal categories. The 50 monosyllabic characters were selected from a list of common words that the participants had learned throughout the academic quarter. Pinyin was provided for each character to help participants correctly pronounce the sound. Among the 50 chosen characters, there were 12 1st tone, 12 2nd tone, 12 3rd tone, 12 4th tone, and 2 neutral-tone characters. This was done to avoid the potential influence of the tones' markedness on participants' production. Characters were specifically selected so as to ensure that all 50 characters appeared in the teaching materials and had been practiced throughout the 10 weeks to avoid the potential influence caused by any character's unique frequency of appearance. Although neutral tones may cause less trouble in production, they were used in the study to test whether the participants could distinguish them from other tones in their production and awareness. Only two neutral-tone characters were included in the list because of the low frequency of neutral tones in the teaching material. Furthermore, the test items were used in a pilot study with 10 intermediate-level CFL learners enrolled in the same language program in order to verify the test items' validity.

The oral test took place in the soundproof language lab of the Department of Modern Languages. Every participant took the test individually and was given plenty of time to finish the test. During the test, each participant was required to read aloud each character/pinyin on the list and was recorded with a microphone headset from Radio Shack and a Dell Pentium IV laptop computer with Windows XP in the lab. Participants were allowed to re-record their pronunciation if they felt any earlier recording to be inaccurate. Following the oral test, the written test was conducted in a different room where participants marked out the tonal categories of the listed characters by either writing down the tonal marks or using numbers to indicate tonal categories (e.g. 0 as the neutral tone, 4 as the 4th tone). Participants were instructed that they should provide the accurate tonal category of each character or leave the question empty if they were not sure of the answer so as to avoid any answers that were based upon guesswork. Although the 50 characters in the oral test were the same as those in the written test, they were arranged in a different order so as to avoid any memory interference from the previous test.

After the researcher compiled and preliminarily analyzed the oral and written test results, the qualitative data collection was undertaken. The researcher gave a 30-minute semi-structured interview (see Appendix C for sample questions in the interview) to each participant. The interview questions helped solicit the participants' views about the importance of awareness of tonal categories in tonal production and development, the underlying reasons for the discrepancies between their written and oral test results, and the difficulties they encountered during CFL tone learning. Each interview was tape-recorded and later transcribed. A total of 23 sets of quantitative and qualitative data were collected for data analysis.

Data Analysis

Both quantitative and qualitative analysis was conducted during the data analysis phase. The quantitative data analysis consisted of four steps. First, the researcher and a fellow instructor graded the oral test. Both the researcher and the fellow instructor are native speakers of Mandarin Chinese, have received training in Chinese phonology, and have ample experience with CFL teaching. Both evaluators first independently listened to each participant's audio recording and evaluated the production accuracy. A correctly pronounced character earned one point and the perfect score for the oral test was 50 points. Then, the two evaluators compared the test results of each participant. In the case of any contradictory findings, the evaluators collectively re-examined the recordings until an agreement was reached. As a result of the grading, each participant obtained a grade for their lexical tonal production on the oral test. In step 2, the written test was graded. During this step, the researcher checked the accuracy of tonal categories identified by each participant in the written test. Same with the oral test, any correctly marked tonal category earned one point whereas any unanswered or incorrectly marked tonal category earned 0 point.

In step 3 of the quantitative data analysis, a two-tail correlation/paired samples T-test was run with the use of SPSS to examine the statistical correlation as well as the statistical difference between participants' oral test scores and their written test scores. Step 4 was undertaken to further reveal the relationship between the oral and written test scores since both tests shared the same items. First, each participant's consistent as well as discrepant answers in the oral and written tests were identified and counted. Second, each participant's discrepant answers that were correct on the oral test but incorrect on the written test were calculated. Their discrepant answers which were incorrect on the oral test but correct on the written test were calculated as well. Third, one paired samples T-test was run to analyze the statistically significant difference between the participants' consistent answers and their discrepant answers. Another paired sample T-test was run to analyze the difference between the two types of discrepant answers.

The qualitative data analysis was conducted in five steps. In step 1, all of the interview recordings were transcribed. In step 2, the

researcher inspected each participant's interview transcript in order to gain a general understanding about the participants' view about tonal development. In step 3, the researcher picked one transcript to start with and used the constant comparison method (Lincoln & Guba, 1985) to categorize and group transcript data. A tentative schema was yielded as a result of Step 3 analysis. In step 4, the tentative schema was used to analyze other participants' interview transcript. New emergent categories were added into the schema. In the case that contradictory categories were discovered, the constant comparison method was used to analyze whether the new contradictory categories should be discarded or added into the schema.

Findings

Research Question 1

The correlation test results showed that the correlation between the 23 participants' oral and written test scores is statistically significant (correlation coefficient = 0.643) at the .01 level. The score distribution is illustrated in Figure 1. It indicates that the accuracy of participants' lexical tonal production is statistically significantly correlated to their awareness of tonal categories. In other words, students who performed better in tonal production usually remembered lexical tonal categories more accurately, although the causal relationship is not inferred here.

The results (see Table 1) of the paired samples T-test with the oral and the written test scores show that the participants' oral test scores are statistically significantly different from their written test scores ($t(22) = 6.931, p < .001$). Additionally, the means show that their production of the lexical tones ($m=34.0$) was more accurate than their awareness of the tonal categories ($m=23.3$). The results (see Table 2) of the paired samples T-test with the consistency and discrepancy counts show that the participants' consistent answers between the two tests were statistically significantly different from their discrepant answers between the two tests ($t(22)=3.387, p < .05$). The higher mean of the consistency answers ($m=29.9$) also indicates that the majority of the answers were consistently rather than randomly given by the participants, further proving the close correlation between the two sets of test scores. The results (see Table

3) of the paired samples T-test with the discrepant answers in the two tests further illustrate that the participants' discrepant answers that were correct on the oral test but incorrect on the written test were statistically different from those that were incorrect on the oral test but correct in the written test ($t(22) = 7.657, p < .001$). Furthermore, the mean difference ($m = 15.8$ for answers correct on the oral test but incorrect on the written test; $m = 4.3$ for answers incorrect on the oral test but correct on the written test) indicates that there were more answers that were correct on the oral test but incorrect on the written test than those that were incorrect on the oral test but correct on the written test.

In sum, the statistical analysis results show that there existed positive correlation between the accuracy of the CFL participants' lexical tonal production and their awareness of tonal categories when provided with a same list of characters along with their respective pinyin. However, their lexical tonal production was statistically significantly more accurate than their awareness of the lexical categories. The qualitative analysis further illustrates this relationship from the participants' perspective.

Research Question 2

Despite the statistical results that the participants had very unbalanced competence in terms of their tonal production and awareness of tonal categories, 20 out of 23 (86.9 %) of the participants agreed on the importance of the awareness of tonal categories in their tonal production. For example, Nina said, "It helps me focus on the tones when I speak. Otherwise, I go without any tone. And of course, no Chinese will understand me." Among the 20 participants, 10 (50%) also pointed out that explicit knowledge about tonal categories provides guidance which helps them consistently pronounce tones correctly. For example, Emily reflected that,

I sometimes just go with my instinct. But I know I can at least pronounce the tone correctly every time I have to say it if I know its tonal category. Otherwise, sometimes I may pronounce it correctly, sometimes not, because I am not sure.

16 of the participants (69.6%) specifically emphasized that they consciously consulted their knowledge of tonal categories whenever they had no idea how to pronounce a character. Andrew reflected, "I

often go back to my memory to search a character's tonal category when I don't know how to say it."

Regarding their higher scores on the oral test than those on the written test, 18 out of 23 (78.3 %) participants confessed that when they produced tones, they relied mainly on their memory of the sounds they heard either in class or from audio recordings. They explained that remembering all characters' tonal categories were too cognitively demanding. For instance, Sarah reflected,

I know I should do it... I could put tonal marks beside all the characters we learned to remind me how to pronounce the tones correctly. It is just too much for me to do... So I usually just try to remember and mimic how you pronounce the characters in class.

Due to the difficulty of remembering the tonal category of each character, 5 out of 23 (21.7%) participants also confessed that when learning how to pronounce characters, they seldom paid attention to the tonal categories. For example, Mark confessed, "It is just too much to remember the sound, the character, and the tonal mark. So I just gave up remembering the tonal marks. As long as I can pronounce it correctly, I am happy." Two participants also thought that not explicitly knowing the tonal categories might make them sound more like native speakers as native speakers don't seem to pay attention to tonal categories. For instance, Ben reflected, "I know it is a fourth tone if I look at the textbook. I just want to pronounce it like a native speaker. I don't want to think which tone it is."

Regarding the errors that appeared exclusively on the oral test, the findings showed that all but one participant expressed having difficulty in accurately producing certain tones, despite their awareness of appropriate categories for these tones. 13 out of 23 (56.5 %) participants indicated that the 2nd tone was the most difficult tone to produce, while 7 out of 23 (30.4 %) said the 4th tone was the most difficult. However, only 3 stated the 3rd tone was the most difficult one due to the special contour (e.g. the falling then rising acoustic contour). Specifically, participants identified two main factors that caused their production difficulty despite their awareness of the tonal categories: 1) The difference between English and MC sound systems; and 2) The similarity between tones. For example,

Sarah explained, “The 2nd tone is very difficult for me. I still cannot say it because English doesn’t have the tone.”

Overall, the quantitative analysis shows that the accuracy of beginning-level CFL learners’ monosyllabic lexical tonal production is statistically significantly related to their awareness of tonal categories. However, their tonal production was more accurate than their awareness. The qualitative analysis reveals that the majority of participants agreed that explicit knowledge of tonal categories is helpful for them to pronounce lexical tones accurately and consistently. However, remembering each character’s written form, sound, and tonal category was considered very cognitively demanding. Thus, many participants opted to not use their awareness of tonal categories when conducting the tonal production task. Additionally, the participants also revealed that the difficulty in tonal production when they had the awareness of tonal categories was a result of either interlanguage differences or intralanguage features.

Discussion

The findings of the current study reveal a very interesting picture of the relationship between beginning-level CFL learners’ tonal production and awareness of tonal categories. The relationship seems to be affected by the production task, their view about the importance of explicitly knowing tonal categories, and their proficiency in producing lexical tones accurately.

In contrast to previous studies (e.g. Sun, 1998; Zhang, 2010; Wang et al, 2003) on CFL learners’ tonal production, the participants in the current study were required to produce monosyllabic tones while provided with Chinese characters and their respective pinyin. In other words, the participants had to use their prior knowledge of each character including its form, pronunciation and tonal category in order to perform the task. In such a cognitively demanding task, most of them relied on their implicit knowledge of each character’s pronunciation rather than the explicit knowledge of tonal categories to first recognize the character and then pronounce it with appropriate phonetic sound and tone. Interestingly, their higher scores in the oral test indicate that the majority of the participants subconsciously picked up the tones when they learned each character, although they were not able to consciously identify their tonal

categories, which became evident in their lower written test scores. This might have been attributed to the fact that the 50 characters included in the tests are common and familiar to them. Therefore, corroborating Sun's (1998) claim that task types may affect CFL learners' tonal production performance, the findings of the current study show that many beginning-level CFL learners didn't rely on their awareness of tonal categories when conducting a read aloud task with common characters. Instead, they were able to use their implicit memory of each character's sound to gauge their accurate tonal production. Many of them didn't develop conscious awareness of lexical tonal categories due to the cognitive taxation involved in processing various aspects of a Chinese character.

Despite the lack of consulting their awareness of tonal categories when conducting the tonal production task, many participants' positive view about the importance of the awareness of tonal categories in tonal production indicates the special pattern of L2 tonal development. Most of the participants felt more confident in tonal production when they explicitly knew a character's tonal category. This is further illustrated by their confession that they tended to consult their knowledge of tonal categories when trying to pronounce unfamiliar characters. Although this is beyond the scope of the current study, it is possible that this insecurity might have stimulated the participants to focus on explicit knowledge of tonal categories when they developed the competence to produce tones accurately. Therefore, CFL learners' awareness of tonal categories may emerge in conjunction with their development of tonal production competence, although not all learners can do so due to the cognitive taxation involved in this process. This may explain the positive correlation between the accuracy of the participants' tonal production and their awareness of tonal category.

The findings in regards to the discrepant answers in the oral and written tests further reveal that the awareness of tonal categories may not indicate the accuracy of tonal production. Consistent with the findings in previous studies (e.g. Chen, 1997; Miracle, 1989; Shen, 1989; White, 1981), the current study found that despite the participants' awareness of certain tonal categories as shown in their written test answers, they still couldn't produce the tones, largely due to the interlanguage and intralanguage difficulties. Thus, more

rigorous training in specific tonal perception and production (e.g. Sun, 1989; Wang et al, 1999; Wang et al, 2003) should be provided.

Sun (1998) advocates a beginning-level CFL tonal education approach that avoids explicit teaching of MC tonal orthography and encourages a learning process similar to the L1 phonology acquisition process. The current study's findings confirmed that beginning-level CFL learners could produce monosyllabic tones with impressive accuracy when given the character and pinyin stimuli despite their relative lack of awareness of lexical tonal categories. However, the study also discovered that the majority of the CFL learners felt more secure about their tonal production accuracy when they had explicit knowledge about the tonal category, which significantly differs from L1 phonology development. The awareness of tonal categories is even more crucial when the learners are producing unfamiliar tones. This has significant pedagogical implications in adult CFL tonal development.

Currently, many CFL language programs require students to develop both verbal and written communicative skills. Remembering all aspects of any Chinese character including character form, sound, and tone is inevitably very cognitively demanding for English-speaking learners. Besides necessary training in implicit perception and production of different tones, requiring beginning-level CFL learners to explicitly remember tonal categories before they can produce the tones accurately may be futile, especially when they are conducting a speaking task involving the recognition of Chinese characters. However, in contrast to L1 speakers, CFL learners may feel more confident in consistent tonal production when they have the awareness of tonal categories. Teachers can encourage beginning-level learners to take two steps to develop tonal proficiency. First, they can imitate the native pronunciation and build implicit connection between character form, sound, and tone. Then, explicit knowledge of the tonal categories of characters that are causing difficulty or confusion can be emphasized so learners can develop a reliable guide they can consult when producing unfamiliar tones. In addition, the teacher needs to be aware of whether a beginning-level student's tonal production issue is caused by his or her interlanguage difficulty, intralanguage confusion, or lack of awareness of tonal category. Appropriate assistances should be

provided accordingly.

Limitations and Delimitations of the Study

This study has several limitations which prevent the findings from being generalized to all CFL tonal production situations. First, the participants were selected conveniently from two classes taught by the researcher. The sampling strategy may limit the generalizability of the findings. Second, as mentioned earlier, the study employed a read aloud task with a list of Chinese characters and their respective pinyin. Thus, the findings may not hold true in other tonal production tasks where the learners don't have to recognize character forms. Third, the characters chosen in the task were pre-selected monosyllabic characters. The findings shall not be generalized to disyllabic phrases or other longer utterances in natural conversational contexts. Fourth, although the oral test results were evaluated by two MC native speakers, the subjective evaluation may still not be as reliable as the one conducted with standard acoustic software.

Conclusion

Adopting a mixed method approach, the current study investigated the relationship between beginning-level CFL learners' tonal production and their awareness of lexical tonal categories in a read aloud task as well as CFL learners' views about the relationship. The quantitative findings show that the participants' tonal production accuracy was statistically significantly related to their awareness of tonal categories when they were provided with a list of common Chinese characters. Despite the same items in oral and written tests, their tonal production was statistically more accurate than their awareness of tonal categories. The qualitative findings show that the vast majority of the participants didn't rely on their awareness of tonal categories when conducting the production task and their lack of awareness of tonal categories was due to the cognitive taxation involved in remembering all aspects of a character. However, the majority of the participants held a predominantly positive view about the importance of the awareness of tonal categories in tonal production. They also reported that despite their awareness of tonal categories, their production difficulties could result from

interlanguage differences and intralanguage features. Based on the discovered special relationship between CFL learners' tonal production and awareness of tonal categories, pedagogical implications for beginning-level tonal development are provided.

The study's findings contribute to the field of adult CFL pedagogy. It provides a better understanding of beginning-level non-tonal CFL learners' monosyllabic tonal production when conducting a read aloud task by delineating the learners' use and view of the awareness of tonal categories in tonal production. It also sheds light on CFL learners' tonal developmental process in terms of how CFL learners' awareness of tonal categories may naturally emerge and function along with their tonal production. In addition, methodologically, it is one of the first studies that adopt a mixed method approach to investigating CFL learners' tonal production.

Accurate tonal production is one of the most daunting tasks for non-tonal CFL learners. How the awareness of tonal categories should be taught, developed, and utilized to assist tonal production remains an intriguing issue for CFL teachers and learners. More empirical studies should be conducted to investigate whether and how learners at various proficiency levels develop and use their awareness of tonal categories when developing tonal production competence in various speaking tasks. In particular, the evolution of CFL learners' tonal developmental process merits more systematic in-depth investigation.

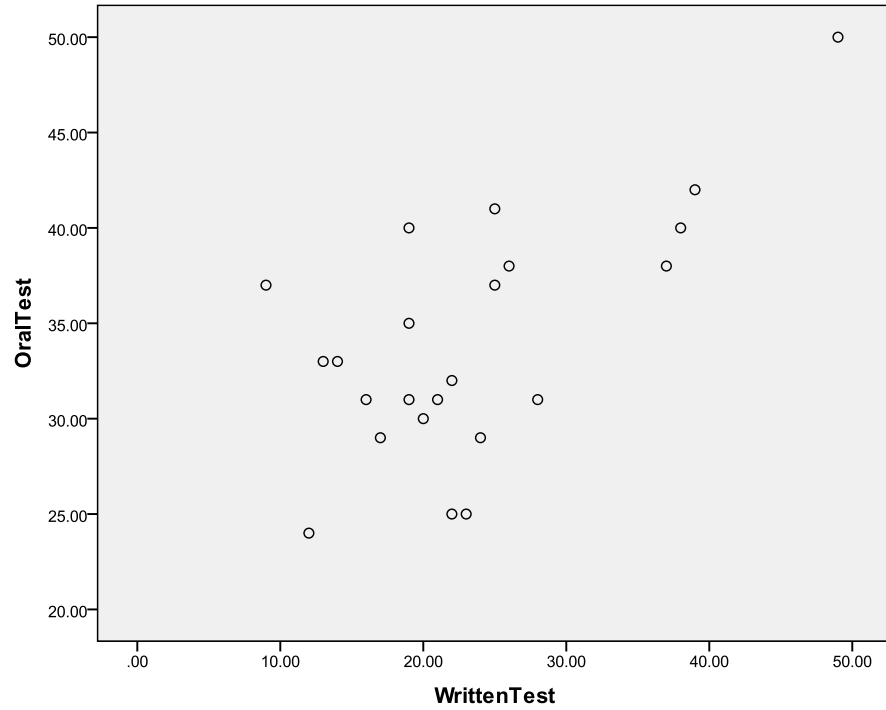
References

- Asia Society. (2010). *Facing the challenges: Preparing Chinese language teachers for American schools*. Retrieved from <http://asiasociety.org/files/chinese-teacherprep.pdf>
- Broselow, E., Hurtig, R., & Ringen, C. (1987). The perception of second language prosody. In G. Ioup & S. Weinberger (Eds.), *Interlanguage phonology: The acquisition of a second language sound system* (pp.350-361). Cambridge, MA: Newbury House.
- Chao, Y. R. (1968). *A grammar of spoken Chinese*. Berkeley, CA: University of California.
- Chen, Q-H. (1997). Toward a sequential approach for tonal error analysis. *Journal of the Chinese Teacher Teachers' Association*, 32(1), 21-39.
- Chuang, C.K., Hiki, S., Sone, T., & Nimura, T. (1971). The acoustical features and perceptual cues of the four tones of standard colloquial Chinese. *Proceedings of the Seventh International Congress on Acoustics (Budapest)*, 297-300.
- Fikkert, P. (2000). Acquisition of phonology. In L. Cheng & R. Sybesma (Eds.), *The first Glot International state-of-the-article book: The latest in linguistics(Studies in Generative Grammar 48)* (pp.221-250). Berlin/New York: Mouton de Gruyter.
- Francis, A. L., Ciocca, V., Ma, L., & Venn, K. (2008). Perceptual learning of Cantonese tones by tone and non-tone language speakers. *Journal of Phonetics*, 36, 268-294.
- Guo, J-F. (1993). *Hanyu shengdiao yudiao chanyao yu tansuo* [Ellucidation and exploration of tone and intonation in Chinese]. Beijing: Beijing Language Institute.
- Howie, J.M. (1976). *Acoustical studies of Mandarin vowels and tones*. Cambridge: Cambridge University Press.

- Jongman, A., & Moore, C. (2000). The role of language experience in speaker and rate normalization processes. *Proceedings of the 6th International conference on Spoken Language Processing, I*, 62-65.
- Lee, C., Tao, L., & Bond, Z.S. (2010). Identification of acoustically modified Mandarin tones by non-native listeners. *Language and Speech*, 53(2), 217-243.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: SAGE Publications, Inc.
- Leather, J. (1987). F pattern inference in the perceptual acquisition of second language tone. In A. James & J. Leathers (Eds.), *Sound patterns in second language acquisition* (pp.59-80). Dordrecht: Foris.
- Leather, J. (1990). Perceptual and productive learning of Chinese lexical tone by Dutch and English speakers. In J. Leather & A. James (Eds.), *New sounds 90: Proceedings of the 1990 Amsterdam symposium on the acquisition of second language speech* (pp.72-97). University of Amsterdam.
- Leather, J. (1997). Interrelation of perceptual and productive learning in the initial acquisition of second-language tone. In A. James & J. Leather (Eds.). *Second-language speech: Structure and process* (pp. 75-101). Berlin: Mouton De Gruyter.
- Lin, M.C. (1965). The pitch indicator and the pitch characteristics of tones in standard Chinese. *Acta Aconstica (China)*, 2, 8-15.
- Lu, J-M. (1992). On the perception and production of Mandarin tones by adult English-speaking learners. *Dissertation Abstract International*, 53(7), 2350A
- Lundelius, J. O. (1992). Pinyin vs. tonal spelling. *Journal of the Chinese Language Teachers' Association*, 28(3), 93-108.
- Miles, M. B., & Huberman, M. A. (1994). *Qualitative data analysis: An expanded sourcebook*. (2nd ed.). Newbury Park, CA: Sage Publications, Inc.

- Miracle, W. C. (1989). Tone production of American students of Chinese: A preliminary acoustic study. *Journal of the Chinese Language Teachers' Association*, 24(3), 49-65.
- Nguyen, H., & Mackey, M.A. (2008). Factors affecting the production of Vietnamese tones. *Studies of Second Language Acquisition*, 30, 49-77.
- Shen, X-N.S. (1989). Toward a register approach in teaching Mandarin tones. *Journal of the Chinese Teachers' Association*, 24(3), 27-47.
- Sun, S. H. (1998). *The development of a lexical tone phonology in American adult learners of standard Mandarin Chinese*. Honolulu, HI: University of Hawai'i Press.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: SAGE Publications, Inc.
- Wang, Y., Spence, M. M., Jongman, A., & Sereno, J. A. (1999). Training American listeners to perceive Mandarin tones. *Journal of the Acoustic Society of America*, 106, 3649-3658.
- Wang, Y., Jongman, A., & Sereno, J. A. (2003). Acoustic and perceptual evaluation of Mandarin tone productions before and after perceptual training. *Journal of the Acoustic Society of America*, 113, 1033-1044.
- Wang, X. (2008). Training for learning Mandarin tones. In F. Zhang & B. Barber (Eds.), *Handbook of research on computer-assisted language acquisition and learning* (pp. 259-274). IGI Global.
- White, C.M. (1981). Tonal perception errors and interference from English intonation. *Journal of Chinese Language Teachers Association*, 16, 27-56.
- Winke, P.M. (2007). Tuning into tones: The effects of L1 background on L2 Chinese learners' tonal production. *Journal of the Chinese Language Teachers Association*, 42(3), 21-55.

- Wu, Z.J. (1986), *The Spectrographic album of mono-syllables of standard Chinese*. Beijing: Social Science Press..
- Xu, Y. (1994). Production and perception of coarticulated tones. *Journal of the Acoustic Society of America*, 95(4), 2240-2253.
- Zhang, H. (2010). Phonological universals and tonal acquisition. *Journal of the Chinese Language Teachers Association*, 45(1), 39-65.



		Paired Differences							
		95% Confidence Interval of the Difference							
	Mean	Std. Deviation	Std. Error	Lower	Upper	t	df	Sig. (2-tailed)	
Oral - Written	10.65217	7.37076	1.53691	7.46482	13.83953	6.931	22	.000	

Table 2

Paired Samples Test with the Consistency and Discrepancy between the Oral Test and the Written Test

	Mean	N	Std. Deviation	Std. Error Mean
Consistency	29.8696	23	7.10508	1.48151
Discrepancy	20.1304	23	7.10508	1.48151

Paired Differences									
95% Confidence Interval of the Difference									
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)	
Consistency - Discrepancy	9.73913	14.21017	2.96302	3.59419	15.88407	3.287	22	.003	

Table 3

Paired Samples Test with Discrepant Answers in the Oral Test and the Written Test

	Mean	N	Std. Deviation	Std. Error Mean
WrOw	4.3043	23	2.45754	.51243
WwOr	15.8261	23	6.72615	1.40250

Paired Differences								
95% Confidence Interval of the Difference								
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
WrOw - WwOr	-11.52174	7.21658	1.50476	-14.64242	-8.40106	-7.657	22	.000

Appendix A

Chinese Lexical Tone Written Test

你 ni	老 lao	家 jia	五 wu	两 liang
问 wen	大 da	照 zhao	九 jiu	中 zhong
贵 gui	孩 hai	口 kou	国 guo	生 sheng
姓 xing	谁 shei	有 you	美 mei	几 ji
叫 jiao	他 ta	人 ren	都 dou	四 si
名 ming	没 mei	好 hao	点 dian	年 nian
事 shi	女 nü	太 tai	天 tian	月 yue
先 xian	的 de	问 wen	日 ri	男 nan
三 san	呢 ne	多 duo	师 shi	和 he
学 xue	吃 chi	工 gong	还 hai	十 shi

Appendix B

Chinese Lexical Tone Oral Test

好 hao	男 nan	先 xian	五 wu	国 guo
都 dou	太 tai	你 ni	九 jiu	人 ren
天 tian	的 de	事 shi	女 nü	多 duo
日 ri	学 xue	吃 chi	美 mei	谁 shei
师 shi	工 gong	他 ta	家 jia	四 si
十 shi	呢 ne	照 zhao	点 dian	有 you
口 kou	两 liang	和 he	贵 gui	孩 hai
问 wen	月 yue	问 wen	姓 xing	老 lao
三 san	没 mei	生 sheng	叫 jiao	大 da
几 ji	年 nian	中 zhong	还 hai	名 ming

Appendix C

Example Interview Questions

- 1 Do you think it is important to know the tonal category, like the 1st tone, 2nd tone, or 3rd tone, when you produce a tone? If so, why?
- 2 If you think it is important to explicitly know Chinese characters' tonal categories, how do you use them when you are producing tones?
- 3 Can you explain why you pronounced these tones correctly while not being able to provide their tonal categories?
- 4 Can you explain why you knew the tonal categories, but didn't pronounce them correctly?