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## A Method of Teaching English Speaking Learners to Produce Mandarin-Chinese Tones

Hui Shi

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A Method of Teaching English Speaking Learners to Produce Mandarin-Chinese Tones

Hui Shi

Dissertation submitted  
to the College of Education and Human Services  
at West Virginia University

in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy in  
Curriculum & Instruction/ Literacy Studies

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Keywords: Mandarin-Chinese Tones, tonal and non-tonal language, pedagogy, tonal production

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## ABSTRACT

### A Method of Teaching English Speaking Learners to Produce Mandarin-Chinese Tones

Hui Shi

Learning Mandarin Chinese tones is a big challenge for English speaking learners. The average tonal production accuracy is reported to be about 70 percent for intermediate-level learners and 40 percent for beginning-level Chinese learners. The Chinese tonal proficiency significantly influences the learners' communicative effectiveness, including listening and speaking, but research often overlooks tonal production. This study proposed and tested a novel method of teaching English-speaking learners to pronounce Mandarin Chinese tones. This teaching method includes a Chinese tones bookmark, and a 30-50 minutes in-class training module. The research undertook five cycles of Design-Based Research (DBR) implementations with 31 public school students, adult learners, and Chinese teachers. Two audio recordings, one pre-training and one post-training, were collected and compared through the paired samples t-tests. Interviews, surveys, and class observations were adopted to determine the participants' attitudes toward the training and the teaching model. The results revealed that the designed teaching method was effective to improve the tonal production accuracy of English speaking K-12 children and adult learners. In addition, the results indicated that the participants' attitudes toward the designed method were positive. This study contributes to the current Chinese tonal teaching repertoire and presents a flexible, practical method for teachers to use when instructing students on Chinese tones.

## Dedication

This dissertation is dedicated to the memory of my father, Yingchun Shi, and my prior advisor, Dr. Patricia Obenauf. Although they were my inspiration to pursue my doctoral degree, they are unable to see my graduation. This is for them.

Thank you to my academic adviser, Dr. Sam F. Stack, who guided me in this process and to my dissertation committee who kept me on track.

I dedicate this dissertation to my husband, Patrick Yao, who survived my five-year study and research with taking much more family responsibilities and tolerating my unstable temper. For my mother, Zhuoxi Liu, who helped me in all things great and small, and made her way to attend my graduation ceremony from China.

This dissertation is dedicated to my children, Allan, Ben, Caden, and Destiny, who managed themselves well throughout my Ph.D. study with less attention and support from their mother.

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# **A Method of Teaching English Speakers to Produce Mandarin-Chinese Tones**

## **Chapter One**

### **Introduction**

The world languages family may be bigger than we thought: there are more than 6000 languages in the world (Ostler, 2005). Depending on if pitch is used to distinguish a word's meaning, languages can be categorized as tonal and non-tonal languages. Sixty to seventy percent of the world languages are tonal languages; most of them have two or three tones (Yip, 2002). Tone is the pitch that is used to distinguish words (Duanmu, 2007). All languages use pitch for various linguistic purposes such as intonation. However, only if different tones change the meaning of the words, even if the pronunciation of the word is the same, the language is a tonal language (Grasu, 2015; Cao, 2012). For example, in Mandarin Chinese, the same syllable “ma,” with a falling tone mà” (骂) means “to scold” and with a rising tone “má” means “hemp.” Many Asian languages such as Thai, Vietnamese, and Burmese and some African languages, like Bantu languages, are tonal languages.

On the other hand, English and almost all other European languages are non-tonal languages. In English, tones and pitches are used to express emotions or to change grammatical roles such as changing a noun to a verb; they indicate nothing about the meaning of the word itself. For example, the word “dog” has a falling tone in neutral intonation and a rising tone in question intonation, but its lexical meaning remains the same. In English, a syllable is composed of two constituents: the initial and the final. However, a syllable in Chinese is made of three constituents: the initial, the final, and the tone (Chao, 1948, 1972). The tonal contrast between Mandarin and English makes conversational Mandarin a tough task for English speakers. With five years' teaching experience, the researcher finds that many students are unable to make

themselves understood while speaking Chinese, very often just because of tonal errors. It is alarming to think that just a slight tonal variation can make huge difference in the meanings. For example, if a non-native speaker goes to a grassland in China and asks a police officer where he could find dà mǎ (大马, big horse), but he mistakenly says dà má (大麻, marijuana), it may cause big troubles. One more example, some places in China only vary in tones such as Shānxī (山西) and Shǎnxī (陕西). Incorrect tones may cause unnecessary problems for Chinese as a Foreign Language (CFL) learners. Chao (1972) asserted that “[i]t is absolutely necessary to learn the tone as the part of the word and not an afterthought. A word pronounced in a wrong tone or inaccurate tone sounds as puzzling as if one said bud in English, meaning ‘bad’ or ‘bed’” (p.24).

Mandarin Chinese (the only official language of China) and English are the top two used languages in the world; Mandarin Chinese has 955 million users and English has 360 million users (Nicole, 2016). It is predicted that one million U.S. students will be studying Mandarin by 2020 (Mitchell, 2016). A large number of elementary, middle and high schools worldwide, as well as some 3,000 colleges and universities in about 100 countries, have opened Chinese language classes. In the United States, more than 700 universities and colleges are offering Chinese language courses. It is also reported that the U.S. government has spent \$1.3 billion annually on educating its students in Chinese (Choi, 2017). The Confucius Institutes, which are affiliated with the Ministry of Education of China, support local Chinese teaching internationally, and facilitate cultural exchanges. There are over 70 Confucius Institutes in America now, and the number keeps increasing (Gallagher et al., 2014). By the end of 2015, there were 500 Confucius Institutes and 1000 Confucius Classrooms in 135 countries and regions in the world (Hanban, 2015). In West Virginia, the number of schools which offer Chinese classes keeps increasing. Daisy Nichol (pseudonym, all the participants’ names showed

in this study were pseudonyms), the Coordinator of World Languages Office of West Virginia Education Department, explained:

*“In the past, the only high schools that offered Chinese were Morgantown High and University High. Next year, Chinese will also be offered at Clay-Battelle High school, so at least the high schools in Monongalia County are covered.”* (Nicholson, D., personal communication, July 24, 2015).

Learning Chinese has been undoubtedly prosperous within the past few decades and will continue to boom in the future. As Zhou (2010) asserted, the rapid rise of China as an economic superpower accelerates the new cycle of globalization. Henceforth, multilingual (Chinese language) competence is not only crucial to the U.S. national security but also to its economic competitiveness in this cycle of globalization (p. 146). Although learners have various motivations for learning Chinese, most of them have conversation as a primary goal. Despite the significance of Chinese tones, even the advanced learners struggle to produce the tones accurately. The researcher taught third-year Chinese major college students, and their tonal production accuracy is also 70 percent. Some of the students visited China before, and they felt very frustrated when, most of the time, they were not understood by native Chinese merely because of slight tonal errors. The researcher has been a Chinese teacher since she moved to the U.S.A. in 2012 and taught English as a college teacher in China. The current study is rooted in her beliefs and experiences as a teacher of both Chinese and English. This study also stems from the researcher’s interest in finding a good method of teaching Chinese tones, which is described as “dreadful” and “frustrating” by her students, and as “notoriously confusing” by CFL teachers. Chen (1993) argued that acquisition of the Mandarin tone system had long been observed as one of the most difficult challenges for English-speaking learners. Lack of accuracy in tonal

performance may cause more than a foreign accent because, in a tonal language like Mandarin, tones are phonemic. Misuse of tones may result in difficulty in communication and, in certain cases, misunderstanding (p. 68).

Unfortunately, while there is an abundance of studies on Chinese tonal phonology, the literature on tone acquisition is exceedingly small. The empirical study of teaching Chinese tones is scarce and almost all are at the college level. Pedagogical research of Mandarin tones to English speakers does not seem to have attracted a significant amount of investigative efforts. Although instructors and scholars are aware of learners' tonal performance, many are probably driven by practical concerns and needs in the language classrooms rather than by a research interest. Yip (1980, 2002) pointed out that while there was an abundance of linguistic studies on tonal phonology, the scholarships rarely considered tonal identification and acquisition. Moreover, most pedagogical research targeted college learners and adult learners (e.g. Hsieh, 1997; Lin, 1985; Miracle, 1989; Zhang, 2006). Very little research has touched on younger CFL learners of English L1 (first language).

Furthermore, there is also more work focusing on tonal perception than on production (e.g. Bao, 1999; Cao, 2012; Chen, 2000; Lee, 2003; Jenson, 2013), while in this research, production across a broad age range is the focus. Previous studies either focus on the contrastive analysis, or the descriptive analysis of tonal error distribution among four (five) tones. For instance, Chen (1974) conducted an acoustic study that compared the pitch range between native Chinese speakers and native English speakers. The majority of the literature focuses on the features of Chinese tones instead of teaching strategy. The pedagogical researches often rely on teachers' experience without proper scientific test. The researcher asked a few Chinese teachers in West Virginia, America and found that the most common way of teaching Chinese tones were still



demonstration and drills: teachers show students the tone shape, demonstrating the tones of simple words, and then followed by drills. In the current college class in which the researcher was teaching, the students who had already learned Chinese for three years, claimed that they had not received any strategic training on tones.

On the basis of the aforementioned factors, the purpose of the current study is to investigate a new model of teaching English speakers to produce Mandarin Chinese tones. The goal of the study is to design, develop, implement, and evaluate the effects of this teaching method which was created by the researcher. The detailed teaching model and research questions will be introduced in the end of Chapter Two: Literature Review. The following chapters will be Chapter 2: Literature Review; Chapter 3: Methodology; Chapter 4: Results; and Chapter 5: Conclusion.

## **Chapter Two**

### **Literature Review**

The Literature Review has three sections: Linguistic Studies of Chinese Tones, Contrastive Analysis and Error Analysis, and Pedagogy of Chinese Tones. The focus is on the Pedagogy of Chinese Tones. At the end of the literature review, Gaps in Literature points out the flaws of the existing literature studies. The Present Study explains how the current research can contribute to a better understanding of methods to teaching Chinese tones to English speakers. It is designed to provide a holistic and practical view of Chinese language and pedagogy.

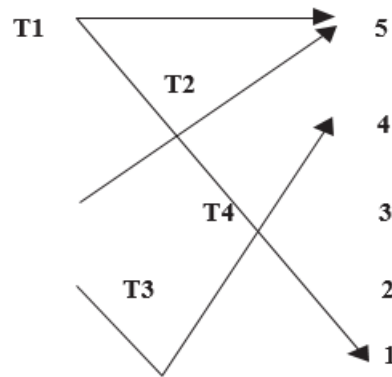
### **Linguistic Studies of Chinese Tones**

#### **Five Level of Chinese Tones**

Chao Yuan-ren (赵元任, Chao is the last name in Chinese culture) (1892-1982) was a leading authority in the field of CFL linguistics and pedagogy. Chao was a Chinese-American linguist, educator, scholar, poet, and composer, who contributed to the modern study of Chinese phonology and grammar. His book, *A Grammar of Spoken Chinese*, has been cited over 4488 times. Another of his books, *Mandarin Primer: An Intensive Course in Spoken Chinese*, was a widely used textbook in America. Chao's description of the pitch levels of Mandarin tones has been acknowledged and widely used in tone research and pedagogy. Almost every scholarly research on Chinese cited Chao. His study helps form the basis for current study.

Chao provided Chinese linguistics a description of Mandarin phonetics that has been followed by both phoneticians and practitioners of Mandarin language teaching and research ever since. Chao was the first scholar who developed the Chinese Romanization system (Pinyin). Chao was also the first scholar who used digits, 1-5, to represent the phonetic feature of Chinese tones. Chao's system divides a pitch scale into five distinct levels, ranging from 1 (the lowest) to

5 (the highest) (Bao, 1999). Chao, for the first time, drew the map of Chinese tones with distinguished numeric scales. This systematic method of transcribing the phonetic pitch with a five-level numerical scale for representing pitch height, with “1” being the lowest pitch value and “5” the highest pitch value within a speaker’s pitch range. In this scale, T1 through T4 are represented as “55”, “35”, “214”, and “51”, respectively (Yang, 2013, p. 222)



*Figure 1.* Pitch level of Chinese Tones (adapted from Chao, 1972; Tsai, 2011; & Van de Weijer & Sloos, 2014).

Chao helped to shape the field of modern Chinese linguistics, but also made an immeasurable contribution to the field of Chinese pedagogy (Xing, 2006). The transcription of tones has been widely used ever since it was invented. In addition, Chao, for the first time, used musical scales in illustrating the tonal contour (see Figure 2). He believed that music gives a still closer analogy to language than visual representation.

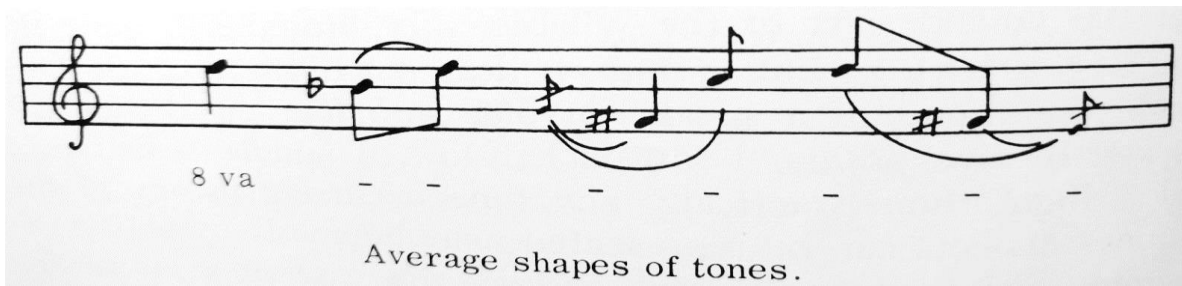


Figure 2. Four tones on musical scales (reprinted from Chao, 1968, P. 24).

Chao's books are the foundation of this research. The teaching model in this research was inspired by his ideas of five pitch levels and musical scales.

### **Pinyin**

Unlike most alphabetic languages in which there is a natural correspondence between the visual and phonological forms, in logographic Chinese, the mapping between visual and phonological forms is rather arbitrary and depends on learning and experience. To help CFL learners, the Chinese government adopted Pinyin in 1979 to represent Chinese characters for non-Chinese speakers. Pinyin uses the Roman alphabet and a set of tonal symbols to represent the pitch and sound of Chinese characters. The Romanized Pinyin provided non-native speakers, especially speakers of Roman alphabetic languages, a practical aid of pronunciation.

Pinyin has been shown to be helpful for CFL learners to pronounce Chinese characters with little training and it is proved by teaching practicum that students can have a consistent standard pronunciation assisted with Pinyin throughout their learning process. Therefore, Pinyin is in widespread use in Chinese textbooks and many other sources such as street signs. As a result, CFL learners heavily depend on Pinyin when learning the pronunciation of a new word. However, because of the tonal and non-tonal contrast between Chinese and English, CFL learners still have a lot of problems in producing correct Pinyin.

### **Four Tones: Representation and Frequency**

Many Chinese words, especially monosyllabic ones, are differentiated solely by tone. In a multisyllabic word, each syllable often carries its own tone. Mandarin Chinese has four tonal inventories, a relatively large number compared to other tonal languages like African languages, which usually have two tones. The reason for having these tones may be that the Chinese language has very few possible syllables – approximately 400, excludes r-colored vowels (erhua), and the neutral tone, while English has about 12,000 syllables. For this reason, there may be more homophonic words, words with the same sound expressing different meanings, in Chinese than in English (Yip, 2002). When spoken, many characters with entirely different meanings are distinguished only by the small difference in tone. Therefore, the correct implementation of the four tones is crucial to the development of spoken competence in Chinese.

An apparent limitation of Pinyin is that it cannot provide students direct reference on their pronunciation of tones (Lee, 1993; cited in Wu & Miller, 2007). Pinyin uses four diacritical marks to represent the four tones in standard Mandarin Chinese. “Mandarin tones are distinguished by their distinctive shape, known as contour, with each tone having a different internal pattern of rising and falling pitch” (Yip, 2002). The four lexical tones are represented by four diacritical marks in Mandarin Chinese. They are also called First Tone, Second Tone, Third Tone, and Fourth Tone. Their pitch characteristics are as follows: First Tone is high and level; Second Tone rises from mid to high; Third Tone falls quickly to low, stays there, and then quickly rises; Fourth Tone quickly falls from high to fleetingly low (Dow, 1972; Jenson, 2013). All four tones can in general appear on all vowels and diphthongs, regardless of initial or final consonant. The first tone (T1), is represented by a macron accent ( ¯ ), meaning that the word is pronounced with a constant high pitch. The second tone (T2), “high rising,” is represented by an acute accent ( / ), meaning that the word is initially pronounced with a low pitch that increases

throughout the vocalization. The third tone (T3) is called “low falling rising” and is represented by a caron accent ( ˇ ). These words start with a low pitch, fall lower, and then increase above the initial pitch. The fourth tone (T4), represented by a grave accent ( ` ), is called “high falling,” meaning that the word starts high in pitch and then falls below the initial pitch (Wu & Miller, 2007; Cao, 2012; Chao, 1972, Duanmu, 2007). Among four tones, Tone 1 is a level tone, and the other three are contour tones. A level tone is one whose pitch stays level through the syllable. A contour tone is one whose pitch changes over the syllable (Duanmu, 2007).

Tsai (2011) used a table to describe the four lexical tones:

Table 1  
*Description of Four Lexical Tones of Mandarin Chinese*

Tone	Description	Tone depicted in Pinyin	Pinyin example	Meaning
1 <sup>st</sup>	high and level	-	mā	mother
2 <sup>nd</sup>	rising	/	má	hemp
3 <sup>rd</sup>	falling and rising	ˇ	mǎ	horse
4 <sup>th</sup>	falling and stressing	`	mà	admonish

*Note.* From “Teaching and learning the tones of Mandarin Chinese” by Tsai. R., 2011, *Scottish Languages Review*, 24, p. 45.

Yang (2015) summarized the linguistic description of the four tones as follows:

Table 2  
*The Linguistic Description of Four Tones*

Tone category	Example	English meaning	Classical tone category name	Pitch value	Tone contour
T1	tang1	“soup”	Yinping	55	Level
T2	tang2	“candy”	Yangping	35	Rising
T3	tang3	“lie down”	Shangsheng	214	Dipping
T4	tang4	“burning hot”	Qusheng	51	Falling

*Note.* From “Perception and Production of Mandarin Tones by Native Speakers and L2 Learners” by Yang. B., 2015, Springer, p. 4.

Duanmu (2007) asserted that, in principle, any full syllable in standard Chinese can carry any of the four tones (Duanmu, 2007). The four tones are the standard tones of Chinese. He analyzed the phonology of Mandarin Chinese and found that standard Chinese has altogether 1300 syllables. Furthermore, Duanmu investigated the tone distribution in all the 1300 syllables and found that most of them are full syllables, each of which carries one of the four tones. In addition, the four tones are roughly evenly distributed, as shown in Table 3. Although we can see that there are slightly fewer second tones than other tones, considering the Third Tone Sandhi Rules (it will be introduced in the later of this section), the four tones are evenly distributed in real speech. Bao (1999) also asserted that there is no bias in favor of any particular tone as the default tone in Mandarin Chinese.

Table 3  
*The Frequency of Four Tones*

Tone	Frequency of Tones				All
	First	Second	Third	Fourth	
Number of syllables	337	255	316	347	1255

*Note.* From “Phonology of Standard Chinese” by Duanmu, 2007, Oxford University Press. p. 253

### **Neutral Tone and Tonal Variation (Tone Sandhi Rules)**

Some scholars (e.g. Wu, 2007; Wang, 2013) claimed that Mandarin Chinese has five tonal variables, which include four lexical tones plus a neutral tone (some scholars call it light tone, e.g., Wang, 2013). Some words, on a component syllable of a compound word, all four tones may lose its citation form and become the neutral tone (Lee, 2003). The pitch value for the neutral tone varies, depending mainly on the preceding citation tone, but the variation is not obvious in normal speech (Chen, 2000). For example, in the compound word 妈妈 (māma, meaning Mom), the second 妈 loses its tone and becomes a neutral tone, which carries no tonal

mark on Pinyin, thus it is also referred to be toneless. Unlike the basic tones, a neutral tone cannot be pronounced in isolation, and it never occurs in the initial position of a word or phrase. It is not on the lexical level, the word itself carries tones. Like in the prior example “mā 妈,” the lexical tone is the first tone. The vast majority of the morphemes, monosyllabic or otherwise, have lexically specified tones (Bao, 1999). Therefore, the researcher agreed that neutral tone is not a standard tone; it is mostly a tonal variation.

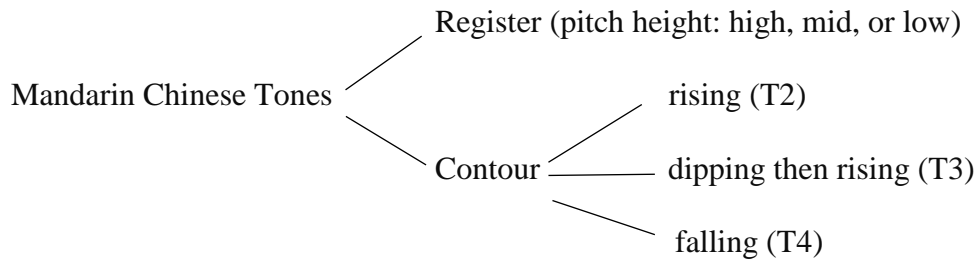
In addition to the four standard tones and neutral tone, tonal variations happen under certain rules, which occurs most common with T3 (Duanmu, 2007). This tone variation is called tone sandhi. For example, when two T3 put together as in “你 nǐ, 好 hǎo, the first T3 changes to T2, so it changes to ní hǎo). Another example, T2 and T1 in trisyllabic expressions often change their tones. T3-T3-T3 (好几种, hǎo jǐ zhǒng) change to T2-T1-T3 (hǎo jī zhǒng). Yip (2002) also investigated the empirical evidence regarding facts (tonal change under certain rules), especially topological phenomena that involve contour tones. Van de Weijer and Sloos (2014) believed that T3 sandhi is essentially a simplification process. For instance, a complex T3 changes into the less complex T2. They argued that this kind of variation process is expected, since T3 has the most complex representation. The resolution is natural and logical given these representations, consisting of the loss of the first H (HLH → LH). Furthermore, T3 is further simplified to a tone that is perhaps best represented as a single L tone when it is followed by other tones (Duanmu, 2007). In conclusion, in the real speech, T3 only appears in its underlying concave shape when it is in the sentence or word final place.

### **The Phonetic Feature of Mandarin Tones: Pitch, Contour, and Duration**

In current Chinese linguistics, a tone is often described in terms of its pitch height (register), and the pitch shape (contour) (Bao, 1999). Register is related to vocal cord tension; for



the same vocal cord thickness (pitch), stiffer vocal cords give higher F0 (Duanmu, 2007, p. 231). F0 is defined by the vibration rate of the vocal folds and is measured in hertz (Hz) (Yang, 2015, p. 8). Register signifies the comparative height of pitches: high, mid, or low. Almost every Mandarin syllable must carry a tone. Each tone represents a fixed pitch pattern, being either level or contoured (Chen, 2000). Tone, whether level or contour, has an internal structure (Bao, 1999). The four tones in terms of their register (pitch height) and contour (the changing route within a tone) can be represented by the graph below.

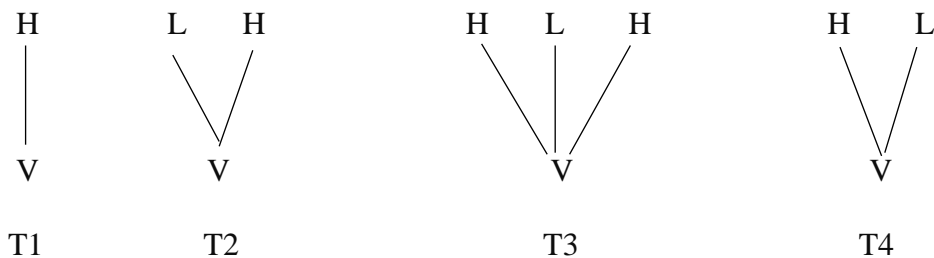


*Figure 3: Hierarchically organized system (revised from Shih, 1986).*

From Figure 3, we can see that Mandarin Chinese tones can be distinguished by register and contour. T1 is a high-level tone, T2, T3, and T4 are contour tones. T2 is a mid-rising tone, T3 is a low-dipping rising tone, and T4 is a high-falling tone (Chao, 1948). However, the phonetic feature “pitch” in Mandarin Chinese is very different from the pitch in English. In Mandarin Chinese, Pitch is the inseparable component of a tone that discriminates lexical meanings, in addition to vowels and consonants. The three of them are integrally perceived by native speakers (Cao, 2012). On the other hand, in English, pitch is used to signal syntactic or emotional information at the phrase or sentence level (Cao, 2012; Yip, 2002). The difference of pitch in Chinese and English causes trouble in English speaking Chinese learners. This will be further discussed in the later section of Error Analysis. Cao (2012) asserted that when a non-

native speaker starts to learn a tonal language, great difficulty can be predicted simply because in their native phonological system, tone as an integral cue for identifying a speech sound does not exist.

Van de Weijer and Sloos (2014) also described the phonological representation of the four tones as H (igh) and L (ow) instead of numeric scale. T1 is the only level tone and should be represented as a single H. T2 is a rising tone, representable as a LH contour. It would be possible to represent the tone as MH (since it starts with mid-level 3), but a mid-level tone M seems phonologically superfluous for Mandarin. In other words, based on this view, the realization of T2 as 35 (in Chao’s numeric notation) is the phonetic implementation of a phonological LH contour. T3 (the ‘dipping’ tone) is a concave tone, which would be represented as HLH. Finally, T4, the falling tone, is represented as HL. Again, the fact that L in T2 is a mid-level tone and L in T4 is genuinely low is left to the phonetic implementation. Note also that the first H in T3 (HLH, 214) is in fact lower than the L in T2 (LH, 35), consistent with the fact that tone is a relative notion. The proposed representations for T1-T4 are given in the graph below:



*Figure 4:* Phonological (High and Low) representation of the four tones (copied from Van de Weijer & Sloos, 2014, p. 182.)

Except for pitch and contour, some scholars proposed that the four tones can be differentiated by their duration (e.g., Howie, 1976). They found that, compared to T1 and T2, the duration of T4 and the nonfinal T3 is rather small. Specifically, T2 is 7 percent longer than T4

and T1 is 2.6 percent longer than T4. However, some scholars (e.g., Chen, 2000) argued that these tonal durational differences are neither perceivable nor producible in natural speaking because Chinese also has a longer duration due to signal stress.

### **Error Analysis**

Learning a language, regardless of age, can be regarded as a process of learning from making mistakes. Error analysis is the method that studying the characteristics of the language errors, the pattern of the common errors, and the situation involved in the errors to help analyze errors systematically, as well as to understand and find the causes of such errors (Sompong, 2013, p. 110). With clear reasons for the systematic errors, and the similarities and differences between L1 and L2, an effective pedagogy is expected to result (Larsen-Freeman & Long, 1991).

In this study, error analysis has a broader meaning than linguistic error analysis, which is a cross-language, cross-cultural method of explaining why some features of a target language are difficult to acquire, and why some errors systematically occur. It includes contrastive analysis, intra-linguistic analysis, neuropsychological analysis, and learners' analysis, etc. Overall, this study tries to include all of the reasons for Mandarin Chinese tonal errors with an eye toward building a well foundation for the designed teaching method of Chinese tones.

### **L1 (First Language) Transfer**

Ortega (2009) suggested that all second language (L2) learners, by definition, possess complete knowledge of an L1... Thus, previous language knowledge is an important source of influence on L2 acquisition... It is believed that systematic L1-2 comparisons would eventually allow researchers and teachers to predict when negative transfer will occur and what errors will be produced by particular L1 background groups of L2 learners (p.31).

L1 transfer can be positive or negative. Quite a few scholars have noticed the L1 transfer on

learning Chinese tones, and there is a well-accepted theory that the great and confusing tonal differences between English and Chinese is the root cause of tonal errors of English speaking Chinese learners.

Cao (2012) argued that the different uses of pitch in Chinese and English were the chief reason for errors. English also has pitch, but the phonetic feature of pitch is very different in Chinese. Mandarin Chinese uses pitch information to discriminate lexical meanings, in addition to vowels and consonants, the three of which are all integrally perceived by native speakers. On the other hand, in an intonation language, pitch is used to signal syntactic or emotional information at the phrase or sentence level. Therefore, when a non-tonal language speaker starts to learn a tonal language, great difficulty can be predicted simply because in their native phonological system.

Chao (1968, 1972) indicated that Chinese tonal errors of L2 learners are complex. He observed from his decades of teaching experience and asserted that it was difficult to teach American students tones. The difficulty, according to Chao, did not lie in the fact that they could not imitate the tones accurately, but rather in the fact that the students had difficulties controlling the opposing pitches within the tonal system. Chao further indicated that this might be due to the difference between Chinese and English. In Mandarin tones, the concept of “level” does not indicate a particular objective value of frequency. Because of the complexity of Chinese tones and the contrast between Chinese and English, tones can be problematic. The cause of the difficulty was not only learners’ narrower pitch ranges, but also the negative transfer of English intonation.

Chen (1974) conducted an experiment comparing pitch range between native Chinese and native English speakers. He found that the pitch range of Chinese speakers speaking Chinese was 1.5 times wider than English speakers speaking English. Specifically, native Chinese speakers were 25 percent higher and 25 percent lower than CFL learners of English L1. Even when English

speakers spoke Chinese, their pitch range increased, but not to the same degree as that of native speakers. Chen's study regarding Chinese speakers have a wider pitch range than English speakers is generally accepted. However, whether it is 1.5 times wider is open to question.

White (1980, 1981) suggested that the systematic errors can be partially traced to speakers' transfer of English intonation patterns onto Mandarin sentences. White conducted a contrastive study on both Mandarin and English. He noted that in Mandarin, the tone falls on one syllable while an English intonation may spread across any number of syllables. White agreed that Mandarin tones cover a wider pitch range than English intonation. White also argued that while native speakers of Mandarin would use the entire frequency range from scale 1 up to 5, English learners of Mandarin would only produce them within the narrow range of 2 to 3. In addition, non-native Chinese students have difficulty identifying and producing the highest and lowest pitch points, as found in the first and the fourth tones. Furthermore, students try to apply the intonation patterns of English to Chinese utterances, and this results in non-existing tones in Chinese.

Miracle (1989) surveyed the tonal production of ten beginning level college Chinese students of English L1. The results revealed that the overall tonal accuracy rate was 42.9 percent. These errors were classified as either tonal register errors (too high or too low) or tone contour errors. The errors were evenly divided between these two types. These errors were also evenly divided among the five tones (four lexical tones plus the neutral tone). Miracle concluded that most of the time, learners admitted it was difficult to find an appropriate register level of the pitch and the contour dimension.

Shen (1989b) investigated eight beginning Chinese learners at an American college. Shen also attributed the source of the tonal errors to L1 transfer. Shen argued that since high pitch was associated with stress in English, the high Tones (Tone 1 and Tone 4) might be perceived as

stressed syllables. Similarly, the weakest syllables in English usually have the lowest pitch, so the low Tone 3 may be perceived as a signal of weak stress. Hence, when American learners of Mandarin hear syllables that are higher than other syllables, they immediately interpret this distinction as one of stress. Shen speculated that Tone 4 is more likely to be subject to first language interference because it is prosodically less marked for English learners.

Guo (1991) pointed out that beginning Mandarin learners who had little exposure to lexical tones would find it difficult to determine what their own highest or lowest pitches are (within their own voice range) as well as to determine how the four tones oppose one another. Guo observed that non-native speakers made tonal errors frequently on either pronouncing the beginning of Tone 2 too low or the beginning of Tone 3 too high. Sometimes they could not produce the ending point of Tone 3 low enough, and they pronounced the end of Tone 4 not low enough as well as too short (cited in Zhang, 2006).

Chen (1993) investigated natural data from both perception and production tasks of beginning-level adult American Chinese learners. Chen suggested that the tonal contrasts between Chinese and English were not only realized by differences in contour, but also realized by F<sub>0</sub>, height, and pitch level. Chen advocated that the negative transfer from the English intonation to American learners' Chinese tones was seen clearly by the fact that American learners' tonal errors were not caused by randomly replacing one tone with another. Chen found that sixty-six percent of the errors were simply not Chinese tones at all. A great number of alien level tones might have been caused by the interaction of English prosodic features. Interference from the English intonation is more evident in the tendency that at the beginning of a sentence the low Tone 3 may get a higher fundamental frequency to resemble Tone 1 while at the end of a sentence the high-level Tone 1 more or less attains the feature of the falling tone (p. 75).

Chen (2000) summarized four types of typical tonal errors in continuing environments: (a) a significantly-reduced pitch range; (b) a prevailing tendency to level and falling tones; (c) non-full realization of tonal values; (d) instability and inconsistency in the pronunciation of the same tone. It is believed that these errors, combined as a “tone mess,” contribute to a foreign accent (p. 15).

Bent (2005) introduced a model called the Perceptual Assimilation Model (PAM) that explained how non-native listeners perceptually discriminate pairs of non-native phonemes. The PAM hypothesized that listeners assimilate non-native sounds to the closest sound in their native system in terms of articulatory similarity.

Liao (2008) introduced an experimental study of Mandarin tonal sequences produced by native English speakers. She found that the tonal variation in accented Mandarin was not correlated to the original Mandarin tones or to the context of the original Mandarin tones. She recognized that the percentage of pronounced Tone 1’s and Tone 3’s was much higher than those of other pronounced tones in the accented Mandarin: two thirds of the syllables carried these two tones. Liao asserted that this uneven occurrence of the tones might significantly contribute to the learner’s accent. Liao further indicated that, “the basic reason that accented Mandarin tones vary in the above ways must be that the intonational system of the learners’ native language, English, affects the pronunciation of the second language. The two basic tones in English are a high tone and a low tone, which cause the learners to frequently pronounce Mandarin tones in similar ways” (p. 174).

A few scholars (e.g. Lee, Vakoch, & Wurm, 1996; Wayland & Guion, 2004) argued that the perception of non-native tones by speakers of tonal L1s outperforms speakers of non-tonal L1s. These studies found that speaking a tonal L1 may make it easier for listeners to perceive tonal L2. For example, Wayland and Guion (2004) trained native English and Mandarin Chinese adult

speakers to discriminate and categorize a pair of Thai (a tonal language) tones that were regarded as difficult even for native Thai speakers. While the Chinese group showed apparent improvement after training, in contrast, the English group did not display any improvement in discrimination and showed only slight progress in categorization. They concluded that speakers of tonal L1s might have an advantage over speakers of non-tonal L1s in learning to perceive tones in a tonal L2.

Li (2015) investigated the Mandarin tonal perception accuracy of 24 adult Thai (a tonal language) and 21 adult English speakers. The result showed that Thai speakers significantly outperformed the English speakers, but Thai speakers and the English speakers displayed very similar degrees of difficulty in the perception of Mandarin T2 and T3.

Zhang (2016) claimed that tonal or non-tonal L1 backgrounds pose different challenges for adult Chinese learners. Zhang investigated the tonal productions of 40 beginning college Chinese learners from Japanese (a pitch-accent language, some words' meanings can be different if different syllables are stressed) and English L1 backgrounds, 20 students for each L1 background. As a result, the English-speaking learners produced more incorrect tones than the Japanese-speaking learners. The study suggested that the main source of errors for these learners stems from first language transfer of prosodic structures. Zhang pointed out that speakers of English, a "head-prominence" language, performed well with T1 and T4. English speakers' favor of the high falling pitch contour is reflected in the significantly greater use of T4 as a substitute for other target tones (p. 37).

Some scholars believed that the negative L1 transfer may be mitigated with accumulation of learning experience. He and Wayland (2010) compared inexperienced and intermediate level Chinese learners; they found that with the increase of learning experience, students' accuracy rate of perception and production on isolated Mandarin tones can obtain a significant improvement.



Furthermore, it was found that with increased experience, the production of coarticulated tones becomes more resistant to such phonological and phonetic factors as tonal contexts and syllable position (p. 4).

Tsai (2011) pointed out that many students admitted that they had difficulty remembering which tone goes with which word. Tsai believed this showed that they were still thinking of tones as not really being part of a word. For native speakers of Mandarin, tones are always part of a word, so it is not possible to learn a word and forget its tone. However, Tsai suggested that with sufficient time and emphasis on tones, students would not have such a problem.

However, not every scholar believed L1 transfer accounts for tonal errors. Some scholars argued that L1 transfer is not the main reason accounting for learning difficulty and errors. Wang (2006, 2013) challenged the well accepted concept that learners' experience with lexical tones and pitch accent in their first language facilitates the acquisition of L2 lexical tones. Wang compared the accuracy rate in perceiving Mandarin tones by beginning adult learners of three different L1 backgrounds: Hmong (a tonal language), Japanese (a pitch-accent language), and English (a stress language). In the study, while Japanese and English speakers performed roughly the same, the Hmong speakers performed significantly worse than either of the other two groups. The author inferred that the tonal system of Hmong speakers' L1 may have interfered with their perception of the Mandarin tonal system, hindering them in acquiring Mandarin tones. More specifically, mismatch between the two tonal systems may cause confusion to the learners when the similar but not identical L1 tones interfere with the perceptual identification of L2 tones.

Hao (2012) also examined whether second language learners from tonal and non-tonal first language backgrounds differ in their perception and production of L2 tones. Hao chose Cantonese (a tonal language) and English (non-tonal) adult experienced Chinese learners in the experiment.

The result contradicted the results of Lee et al. (1996), who purported to show that Cantonese speakers discriminated Mandarin tones better than English speakers. Hao's study revealed that both Cantonese speakers and English speakers had similar learning rates and difficulties in learning Mandarin tones (p. 276). Overall, the study suggested that for explaining difficulties in acquisition of certain L2 sounds, factors other than learners' L1 backgrounds may also play a significant role.

Yang (2014) investigated the perception and production of native speakers and non-native Chinese speakers. Yang found out that, to native speakers, most boundary areas are located between two neighboring tones. However, in the non-native speakers' perceptual space, tones in the boundary areas are sometimes not in the neighboring stable areas. Non-native speakers' ranges of pitch perception are narrower than native speakers. The pitch range of non-native speakers' perception and production differ from that of native speakers'. The pitch range of non-native speakers' production is smaller than that of native speakers' production. However, the high and low-end point production is similar to that of the native speakers'.

The majority of the aforementioned studies examined the performance by learners who had no knowledge or very short experience of learning Chinese (e.g. Chen, 1974; Miracle, 1989; Wayland & Guion, 2004; Wang, 2006). A couple of pieces of literature (e.g. He and Wayland 2010; Tsai, 2011) surveyed learners' perceptual and the productional accuracy of nonnative speech categories. Most of these studies indicated that the tonal quality would improve through long-term exposure to L2 input or through perceptual training.

### **Error Distribution in Four Tones and Acquisition Order**

As mentioned in the section of "Linguistic Studies of Chinese Tones," the four Chinese tones have different inner structure, frequency, and tone sandhi rules, thus they have different difficulty levels to the L2 Chinese learners. According to many scholars (e.g. Shen, 1989a; Chen,

1993; Hao, 2015; Zhang 2016), the four tones are not equally difficult to acquire. A hierarchy of acquisition sequences for the Chinese tones has been suggested on the basis of first language empirical studies. Bluhme and Burr (1971) conducted a research with 10 Chinese learners of English L1. They reported that the first and the fourth tones are generally regarded as easier to learn and were achieved with fewer repetition practices. The second and third tones were considered to be more difficult and took double of the time to achieve the native-like quality.

Li and Thompson (1977) induced the natural tonal acquisition order based on the production data from two Chinese children: T1—T4—T2—T3. The result showed that Tone 2 and Tone 3 are more difficult for the children to produce. Not only do they appear later in their speech, but they are also the only tones confused with each other throughout much of the early acquisition period (cited in Chen, 1993). Yue (1980) investigated his own child learning Chinese as L1. Yue agreed with Li and Thompson (1977) that Tone 1 was the easiest to learn followed by Tone 4, Tone 2 and Tone 3 (T1 -T4 -T2- T3).

Van de Weijie and Sloos (2014) conducted a corpus study and found out that T1 and T2 have similar frequencies: they remain stable at 12–14 percent (T1) and 10–12 percent (T2). T3 stabilizes at a level of approximately 25 percent; T4 becomes stable at a level of around 28 percent. Weijie and Sloos argued that these frequencies might predict the sequence of tonal acquisition: the acquisition of common structures precedes acquisition of less common structures. Based on the frequency, they predicted the acquisition order should be T3 > T4 > T1, T2 (“>” represents acquired before). Cai and Brysbaert (2010) also suggested that the word frequencies were a good estimate of daily language exposure and captured much of the variance in word procession efficiency.

Van de Weijer and Sloos (2014) predicted the acquisition order based on the difficulty of the tones. They argued that T1 (level) is expected to be the easiest, having only one tonal feature. Tones 2 and 4 (both contours) might be expected to be intermediate. T3 seems to have the most complex representation and might therefore be expected to be the hardest to acquire. So, the acquisition order should be  $T1 > T4 > T2 > T3$  (where '>' means 'is acquired before').

Chun et al. (2015) studied 35 college CFL students and found that T3 and neutral tones had the least accuracy rate. Furthermore, the percentages of "pitch height incorrect" were higher than the ones of "pitch contour incorrect" for all five tones. This means that learners have more problems with pitch height than with pitch contour when producing Mandarin tones (p. 97).

Shen (1989a; 1989b) contradicted a little with the above studies. Shen investigated a group of beginning American learners of Mandarin through auditory and acoustic analysis of gathered data. Findings from Shen (1989b) showed that according to acoustic evidence, in the CFL environment, the hierarchy of difficulty in acquiring tones was T4 -T1 -T2- T3. In other words, Tone 4 was the easiest to acquire and Tone 3 was the most difficult. American learners who had learned Chinese for four months were tested for production of tones.

Chen (1993) surveyed eight American college students at the beginning-intermediate Chinese level. The result suggested that the level tone (T1) is easier than the contour tones (T2, T3, and T4); and falling tone (T4) is easier than rising tones (T2, T3). Tones 2 and 3 were more likely to get confused with each other, and the same applied to Tones 1 and 4. Through the error analysis, Chen concluded the acquisition order was T1 -T4 -T2- T3. Winke (2007) investigated 52 college Chinese beginner level students and reported the same difficulty hierarchy as Chen. Winke claimed that learners with different L1 backgrounds did not show different problems in producing Chinese tones.

Wong, Schwartz, and Jenkins (2005) found that native Chinese children perceived and produced T3 significantly worse than other tones, and their most common error was the confusion between T3 and T2. Lin (1985) showed that even Mandarin-speaking adults sometimes confused between T2 and T3. Therefore, it is not surprising that this tone pair is also difficult for second language learners. Lin noted that English speakers are basically tone deaf in discerning Chinese sounds (p. 34).

Tao and Guo (2008) investigated the free speech of 16 beginning college Chinese learners and found that Tone 1 seems to have the least production problems with 75 percent acceptable tone production. Tone 3 is the most difficult to produce, with only 48 percent accuracy rate (p. 26). He and Wayland (2010) reported similar results in that Tone 1 was the best, followed by Tones 4 or 2, and Tone 3 as the worst.

Hao (2012) suggested that the major difficulty learners faced in acquiring Mandarin tones was associating pitch contours with discrete tonal labels, and this confusion stemmed from factors outside of learners' L1 experience. Hao argued that the T2–T3 contrast is hard for L2 learners regardless of their native languages because of these two tones' acoustic similarity and their complex phonological relationship.

Neal (2014) conducted corpus study with five students in his Year 10 class (aged 15–16). Neal found that Tone 1 was the only tone which was not problematic for his learners. (Neal, 2014, cited in Tinsley & Board, 2014).

Hao (2015) examined English-speaking learners' production of Mandarin tones in different prosodic contexts. The results showed that these learners' errors vary extensively depending on the prosodic context. For example, in the word-initial position, the learners' production of T2 was frequently heard as T3 when followed by T1. These findings suggested that Mandarin instructors

should train their students' tone pronunciations in different contexts and be aware of the possible causes for their difficulty. These findings are compatible with the observation in previous studies that T2 and T3 are least accurately pronounced by English speakers (Chen, 1993; Chen, 1997; Bent, 2005; Hao, 2012). It indicated that L2 learners' difficulty in Mandarin tone production is not associated with individual tones but with specific tone combinations. This highlighted the importance for research on L2 tone production to look into tonal sequences rather than tones in isolation.

Zhang (2016) investigated the tonal production accuracy of altogether 40 college CFL learners: 20 native English speakers and 20 Japanese speakers. Zhang found that the accuracy rates of each tone type are 60 percent for T1, 40 percent for T2, 10 percent for T3, and 100 percent for T4. The substitution rates confirmed that English speakers' favoring T4. T4 was used most often as a substitute for other (non-T4) target tones, while T3 (low tone) was used the least. About 55 percent of all errors used T4 as a substitute; 30 percent of all errors used FT3 (low dipping tone) as a substitute; 10 percent of all errors used T1 as a substitute, and 2.5 percent of all errors used T2 as a substitute; and 2.5 percent of errors used the non-Chinese low falling tone as a substitute (p.31). The error accuracy rate and substitution rates are illustrated below.

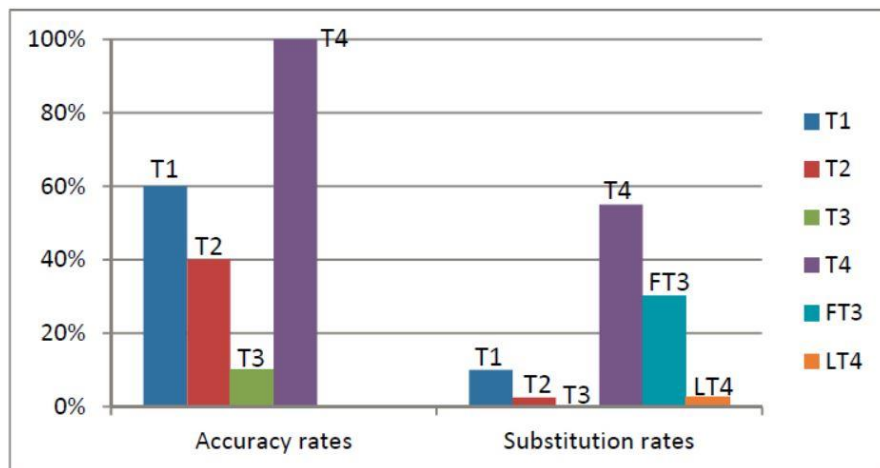


Figure 5. Accuracy and substitution rates for focused monosyllabic words for English speakers (revised from Zhang, 2016, p. 31).

Yang (2014) summarized the literature of tonal acquisition order as follows:

Table 4  
Summary of the Literature of Tonal Acquisition Order

Study	Mode	Order
Kiriloff (1969)	Perception	4 < 1 < 3 < 2
Elliot (1991)	Perception	4 < 3 < 1 = 2
	Perception: self	4 < 1 < 3 < 2
Sun (1997)	Perception: TIDT (stimulus)	4 < 1 < 3 < 2
	Perception: TIDT (response)	1 < 4 ≤ 3 < 2
Hao (2012)	Perception	4 < 1 < 3 ≤ 2
Miracle (1989)	Production	1 < 4 < 3 < 2
Shen (1989)	Production	2 < 3 < 1 < 4
Leather (1990)	Production	1 < 4 < 2 = 3
Elliot (1991)	Production	1 < 4 < 2 < 3
Chen (1997)	Perception/production	1 < 4 < 2 < 3
Sun (1997)	Production: REPT&RDGT (stimulus)	1 < 4 < 3 < 2
	Production: REPT (response)	3 ≤ 4 < 1 ≤ 2
	Production: RDGT (response)	4 < 1 ≤ 3 < 2
	Production: TRAT (stimulus)	1 < 2 ≤ 3 < 4
Hao (2012)	Production	1 < 4 < 3 ≤ 2

*Note.* This table was used by author to illustrate the relative difficulty of the tones reported in previous studies. “<” means acquired first. “Perception and Production of Mandarin Tones by Native Speakers and L2 Learners.” By Yang, B., Springer. 2015, p.42.

From all the research in difficulty order, we can conclude that although there is no congruency in the difficulty sequence of the four tones, it is well admitted that T4 and T1 are comparatively easier or acquired earlier than T2 and T3.

Finally, there is a need to mention the problematic tone sandhi rules, which counts for

many errors since a few tonal variation words, such as yi (一) and bu (不) are the high frequency words in Chinese. Chen (2000) surveyed over 6000 syllables from 40 subjects and found that in all the yi [one] and bu [not] cases, only a small number of subjects have the expected performance on the tones occasionally. For the word yi [one], in particular, many subjects tend to produce it in a high-level tone (Tone 1) when it should be rising (Tone 2) or falling (Tone 4). The error might be related to the fact that almost every Mandarin learner picks up the word yi [one] as a high-level tone because this is how it should be pronounced in isolation or counting. If Tone 1 represents the correct internalization of yi [one] in isolation or counting, it could become a mis-internalization in the above-reported phonemic sandhi cases (p. 175). In addition, the Tone 3 sandhi rule makes the problematic T3 more complicated. Due to Tone 3's complicated tone sandhi rules, the error rate of Tone 3 is anticipated to be high and the underlying causes are difficult to trace. Gandour (1984, 1994) and Huang (2004) suggested that tone sandhi rules may also influence tonal perception. For instance, errors in Tone 3 might be produced because of the complicated tone sandhi rules, but the position of Tone 3 in the sentence might also be responsible for the errors (Zhang, 2006). Jongman et al. (2006) also mentioned that listeners may not be able to distinguish a Tone 3 when it had undergone tone sandhi and changed to a Tone 2.

### **Neuropsychological Analysis**

Klein et al. (2001) used PET, a neuropsychological method that determines whether neural mechanisms subserving pitch perception differ as a function of linguistic relevance (p. 646), to compare tone perception in 12 native Mandarin speakers and 12 English speakers with zero Mandarin experience. The results showed that regions in the left hemisphere of the brain was activated when tones were decoded by L1 Chinese listeners, while English listeners used



the right hemisphere.

Similarly, a few other neuropsychological scholars (e.g. Gandour, Wong, & Hutchins, 1998; Gandour et al., 2000; Wang, Jongman, & Sereno, 2001; Jongman et al., 2006; Zeng, 2006; Zatorre & Gandour, 2008) had similar findings. These studies indicated that the left hemisphere was more adept at phonemic processing, including phonemes, syllables, and words while the right hemisphere was better at melodic and prosodic processing, including music, pitch contours, and affective prosody (Jongman et al., 2006). For instance, Wang, Jongman, and Sereno (2001) investigated the lateralization of lexical tones with twenty Americans who had no tonal language backgrounds along with 20 native Chinese. The error analysis results showed that the Chinese participants had a significant right ear advantage. However, the American listeners revealed no significant ear preference. Wang argued that the results indicated that Mandarin tones were predominantly processed in the left hemisphere by native Mandarin speakers, whereas they were bilaterally processed by American English speakers with no prior tone experience. The results also suggested that the left hemisphere superiority for native Mandarin tone processing was similar to native processing of other tonal languages. Wang et al. (2003) showed that in the early stages of learning Mandarin Chinese, some changes were observed to be made in the brain: learning a tone-based second language involved both the expansion of pre-existing language-related areas and the recruitment of additional cortical regions specialized for functions similar to the new language functions.

Neuropsychologists further tested the hypothesis that musicians were more sensitive to subtle pitch variations than non-musicians (e.g., Schön, Magne, & Besson, 2004; Alexander, Wong, & Bradlow, 2005; Micheyl, et al., 2006; Lee & Hung, 2008). For instance, Micheyl et al. (2006) reported that discrimination thresholds for pure and complex harmonic tones were

six times lower for musicians than for non-musicians. Lee and Hung (2008) used intact and modified Mandarin syllables with the four Mandarin tones produced by multiple speakers in an attempt to specify the attributes of pitch (pitch height, pitch contour, pitch variability) that English musicians (with 15 years of musical training on average) perceived Mandarin tones better than non-musicians. They found that musicians processed pitch contour better than non-musicians (which was not due to absolute pitch abilities as none of the musicians had an absolute pitch). Taken together, this behavioral data concurred in showing lexical tone processing advantages in musicians compared to non-musicians (cited in Marie et al., 2011, p. 2702).

Marie et al. (2011) extended the musician hypothesis to pitch processing in tonal speech. They investigated 12 musicians and 12 non-musicians. Results showed that musicians had significantly lower error rates than non-musicians in their tonal production. It confirmed that musical practice increased sensitivity to pitch therefore to lexical tonal contrasts. Furthermore, music expertise would also facilitate the processing of segmental variations. In conclusion, these results provided further evidence of music-to-language transfer effects (p. 2707).

Nan and Friederici (2013) advocated that the abilities to process musical pitch and linguistic tone were closely linked. Pitch-related expertise seems transferable across domains (p. 2045). They conducted a fMRI scanning on 18 young Chinese musicians. The results demonstrated a common pitch processing network across music and tone language, including the triangular part of Broca's area and the right STG with the latter region differentially modulated by the different domains (p. 2050).

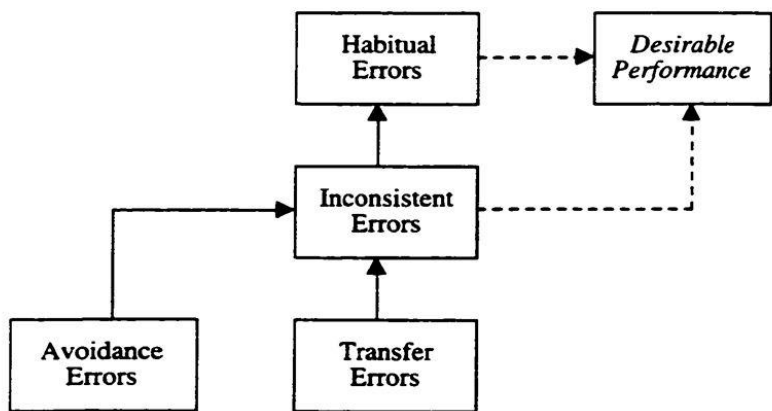
The interlink between music and Mandarin tones have been demonstrated by CFL teachers. Some scholars and educators advocated involving music related methods in the

pedagogy. This will be introduced in the Pedagogy of Chinese Tones section.

### Subjective Reasons and Other Reasons

In addition to the linguistic and neuropsychological reasons, there is one more category accounting for the tonal errors, which is categorized as subjective reasons because they are closely related to the individual teachers and learners.

Chen (2000) studied 40 CFL learners' Mandarin speech and suggested that learners' various types of strategies also contributed to the tonal errors. For example, in order to overcome problems in communication, learners tended to avoid problematic items in a second language by substituting something easier for them or something they feel safe about, which constituted "one of the processes responsible for learner errors" (Ellis, 1997, p. 60, cited in Chen, 2000). Chen found that it was not random that so many strings of mid-level tones were produced by CFL learners. Besides avoidance, another strategy, overuse of a specific tone, was also observed as an idiosyncratic phenomenon in the data (p. 160). Furthermore, errors may come from the learners' developmental process itself (see figure 6). Tonal errors of different natures were mingled together in a learner's speech, mixed up with correct tones here and there, resulting in a kaleidoscopic performance. Zhang (1997) also mentioned the avoidance of Tone 3 sandhi and gave explanation from linguistic theories.



*Figure 6: Mandarin tonal error in the developmental process (copied from Chen, 2000, p. 177).*

Tao and Guo (2008), disagreeing with Chen, argued that students did not try to use avoidance as a strategy to avoid pronouncing Tone 3, although it appeared to be the most problematic one. In other words, avoidance was not a universal strategy of L2 learners in their learning of a foreign language, or at least not a strategy applied across all areas of Chinese language acquisition (p. 35).

Tsai (2011) found out that apparent individual differences were observed accounting for their tonal performance. For example, some students felt silly making strange sounds when speaking Mandarin Chinese; other students did not like to make hand gestures when speaking. Tsai also found that learning success was found to be associated with the learner's ability to perceive pitch patterns in a non-lexical context and their previous musical experience. Tsai suggested that experienced teachers had also reported that students with musical training learn Mandarin faster (p. 49).

Yang (2015) examined the beliefs of 42 Mandarin teachers and 443 beginner English learners of Mandarin in secondary schools in the UK. The difficulty related to tones mentioned most in the study by both pupils and teachers was listening and understanding Chinese speaking. This was due to the difficulty of discerning similar sounds, especially Chinese tones. The reasons students offered include confusions of individual tones, such as tone 1 and tone 4, tone 3 and tone 4, and the tone sandhi in the flow of speech. Apart from that, according to teachers, Chinese tones were unfamiliar for non-tonal English speakers, and thus only students with musical talents or trained with musical skills would find it easier than others to perceive pitches of Chinese tones (p. 283). Surprisingly to Yang, students believed speaking Chinese, including the tones, was relatively easy. Students expressed a remarkable confidence in their knowledge

about tones, yet it turned out they tended to say the tones randomly when speaking (p. 285). Yang concluded that the beginning learners were not aware of tones in changing meanings of words when speaking Chinese. Given that communication was viewed as one of many priorities in learning, they were likely to overlook the tones (p. 286).

Zheng, Li and Sun (2011) suggested the tendency to use computers in typing Chinese could cause more problems for learning Chinese tones because students did not need to type tones to acquire the desired words on computer. Therefore, tones were likely to be omitted or neglected with the increasing use of computer typing. Indeed, the popular Chinese input method in China, using pinyin as a medium to type Chinese characters, only focused on the spellings of onsets and rimes of syllables rather than tone marks (Zheng, Li, & Sun, 2011). However, this typing method causes problems for CFL learners while studying tones.

In conclusion, from the existing research, there are four major sources of difficulties accounting for learners' tonal errors: (1) L1 transfer (2) hierarchical linguistic features of the tones (3) neuropsychological factors, and (4) subjective and other reasons. The results of these studies have benefitted Chinese teachers by improving their understanding of the characteristics of tones and students' behaviors in acquisition.

### **Pedagogy of Chinese Tones**

Based on the linguistic, contrastive error analysis, and neuropsychological research, Chinese scholars and educators have made efforts in developing pedagogical ideology, models and methods.

### **Explicit and Implicit Learning**

The distinctions relating to implicit/explicit learning and knowledge originated in cognitive psychology. It suggest that implicit language learning takes place without either

intentionality or awareness, while explicit language learning is necessarily a conscious process and is generally intentional as well. “It is a conscious, deliberative process of concept formation and concept linking” (Hulstijn, 2002; cited in Ellis, 2009, p. 7). Schmidt (1990) argued there was no such thing as complete implicit learning and so a better definition of implicit language learning might be “learning without any metalinguistic awareness.” Dekeyser (2008) argued that there was an important factor for implicit learning to happen, which involved concrete and contiguous elements.

Implicit instruction is popular in second language acquisition field. However, its effectiveness in teaching Chinese tones is under investigation. Yang (2015) pointed out, Chinese teachers all believed that tones were important and complained students had not paid enough attention to it. Teachers thought repetition, perception exercises (e.g. listening to Chinese words and deciding what the tones are) and error correction were useful. Teachers had a strong preference for error correction. Although Yang did not illustrate how teachers corrected the tonal errors, he mentioned that “most of the time they were not aware that students actually did not take their feedback as an error correction.” From Yang (2015)’s description and the researcher’s observation, it is believed that in the CFL field, most of the tonal teaching method was implicit instruction, which does not provide specific guidance on what is to be learned from the task. It may provide examples, uses, instances, illustrations, or visualizations of knowledge components without a direct statement (or rule) that specifically directs the learner on what is to be learned (knowledge component) (Ellis, 1994).

In the researcher’s opinion, implicit instruction on tones may be sufficient for students who are in a Chinese-as-a-first-language environment. A good example of acquiring Chinese with implicit tonal instruction can be found in a report of the Chinese Broadcast Channel, which

interviewed Dashan, who is Canadian but well-known for his fluency in Mandarin Chinese and his crosstalk. Dashan claimed that Chinese tones were very difficult to grasp when he took Chinese courses at the University of Toronto, and at the beginning when he went to China. But within a few months of living in China and daily communicating with Chinese people, he gained enough feeling for it (Victor, 2017). However, in a Chinese-as-a-second-language setting, even if it is an immersion program in America, the implicit instruction may not be effective because the natural input from the instructor may not be sufficient. In these programs, usually one instructor teaches about 20 students. Students may not notice the tones enough in the instruction since they usually are exposed to little “natural native communicational input.” Under this circumstance, the researcher claims that explicit teaching is a more efficient instructional method for teaching Chinese tones in America.

On the acknowledgement that explicit teaching in tones is more effective in CFL settings, the designed teaching method is fundamentally an explicit instructional model. The teaching method starts from the explicit teaching about the importance of Chinese tones and the explicit explanation of the tonal features. It is expected that the explicit teaching could raise the learners’ awareness on the importance of Chinese tones as well as equip students with handy techniques of pronouncing Chinese tones.

### **Raising Consciousness towards Chinese Tones**

Mandarin Chinese tones are critical to both perception and production, thus to the quality of comprehending and producing speech in conversation. However, not every student or teacher realizes it henceforth invests sufficient efforts in it. As a consequence, it is pertinent to set the first step of tonal pedagogy as raising consciousness toward Chinese tones, for both students and teachers.

White (1981) believed that teachers' consciousness is even the priority. White emphasized that the difficulty in learning Chinese tones for English speakers lied in the the confusion between Chinese tones and English intonation. English patterns for contrastive and emphatic stress cause tremendous interference-related problems. White suggested that CFL teachers must be aware of the English intonational contours as well as its pragmatic process (P. 27). Therefore, teachers can anticipate when a certain English contour may be transferred to a Mandarin sentence. Mandarin teachers must be aware of it and attempt to share this awareness with student (p. 54).

Kecskés (2013) believed that teachers and students should clarify four reasons for investing in tones study: (1) Not reliably being able to hear tonal differences makes it very difficult to understand anything spoken at normal speed except very simple Chinese; (2) Not attending to tone makes it much harder to retain Chinese vocabulary, as the syllable pool is effectively reduced fourfold; (3) Being incompetent producing tone can make a learner's spoken Chinese difficult to understand, confusing, unintelligible, even absurd or offensive; (4) From experience of many Chinese learners, not being able to handle tones proficiently leaves them feeling miserable: they know Chinese has tones, they know they have not mastered the system and that they sound wrong or bad, but they feel helpless to improve: the teacher doesn't seem to care, or cannot provide a solution. For many, the only way out was to give up.

Yang (2014) believed that at the phonological function level, teachers should strive to help students match the phonetic categories of tones to the phonological functions. Yang pointed out that it is important to connect syllable meanings to the tones at this level, in order to help learners, use tones instead of the intonation carried by a phrase or a clause. For this purpose, teachers might provide examples of characters which have different meanings yet have the same



consonants and vowels with different tones. This will help students learn to distinguish meanings based on the different tone categories (p. 151).

Unfortunately, despite the great importance and difficulty of Chinese tones, many scholars and teachers consider tones as not-so-important and avoidance-worthy. Tinsley and Board (2014) pointed out that all teachers wanted to instill good pronunciation and to provide learners with correct models of tones as part of this, but many believed that tones were not crucial to understanding and should not be over-emphasized at the expense of progression in other areas (p. 8).

The researcher taught a third-year Chinese major college class for one semester. Students claimed that they were not understood by native Chinese when they went to China. They felt disappointed by their tonal production. Students argued that they had not received enough tonal training except the very brief introduction at the beginning of the first year of Chinese study. Their homework and tests, whether oral or written, almost presented no requirement on tonal accuracy. As an instructor, the researcher was required not to deduct points from tonal problems as long as they were understandable. However, being understood by the teacher does not represent being understood by common native speakers since the teachers usually are familiar with the context and can predict what students mean to say.

### **Widening Pitch Ranges of English Speakers**

Much aforementioned research pointed out the different pitch range between Chinese speakers and English speakers. Chen (1974) found that Chinese speakers' pitch is 1.5 times wider than English speakers. Therefore, Chen suggested that English learners of Chinese need to make pitch range much wider. White (1981) and Miracle (1989) agreed with Chen, they also advocated in training English learners of Mandarin to widen their voice ranges. White

suggested that students practice the pronunciation of syllables with high and low tones even exaggerating the extremes assisted with visual resources, such as a diagram of Chao's (1972) five-level pitch range.

In proposing a pedagogic measure to train students' awareness of tone registers, He (1987) proposed a vocal-cord method to inscribe the different registers of the tones in the mind of L2 learners. He suggested that to produce Tone 1, the vocal cords should keep tensing; Tone 2, the vocal cords at first neither tense nor lax, then tense rapidly; Tone 3, the vocal cords lax immediately after tense, and then tense again; Tone 4, the vocal cords suddenly tense, and then lax gradually (cited in Zhang, 2006, p. 55).

However, Shen (1989) rejected Zhao's (1987) suggestion because this method was far-fetched for CFL students who are neither singers nor phoneticians. They are not trained to effectively control the complicated muscle movements of the vocal cords (cited in Zhang, 2006). Shen agreed with Miracle (1989) that learner errors largely came from tone register and proposed that teachers should let students experience physically the various level of register in their own voice until they become conscious of them. Shen believed that students need to master from the very beginning the gamut of the register in order to avoid register errors. Shen also pointed out that it is essential for Mandarin learners to be aware of their idiosyncratic pitch range and of the low, mid, and high pitch levels of their voice. Shen hoped that in this manner learners would thus be trained to change their voices from one register to another within their own pitch range and with their own proper fundamental frequency. In addition, Shen warned of a wholesale dependence on the representation of tones using the five-point scale (Chao, 1972) because the actual production of tones in the connected speech does not correspond in a one-to-one manner to the phonological prediction. Shen believed that it is pertinent to simplify the pitch registers of

the starting, ending, and turning-points of Mandarin tones to three pitch registers, which are high, low and mid. After learners have mastered the different pitch levels, the instructor should then tell them that Tone 1 starts with a high key and remains in this high key; Tone 2 starts with a mid-key then moves up to a high key; Tone 3 starts with a mid-key, shortly after dips to a low key and glides upward to a mid-key; and Tone 4 starts with a high key then drifts sharply to a low key. Learners will thus be trained to change their voices from one register to another within their own pitch range and with their proper fundamental frequency. What they learn in tonal pronunciation is not tonal shape—such as level, rising, and falling--but tonal register such as high, low and mid (p. 40). However, Shen has not proposed any concrete techniques to train learners to be more aware of their own pitch range.

Zhang (2006), on the contrary to Shen (1989 a; 1989 b), supported He (1987) and believed that it is possible to train students to control those muscle movements of the vocal cords. The training might not, however, involve artificial training of those tones but a change of body tension and proprioception might be necessary. Zhang asserted that “while we cannot artificially and forcefully make students enlarge their pitch range, training the different muscles and the use of the body in speaking Mandarin could be a successful way of training students to enlarge their pitch range” (p. 56).

Hao (2015) argued that, before teaching the different tonal shapes, the instructor should ask learners to utter a sound naturally in their low register, then a sound in their high register and finally a sound in their mid-register, until learners become conscious of these three levels of their voice.

Zhang (2016) pointed out that since Chinese focal prominence is expressed mainly by expanding pitch range, intensity and duration, but not by changing a tone’s essential pitch contour, it

is important for learners of Chinese to be trained in preserving lexical tone contours in various post-lexical phonological events. Zhang challenged some textbooks, such as *Integrated Chinese*, which is used by many universities. Zhang criticized the training materials of tones are mostly at word level, either in the form of single disyllabic words or the combination of words forming 3 or 4 syllabic chunks. Sentences with foci placed at various prosodic positions are not added to the tone exercises. Zhang also suggested that the explicit expression of focal prominence would benefit the students' understanding of Chinese tones (p. 210).

From my observation and experience, it is necessary to raise students' consciousness of the pitch width difference between English and Chinese. In addition, training toward widening English speakers' pitch range should be implemented at the earlier process. English is comparatively flat while Chinese is more cadenced. It might sound like singing to some beginning Chinese learners. However, I have not found any studies about how to specifically help students to widen their pitch to a suitable scope for learning Chinese tones.

### **Audio-lingual Methods**

The Audio-lingual method is an oral based method used in teaching foreign languages. It is based on behavioral psychology, which postulates that humans could be trained through a system of reinforcement. Audio-lingual method deems language learning as a process of habit formation in which target language patterns were presented for memorization and learning through dialogue and drills (Castagnaro, 2006). It helps learners to respond correctly to stimuli through shaping and reinforcement.

In the typical Audio-lingual presentation, tones are presented as minimal pairs or minimal quadruplets. In such a case, there is a tendency for them to be presented in phonetic pre-units: lessons that contain no conversational material, but rather preview phonemic

contrasts (in particular the tones), using whatever words are needed for this, whether or not these words will be taught during the subsequent course. Their meanings may be given for immediate reference, but students are not expected to learn their meanings, much less their use in context (Bar-Lev, 1991).

Yue (1980), through a longitudinal (from 2 months to 28 months old) case study of his daughter, demonstrated that tones are acquired at a very early age. Yue proposed a word play, which is similar to the minimal pairs. Yue simply pointed to certain familiar objects in the house, the words for which differ only in tone, for example, various fruit-shaped magnets were placed on the refrigerator door, among which were a lǐzi (李子 plum) and lízi (梨子 pear) and asked her to identify or name them. With repeated exercises, his daughter acquired the tone pairs. However, Yue found that for Tone 2 versus Tone 3, the “experiments” were not always successful.

Wang et al. (1999) attempted to train American adult listeners to perceive Chinese sounds in a linguistically meaningful manner. By using relatively simple auditory training, Wang helped listeners create a new phonetic category that was usable in various phonetic contexts and can be retained in long-term memory. The four tones were trained pairwise (i.e., Tones 1 and 2, Tones 1 and 3, Tones 1 and 4, Tones 2 and 3, and so on). Pairwise presentation during training allowed for a systematic increase in difficulty of tone contrasts. The stimuli were tape-recorded monosyllabic Mandarin words presented in isolation. An example stimulus presentation and feedback was as follows:

Talker: běi

Trainee’s response (two- alternative forced-choice identification: běi or bèi)

Neutral English voice: That was Tone 3, běi. Talker’s repetition: běi

Neutral English voice: Tone 4 is: Talker: bèi (p. 3652).

After each two consecutive sessions, trainees were given more stimuli. Posttest and retention test after six months showed an improvement in their identification scores from pretest (69 percent correct identification) to post-test (90 percent correct identification). Moreover, the six-month retention test showed that the improvement was retained long after training by an average 21 percent increase from the pretest (p. 3649).

Xing (2006) pointed out that influenced by the traditional audio-lingual method, most teachers “present tones or initials and finals as minimal pairs (e.g. mā vs. mà, zī vs. cǐ), triplets (e.g. jī, qī, xī) or minimal quadruplets (e.g. lān, lán, lǎn, làn)” (Ma, 1999; Ma and Smitheram 1996; cited in Xing, 2006) then ask students to listen to tape recordings and practice instructed tones, initials and finals. Xing further suggested a typical fifty-minute Chinese lesson during the first few weeks of students’ first Chinese class.

During the first half of class:

Teacher: – introduce a new group of initials, finals, or tones;

– demonstrate how to pronounce these sounds;

Students: – imitate those sounds after a teacher or recording;

– practice those sounds with classmates.

During the second half of class:

Teacher: – introduce a group of characters, especially those having the sounds that students worked on during the first half of the class.

– demonstrate how to pronounce those characters, how to write them and how to use them in communication;

Students: – listen to the teacher or recording how to pronounce those characters;

– practice those characters by articulating the sounds, writing the

characters, and composing a mini-dialogue using the characters.

Yang (2014) advocated developing production practice exercises that use minimal pairs to contrast the falling contour and the level contour, the falling contour versus the rising contour, and the rising contour versus the level contour. Yang believed this might help learners of Chinese get a sense of the multidirectional contrast of tonal contours. To permit students to form generalizations based upon what they learn, teachers could also provide different variations of syllables, including syllables with nasal consonants and multiple vowel finals.

Audio-lingual method has limitations not only in the behaviorism hypotheses, which many linguists argue that learning a language is not a behavioral case, but also in the non-communicational meaning: some words chosen for drills are not even commonly used. Zhang (2006) pointed out that the drilling of both individual sounds and single syllables should be avoided. This is because sounds rarely occur in isolation in real conversations. However, because of its practicality and accessibility, Audio-lingual method, from my observation and experience, is still widely used in Chinese classes in America.

### **Music Related Methods**

The interlink between music and learning Chinese tones has long been realized by experienced linguists and teachers. Chao (1948, 1972) pointed out that the students who practiced musical instruments had better master of Chinese tones. This hypothesis has been confirmed later by neuro-psychological experiments (Please refer to the Neuropsychological Explanations in Error Analysis section). Since then, a few scholars have tried to incorporate musical elements into the pedagogy of Chinese tones.

Woo (1976) first put forward the idea of using musical symbols and instruments to represent

and teach tones. In his study, Woo proposed that music scales should be used to represent teaching materials or tone drills rather than using an abstract contour line to represent the tones. Woo also advocated using the musical scales to represent the sounds through visual images. Woo gave an example as following:



Figure 7. Singing Chinese characters (copied from Woo, 1976, p. 102).

Woo gave an example of a student who claimed to be deaf to Chinese tones. Woo used a trombone to demonstrate to her four different tones which she recognized easily by ear. Woo pointed out to her that these tones were similar to the four tones as used in spoken Mandarin and the vocal cords can produce the different tones as well as the trombone. That student did succeed finally.

Lin (1985) agreed with Woo (1976) and believed that Chinese sentence can be written into musical staff (see figure 11). Lin replaced Chinese characters by Pinyin under the musical staff. Lin also suggested that teachers should hand out the drill materials like below and students practice like singing. The steps of the drills may be: teacher say two times while students listen carefully, then read after teachers at the third time. Teachers point to the contour, ask students to read in unison and individually.



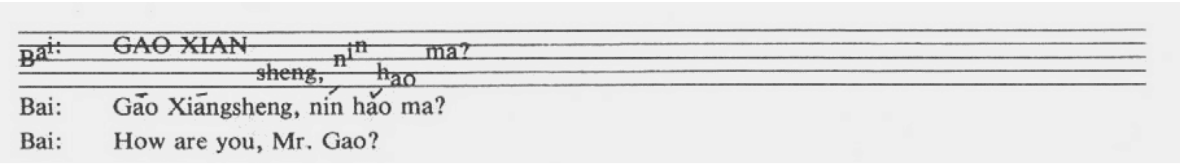


Figure 8: Dialogue in musical scales (copied from Lin, 1985, p. 42).

Duanmu (2007) suggested that tones could be superimposed on musical notes in some subtle ways. For example, the falling tone (T4) on a high musical note might be realized as a slight fall in the high pitch range, and the falling tone on a low musical note might be realized as a slight fall-in the low pitch range. The rising tone (T2) can be similarly coded. The low tone (T3) can be realized with a level pitch and a murmured voice quality and the high tone (T1) can be realized with a level pitch and normal voice quality. However, Duanmu admitted that this suggestion is quite plausible but there is again no experimental evidence for it (p.252).

Yang (2014) suggested that teachers can also demonstrate tones using the musical scale, do, mi, and so (C, E and G). T1 is so (G), and T3 is do (C). In this case, musical pitch can aid learners in distinguishing tones in terms of register.

The relationship between Chinese tones and music scales has been realized and admitted. However, there is still a big gap between research and practice. In teaching practice, the researcher has never observed or heard any Chinese class use the above methods. Four reasons may account for the breakdown between theory and practice. First, not all teachers are musicians. Chinese tones do have five pitch scales, but these five scales do not match the musical scales, they do not have treble and clef, or musical notes such as ABCDEFG. It is almost impossible for teachers to design Chinese sentences into musical scales. Secondly, not all students are good at music. For those students who do not practice any musical instrument or even do not have musical talent, this method brings extra confusion for them. Thirdly, so far, no textbooks or teaching materials are

designed with the musical based teaching methods. Last but not least, the musical related teaching methods lack evidence from empirical data. No studies showed that the musical method is effective to common CFL students. This may explain why no in-field teachers use this method. However, this method inspired me in designing the present teaching model.

Related to music teaching method, many in-field Chinese teachers like teaching Chinese songs to students, especially to young learners. In my opinion, this method might affect students' acquisition of tones in a negative way, especially at the early stage of CFL learning, because tonal shapes and contrasts can be ignored easily in singing. Melodic approach is expected to have effect on the entire language acquisition process (Mora, 2000). However, this approach may work for non-tonal languages, or to native language learning. When singing a song of a tonal language, tones disappear. A few of the researcher's young students learned Chinese songs from their schools. When the researcher tried to teach them the same words as the lyric, they often sing out or say the words with the flat intonation. From my experience, songs cannot be taught at the same phase as tones. Instead, songs could be taught to students at a higher level after the tonal acquisition.

### **Visual, Gesture, and Kinesthetic Methods**

Before the 1990s, many studies adopted a perceptual training paradigm with auditory input only. Since the 1990s, scholars have tried to find more cues for CFL learners other than audio input.

Bar-Lev (1991) proposed two innovative teaching methods including a double system of representation and a special sequencing for presenting the tones. The double system of representation includes the diacritics presentation, which is, according to Bar-Lev, more easily pronounced by those who can relate to musical notes. In addition, a system of English letter presentation (HRLF, H for high

level; R for rising; L for Low; and F for falling) is included to augment the recognition of tones. Bar-Lev believed English speakers have better mastery if tones are represented by English letters.

Zhang (2006) conducted a study of adult learners in Australia. The study suggested the use of movement and gesture in the early stages of learning to enhance students' perception and production of Mandarin. This approach provided students with useful memory tools for learning both in class and in self-accessed learning. Zhang (2006) suggested not to teach tones with explicit explanation, but through a combination of movements and gestures, provision of visual and auditory feedback.

Chen and Massaro (2008) hypothesized that there may be additional visual information (e.g. using mouth, head/chin movements, and especially activities of the neck) for lexical tones. They believed that students might perceive Chinese tones better if students learn about the nature of the visual information. Chen and Massaro conducted research with 28 native Chinese speakers. These Chinese speakers were asked to identify tones by only seeing the stimuli (a face of a speaker saying different tones). They found that when participants were taught a specific identification strategy, their tone identification performance improved significantly to a level well above chance. The study suggested that there was more visual information for Mandarin tones than anticipated. With instruction, participants appeared to be able to use the speakers' neck activities and head/chin movements to identify tone.

Liu et al. (2011) implemented an experiment among 35 beginning Chinese college students. Pretest and posttest after training were used to compare the effect. The purpose of the experiment was to test if Contour + Pinyin condition, or Number + Pinyin condition, or Contour only condition is the most effective visual cue. The results showed that Contour + Pinyin improved student's tone perception more than Number + Pinyin and Contour Only.

Tsai (2011) pointed out that there are two stages in learning tone: first is that learning a tone as a general feature to speak with any syllable, and second is that learning individual syllable plus tone combinations so that meaning can be understood. Tsai claimed that many teachers use hand gestures and other body movements to help teach tones. The method Tsai uses is:

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Table 5  
*Gestures for Four Tones*

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1st tone	flat hand moved across the body at shoulder height
2nd tone	raise your eyebrow every time you say the 2nd tone.
3rd tone	drop your chin on your neck and raise your chin when you say the 3rd tone.
4th tone	stamp your foot when you say the 4th tone.

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*Note.* From “Teaching and learning the tones of Mandarin Chinese” Tsai, R., 2011. *Scottish Languages Review*, 24, p. 46.

Tsai (2011) also mentioned that students were encouraged to make the gestures themselves when they speak, and it was generally accepted that when students say the tones with the actions at the same time, they can master the tones faster than if they do not use the actions. Colors can also be used to show tones. This has the advantage that the color system can be extended to flashcards with characters at later stages of learning (p. 46).

Keckskés (2013) suggested that kinesthetic strategy was successful. He mentioned that movements by both teacher and peers could help the grasp of the tones of the new words and could enhance the retention and application. Movement is also the means of entry into the prosody of our first language and the mirror of the voice in speech. He also commented that despite being integrally involved in language use and astonishingly effective in learning, the kinesthetic domain has been largely ignored in the practice of language teaching.” Keckskés emphasized that unequivocally the powerful role gestures that accompany discourse play in deep

learning processes. He argued that discourse with gestures produced better recollection of conceptual information.

Yang (2014) proposed to use pictures to elicit disyllabic words. Yang indicated that most words in modern Chinese are disyllabic. Second, tones carried by the disyllabic words are more stable than other tones. Third, in addition to encouraging learners to match the phonetic categories of tones with the phonological functions, the use of pictures can also be part of training learners to coarticulate two tones nearby in context (the second level of tonal acquisition). However, Yang did not elaborate how to use pictures in instruction.

From my observation and experience, visual, gesture, and kinesthetic methods are commonly used in teaching Mandarin tones. Students tend to absorb more when receiving both visual and audio stimuli of tones. In regards to the visual input, although there are three representations of tones: contour shapes (ˊ / ˋ \), numbers (1、2、3、4), and English letters (HRLF), the researcher agrees with Liu (2011) that pinyin plus contour is the most effective way of learning Chinese tones. The contour signs directly match the pitch shape and route. Experienced students know the shapes of the tones as soon as they see the contours. More importantly, most current textbooks use tone contours. Occasionally, the researcher sees students use numbers to signify the tones. However, they need to transfer the numbers to the contours in the brain to make the correct tones. The researcher has also observed some Chinese teachers use tone numbers in homework and tests. It may be easy for both teachers and students to type numbers instead of tone contours, especially when they need a special software (PinyinPut) to type contours. The biggest problem for numeric tonal representation is that in China no numbers are used for tones. Consequently, students who learn the numeric tonal representation may have trouble when they go to China.

As for gestures and kinesthetic methods, the researcher feels they may be helpful at the beginning phase when practice is mainly on short-word phrases or simple-structure sentences at a slower speech pace. These methods help beginning learners enforce the link of tones with diversified mnemonic techniques. However, with the development of tonal acquisition, or advancement to complex sentence level at a normal speech speed, gestures and kinesthetic actions may cause the speakers to look awkward.

### **Methods on Problematic Tones and Tone Sandhi**

In the prior section of Error Analysis, a few samples of literature regarding the difficulty order were reviewed. Primarily, most scholars believe that there is a hierarchical acquisition order of four Mandarin tones, and Tone 3 seems to be the most problematic one. Based on these findings, educators proposed pedagogical solutions.

Lin (1985) believed that inaccuracy in determining, describing, and explaining Tone 3 causes the major difficulty in learning Chinese tones. Lin proposed that Tone 3 should be taught as mainly low dipping rather than low-dipping-rising, since T3 occurs more than half of the time in the connected speech as a low-dipping tone. Lin asserted that considering frequency, this dipping tone should be considered basically a low-dipping tone (p. 197). Lin suggested classroom teachers not be rigid with the linguistic features of Tone 3. In addition, native Chinese speakers usually pronounce Tone 3 as low dipping without the rise. Lin's suggestion on Tone 3 was taken by some in-field teachers and scholars. For example, Hsieh (1997) took up Lin's suggestion of teaching Tone 3 as a half Tone 3 rather than a full Tone 3. Hsieh also indicated that the confusion between Tone 2 and Tone 3 should not be a dominant factor for teachers to emphasize T3 as a low-dipping-rising tone.

Many other researchers such as Xu (1997), Chen (2000), and Yip (2002) suggested considering T3 as a low pitch when in context; thereby, students could establish its contrast with T4 as one of higher height. Unfortunately, this method does not directly address L2 learners' troubles in distinguishing T2 from T3, even though T3's acoustic features are closer to T4's. This is probably because T2's start point is low, and T3 is also perceived as a dipping tone, despite the reality that it is a low tone (Zhu 2012, cited in Yang, 2014).

Zhang (2006) also agreed to teach Tone 3 not as a full Tone 3 but as a low-level tone. Zhang suggested offering students a large amount of exposure and perception training so that students can induce that Tone 3 is recognized as a low-level tone rather than a full Tone. Zhang proposed an idea of special sequencing: to teach the four tones in a few separate mini-course in the sequence of T4-T3-T1-T2. Each course should introduce one new tone as well as reviewing the learned tones within the context.

Xing (2006) advocated that the confusion between T2 and T3 may be clarified by explaining the different pitch values of the two tones as they are realized in natural communication. Xing illustrated the idea by the following mini-dialogue, from which Xing believed that students can be informed of how tone sandhi applies and how the pitch value of the third tone changes.

a: 你好吗?

nǐ hǎo ma? "How are you?"

Tone value: 214 +214+0=> 35+21+0

b: 我很好。

wǒ hěn hǎo. "I am fine."

Tone value: 214+214+214 => 21(4) +35+214

Xing suggested that teachers apply the tone 3 sandhi rules in natural conversation and demonstrate that T3, in most authentic conversational cases, reduces its pitch value by half. This results in the majority of third tones in natural conversation using a low-falling tone, and no rising pitch at all. When students understand this about the tone 3 sandhi, they can apply it with more confidence in natural conversation.

Guo and Tao (2008) argued that in the initial training of Chinese tones, four tones should be trained separately. Tones 2 and 3, especially Tone 3 require more time and effort to master. Moreover, Tone 3 should be taught and practiced in the classroom mostly in multi-syllable units by following the tone sandhi rules.

Yang (2014) argued that at the phonetic feature level, non-native speakers must acquire the phonetic features and phonetic categories at the very beginning of their Chinese instruction. It is critical for CFL learners to learn the multidirectional contrast of contours, such as T1–T3 pair and T2–T4 pair, so they can use them to acquire the phonological categories. Yang provided two specific methods of teaching Tone 3. In the first method, the teacher holds up a sign depicting the rising and falling contours and then asks the students to mimic the dipping tone (T3). In the second method, the teacher should only teach half T3 (the first falling contour). The teacher asks students to produce a low falling tone and then to pause for a very short time for the second half before the following syllable is produced. Yang believed that the second method was effective since T3 is a low falling tone in natural speech.

Hao (2015) suggested that special attention should be placed on focused syllables bearing T2 and T3 for English speakers, Tao et al. believed that learners would benefit from having their attention drawn to the allotones of Tone 3 in connected speech.

Not all scholars agreed that tones presenting more difficulty should receive more attention.



Shen (1989b) suggested not prioritizing the tones in teaching despite the difficult hierarchy because pitch height is more resistant to improvement than pitch contour. Shen argued that slight inaccuracy in tonal production would not affect communication. For instance, if T3, whose phonological tonal value is 214 on the five-point scale, is pronounced as 213, 313, or 314, these productions are still correctly perceived as a 3rd tone (Tseng, 1981; cited in Shen, 1989b).

Research in the pedagogy of four tones and tone sandhi rules depicts a noticeable gap between pedagogy and theoretical research. There are a number of studies on the difficult order, acquisition order, but much fewer on the pedagogy of four tones and tone sandhi. Moreover, even less research has demonstrated its efficacy by data. For example, scholars suggest teaching T3 as a low tone rather than a low-rising tone, but no empirical studies have shown that students acquired improvement in T3 with this method. In the real-life classroom, most teachers still simply introduce the four tones in their natural order: T1, T2, T3, and T4 with equal time and instruction. The researcher has not observed any teacher invest more efforts in teaching the most problematic T3 than other tones. Furthermore, T3 is also treated as a full tone. In the third-year college class the researcher taught, students still use full T3 in natural speech, which made them sound stiff as well as incoherent. Students did not know the basic tone sandhi rules either, for instance, yi (一) and bu (不). Students told me regretfully they never learned they should skip the rising part of T3, and always tried to produce a full T3.

### **Computer Assisted Instruction of Chinese Tones**

The development and wide use of computers offer a new multimedia opportunity for teaching and learning. Computer Assisted Language Learning (CALL) is the search for and study of applications of the computer in language teaching and learning (Levy, 1997). The extensive use of computers provides a whole new perspective and method of language learning;

therefore, this dramatically changes students' strategies in learning and increasing their learning opportunities (Zhang, 2006).

Wang (2005, 2008) implemented a computer-based training to both tonal and non-tone L1 Chinese learners. They were trained for three weeks to identify and produce the four Mandarin lexical tones. One group took the perception and production training only with visual and audio feedback using Kay Sona Speech II software. The target tones produced by native Mandarin speakers were played back through a pair of headphones, and the pitch contours of the target tones were displayed on the computer screen on the top window to be compared with the trainees' productions which appear in real time in the bottom window. Another group of participants took the perceptual training only with four-way forced choice identification tasks with immediate feedback. The same training tokens were used in both training modes. Pretest and posttest data showed both methods were effective in improving learners' tonal accuracy.

Xing (2006) pointed out that teachers should make more use of a wide variety of courseware or on-line programs to help students learn tones. Xing illustrated a tone learning courseware in which students listened to the speaker and identified the tone by clicking on a graphic. The computer then told the listener whether they identified the tone correctly or not. Another kind of courseware involved students listening to minimal pairs or quadruplets, recording and then listening and comparing their own voice with the standard one, performing identification and differentiation exercises, or testing themselves on tones, initials and finals. Xing believed this software could help students learn tones effectively.

Sun et al. (2012) argued that although the typical voice pitch pattern of each tone had been observed in many of the previous studies, it was difficult to utilize observed voice pitch pattern as visual cues in training. Sun et al. argued this was because most textbooks adopted a

conceptually simplified voice pitch pattern set in order to emphasize the high/low and rise/fall contrasts among the four tones. Sun et al. suggested a computer-assisted instruction (CAI) system for self-teaching to discriminate Standard Chinese four tones. This system utilized the displays of the voice pitch pattern of the speech as visual cues in training. On the computer screen, the essential voice pitch pattern of monosyllabic words with each of the Chinese four tones was shown. Furthermore, these words were drawn on a musical scale of six-whole-tones, which was proportional to perceived voice pitch. Sun et al. believed that displaying the corresponding essential voice pitch pattern along with the observed voice pitch pattern was useful for beginners to accurately perceive the underlying tonal features.

Wang (2013) argued that adult L2 learners' perceptual patterns can be modified through intensive laboratory-based training. Wang implemented the research of two training paradigms: (a) The perception training with custom-designed software, which used four-way forced-choice identification tasks with immediate feedback, and (b) The perception and production training with real time visual display of pitch contours on the computer screen (p. 151). The learner repeated the target tonal syllable and recorded his/her own production of the target tone by speaking into the microphone. The pitch contour of the trainee's production was instantly displayed in the bottom window of the screen. The trainee could then compare his/ her own production with the target sound by playing them back repeatedly (auditory input). The trainee could also choose to overlay the pitch contour of the target tone on the contour of his/ her own production to visually compare the pitch differences while playing them back for auditory comparisons simultaneously. The trainees from both groups practiced the training stimuli at a comfortable pace and recycled the four speakers' training stimuli. With six hours of training spread across three to four weeks according to students' schedules, students showed significant

improvement between pretest and posttest (p. 152).

Chun et al. (2015) conducted a CALL research on the use of visualizations of speakers' pitch curves to 35 first grade Chinese major students. The researchers took use of a free acoustic computer program named "Praat" to compare students' tonal production with the native speakers' recordings. The example is as below.

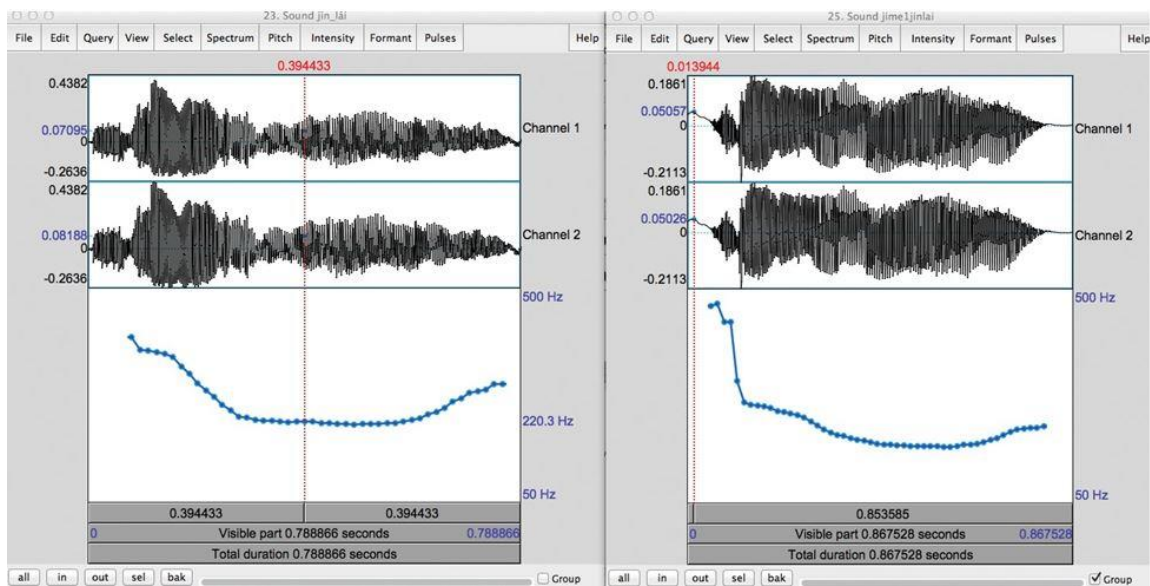


Figure 9. Waveforms and pitch curves of *jìn lái* 'come in' produced by a female native speaker (left) and a female student (right) (copied from Chun et al., 2015, p. 93).

The study was carried out in an authentic learning environment during a regular class setting.

The result showed that students acquired important improvement. The post survey indicated that 68 percent of the participants (23 out of 34) regarded seeing the native speakers' pitch curves as helpful.

From my perspective, Computer assisted language instruction and learning is undoubtedly a compatible but an underused method in CFL pedagogy. Computers are pervasive in American schools. In West Virginia, every student in fourth grade and up is equipped with a laptop from school for free. At school, students use laptops for class materials, information seeking, and

projects. They are also required to bring the laptops home for homework every day. In conclusion, American students are accustomed to and have access to working on computers. CALL methods, therefore, suit their learning habits. On the other side, CALL provides more multi-media and interactional activities than traditional paperback books and materials, which is extremely beneficial for language learning. CALL can supplement teachers' roles and is more flexible and approachable than teachers in some sense. In addition, well-designed CALL programs arouse students' learning interest through psychological design. For instance, my two young children who are learning Chinese don't like to do homework on the workbook, but they are excited to "play" with the Chinese games, especially when they accumulate a certain amount of study time or certificates, they can gain a "prize" from the program.

Regretfully, as far as the researcher observes, CALL is still not popular in CFL pedagogy, whether in public schools or in colleges. CFL teaching is still heavily relying on traditional instruction, paperback textbooks, and workbook homework. The researcher has not found students, other than mine, using any acoustic programs (like software in the aforementioned literatures) to correct their tones, or taking advantage of any well-designed exercise such as the three-way force choice tone training game, which my young learners are using with great interest. The reasons may be concluded as follows. Firstly, the Chinese teachers in America are a little "old fashioned." They may be not good at computers or are used to the lecturing style of teaching. Secondly, there are not many choices of CFL computer software or programs. There are very limited tone learning programs and most of them simply stay in the minimal pair drill or quadric drills phase. Many methods experimentally shown to be effective such as acoustic comparison analysis, are still in the research phase, not being promoted to the market or made handy for teachers. In conclusion, CALL could be an improvement for CFL pedagogy, but it

needs immense cooperation and efforts from researchers, educators, computer specialists, and CALL experts.

### **Perception and Production**

Perception and production are two equally important and inter-connected facets of CFL pedagogy. However, In CFL pedagogical studies, much more research focuses on perception than on production.

Wang, Jongman, and Sereno (2003) examined the relationship between perception and production. They hypothesized that perceptual training also has a positive effect on trainees' production. In their study, eight college students received a two-week perceptual training, and eight controls did not receive such training. The result showed that trainees acquired an improvement in their production from 57 percent in the pretest to 75 percent for the old stimuli, and from 55 percent to 68 percent for the new stimuli, but the control group did not show a difference. The researchers argued that this experiment indicated that trainees' tonal perception dramatically influences their productions in a positive way.

Guo and Tao (2008) proposed two stages of tone learning for beginning level students: the initial stage (i.e., simple unite or quasi-lexical) and the sentential stage. In the initial stage, the input should be in a slow speed and the production should be tolerated to be broken into small units or phrases for ease of tone production. At this stage, tone perception and production should be the emphasis in all Chinese language instruction. Small intonation units should be taught alongside the canonical tones. At the Second Stage of tone learning, participants have obtained some mastery of tones, but their tone production requires major adjustment to transition to connected speech with a greater speed. It is at this stage that mastery of tone production can be gauged. Great emphasis is needed on instruction of tone production in connected speech at this

stage as well. However, Guo and Tao pointed out that tones were often neglected in the later part of first-year Chinese language instruction, especially if instructors switch their attention to complex grammatical patterns and content of language use, assuming that, by then, students would have mastered the tones.

Yang (2014) highlighted the importance of treating perception and production differently. Yang argued that the tones non-native speakers perceived are based on default acoustic experiences, while their production is influenced by the L2's intonation patterns. In response to this difference, teachers should design different teaching methods for training/teaching tone perception and for training/teaching tone production. Yang further argued that instruction on the perception of tones should focus on contours. Teachers can exaggerate their pronunciations when they demonstrate tones as a way of teaching learners to acquire the contrasts of contours. If they do so, however, it is also important they model the production of non-exaggerated tones during other parts of instruction. At the reorganization level, instructors need to incorporate tones into different contexts, especially the HTL context. This will encourage learners to use both acoustic and contextual cues to perceive and produce tones. The context can be selected according to the words or phrases that learners have already learned.

Yang (2015) pointed out that it is impossible for even native speakers to judge non-native speakers' tones as absolutely correct or absolutely wrong. The only thing native speakers can determine is whether the tones are similar to or far from those native speakers would produce, as they are perceiving the non-native speakers' production. Developing a model of native speakers' perception would make it easier for us to measure to what extent non-native speakers' tonal production approximates native speakers' perceptual categories.

As a conclusion, Yang (2012, 2014, 2015) argued that tones are perceived at the

phonological level and produced at the phonetic level. Thus, it takes L2 learners a longer time to acquire phonological features of tones. In other words, tonal perception happens earlier than production. Yang (2013) also pointed out that utterance-level prosody in Chinese has received little attention in both CFL teaching and research. Yang called on more attention on utterance-level prosody in both research and teaching.

### **Psycholinguistic Methods**

A few neuropsychologists have demonstrated that English speakers and Chinese speakers use the different parts of the brain to process tonal perception. The implication from this finding seems to be the explanation of tones.

Wang, Spence, Jongman, and Sereno (1999, 2014) found that non-native learners were able to significantly improve their ability to identify tones by undergoing perceptual training. Improvement results in new contexts that are eventually stored in learners' long-term memory. Wang, Jongman, and Sereno (2003b) found that improvements in tone perception and production from training also led to changes in cortical representations in the direction of native speakers. Wang, Jongman, and Sereno (2014) suggested that this information implied that adult production and perception systems still display plasticity and that cortical representations may continuously grow more native-like with more Mandarin experience (cited in Spencer, 2015).

Tinsley and Board (2014) indicated that psycholinguistic studies of native speakers of Chinese supported the view that the learning of Chinese by non-native speakers will be more successful if teaching starts early.

Neal (2014) suggested that some explicit teaching of tones is needed in the teaching of Chinese as a foreign language because explicit explanation helps build up the factual long-term memory in humans' brains. The researchers suggested that too much procedural knowledge of



tones may result in learners ignoring tones altogether, having no real understanding of how the tonal system works, or even finding that their faulty tones become fossilized. Neal's research analyses hand gestures, body movements, and colors as ways of explicitly teaching/learning the Chinese tonal system and also advocates for peer assessment and tonal awareness tasks as ways of raising learner awareness of tonal production (p. 151).

### **Feedback and Assessment**

Feedback and assessment are necessary in language learning. Effective feedback helps students know the results of their actions and hence would know if any adjustment is needed. Assessment enables both teachers and students to know their learning outcome, henceforth, to adjust their teaching/learning strategies accordingly.

Woo (1976) suggested that frequent quizzes on tones are necessary to check students' memorization of word tones. On the contrary, Jiang (1996) did not advocate for frequent quizzes during tonal study. Jiang investigated the relationship of remembering tones and pronunciation by testing students' tones through written work on a weekly basis. Jiang did a student survey regarding the effectiveness of using written tests of tones; a third of the students pointed out that the written tests on tones allowed them to remember which character went with which tone but did not help them in recognizing what the tones sounded like upon hearing. The written tone test was a mechanical test because it was done by hand and when hearing Chinese through the ears, the students still could not differentiate the tones. Jiang concluded that pronunciation problems arise out of not being able to differentiate the four tones through perception and might not be able to be resolved through paper tests.

Xing (2006) provided a perspective regarding error correction and feedback. Xing pointed out that there are two competing camps among Chinese teachers: (1) teachers who correct

students' pronunciation errors whenever they hear them and (2) instructors who emphasize perception and production leaving students to develop the ability of self-correction. Those who insist on correcting students' pronunciation errors as often as possible believe that only by doing so can students acquire the beautiful standard Mandarin pronunciation. The other camp of teachers, on the other hand, argues that students have to build their confidence in pronouncing individual tones and words first before using them in discourse, and constant error correction discourages students from developing such confidence. It appears that both camps have good reasons to believe in what they consider the best way to teach students' Mandarin pronunciation, yet both appear to have developed their view based on their own observation and/or experience with their own students (p. 91).

Peabody and Senef (2006) argued that efficient feedback is critical to correct the tonal aspect of students' speech. They asserted that correcting students' mispronunciation is extremely important in terms of providing feedback, but not all forms of feedback are necessarily beneficial for learners. In their example, the student unsuccessfully tried to correct his tone within a sentence. He then produced the tone correctly in isolation, but immediately failed to incorporate this change in a sentential context. Peabody and Senef pointed out that one problem was that the student does not know how his voice should sound and only has one reference to base his pronunciation on. The student's anxiety about correctly producing the language may be increased if he is unable to imitate the teacher's voice or identify what the teacher feels is lacking in his pronunciation. Feedback pertaining to various aspects of language learning is given either during or after the conversation. The idea is that, by encouraging the student to come up with sentences and phrases on their own, even if they are imperfect, learning will take place. Feedback may be given to correct major problems, but other problems are allowed to slide. The

general approach to providing tonal corrections in sentences is to modify a waveform of the student's speech. This is done in a two-stage process. The first stage generates a pitch contour from native tone models. The second stage alters the pitch in the student waveform to match the generated contour.

Wu (2007) conducted a tutoring package case study of a first-year college student in a Chinese major. Wu found that the tutoring package was successful: the student's average accuracy rate increased from 50 percent before tutoring to 90 percent after tutoring. The prompt consisted of (a) a manual gesture to indicate the correct change in tone, (b) a demonstration of how to form the lips and tongue to produce the correct pronunciation, and (c) repetition of response attempts until a correct response occurred. Second, the tutor provided praise (in both English and Chinese) and a brief Chinese conversational exchange contingent on a correct response (p. 586). Wu's study showed that the appropriate feedback could fortify the tonal acquisition.

In summary, the Chinese tones pedagogy could be categorized into implicit vs. explicit instruction; raising consciousness toward Chinese tones; widening pitch ranges of English speakers; audio-lingual methods; music related methods; visual, gesture, and kinesthetic methods; methods on problematic tones and tone sandhi; computer assisted instruction of Chinese tones, ideology of perception and production, psycholinguistic methods, and feedback and assessment.

### **Gaps in Literature**

In the above sections, the linguistic studies of Chinese tones, error analysis of CFL students, and pedagogical research are reviews with an eye to an effective teaching method of Chinese tones to English speakers. A few gaps are identified from the existing literature as

follows.

The first gap is between the theoretical research and the pedagogical research. Theoretical research should guide the pedagogical research, and pedagogical research should, in return, provide evidence for or against the theoretical research. However, in CFL tones research, there is an obvious breakdown between the theoretical and pedagogical research. For example, a great amount of psycholinguistic research showed the co-relationship among tone-learning, brain zoning, and music (Shi, 2018). Nonetheless, the related pedagogy research derived from this camp of theory is sparse and some of them are impractical. Another example is the error analysis. Much research has demonstrated the tonal contrast between Chinese and English is the root reason for tonal difficulty. However, almost all the pedagogical methods suggest isolating students' L1 experience from L2 learning, which seems to the researcher, is impossible. L1 experience is influential, regardless of whether it is positive or negative, but also unavoidable. The correct way may be building a bridge between two languages and activate the L1 schemata to help L2 learning instead of breaking down the bridge. The break down between theoretical and pedagogical of Chinese results in the phenomenon that some teaching methods derived from the theoretical research are not practical and the methods derived from the teaching practicum lack theoretical and scientific foundation.

Secondly, most of the existing studies focus on college students. Because college CFL students are comparatively fewer, studies in this age group have a smaller sample size, usually about 10 subjects. On the contrary, the main body of CFL learners in America: K-12 students, has received little attention in the prior studies. In fall 2017, the WVU Chinese major has enrolled approximately 60 students across four grades. In the same time, only in North Elementary School, Morgantown, West Virginia, 300 kids were taking Chinese classes. More

importantly, these kids were in the critical period of developing the sense of a second language, especially for the pronunciation. The deficiency in the tonal pedagogical studies on children will directly influence the conversational ability of these children when they grow up. As a result, the huge investment on CFL education from federal and state government will not gain their intended effect.

Additionally, the existing pedagogical studies focus more on perception than on production. Acoustic analysis and comparison methods are demonstrated to be effective for improving students' perceptual quality. The differences in L2 tone production by speakers of tonal and non-tonal L1s remain under-studied, as does the relationship between tone perception and production. The absence of a substantial body of L2 production training studies has led a number of scholars to investigate whether perceptual training can be of assistance to these learners (Yang, 2014). Many scholars argue that improvement of perceptive proficiency will cause improvement in production proficiency. However, from the researcher's experience as a CFL teacher and an ESL student, perception ability is not equal to production ability. Some students can understand what native people say but cannot express themselves effectively. On the contrary, the production proficiency may actually predict the listening ability. When a student is proficient at speaking, there is a high chance that he/she is also good at listening. Most of the literature assessed subjects' ability to perceive tones accurately while little addressed to tonal production.

Moreover, except for some acoustic research, most pedagogical research was based on non-empirical studies. This phenomenon may be due to the methodological hardship in pedagogical research for in-field educators. It is hard or even infeasible to conduct "experiments" during teaching, which may require a teacher to change the syllabus or pausing the normal

teaching. In the present study, a practical method, Design-Based Research is introduced. The researcher hopes that this method will bring a new perspective to CFL researchers and teachers.

In conclusion, Chinese tones is acknowledged to be one of the hardest aspects of learning Chinese. Yet there is no widely accepted pedagogical method of it.

### **The Present Study**

The present study aims to fill a gap in the current body of literature and attempts to provide CFL educators an innovative teaching model and a practical course design.

First of all, this study was developed with decent theoretical foundation and affluent Chinese teaching practicum. The teaching model is designed with thoughtful considerations on second language teaching/learning theories and Chinese linguistic theories. It is based on an integration of a few prior research studies such as Chao's (1933, 1948, 1972) numeric description of Chinese tones and psycholinguistic judgment about tones and music. The present study was also based on the researcher's pedagogical practicum as a CFL teacher in America since 2012. In addition, the researcher has an academic background of teaching English as a Second Language (TESOL), which helped her deeply understand the knowledge and methods of teaching both English and Chinese. In the teaching model, musical scales, English vocabulary, and live schemata were used as cognitive aids to connect new concepts with learners' existing schema. This current model has been implemented to American CFL students for a few times and has shown effectiveness. Moreover, the researcher has modified the model after every implementation. In addition to the teaching model, the researcher has designed a 30 to 50-minute training session. This training session has also been conducted for a few times in the authentic teaching environment and been confirmed positive. In this way, this study might fix the gap between the theoretical research and the pedagogical research in CFL field.

Secondly, the current study covers a wide range of ages and proficiency levels. The participants were drawn from elementary school, middle school, high school, adult Chinese learners as well as Chinese teachers. The main source of the participants were public school students. This study integrates various ages and proficiencies in order to decrease the gap of the existing literature which mostly focused on college students.

Additionally, this study focuses on tonal production instead of on perception, which had been the focus of prior literature. The researcher believes that production is the major problem in students' speaking proficiency. This belief is based on the researchers' teaching experience that students often claim they encounter more problems in being understood than understanding the native speakers. This study is expected to add weight on the tonal production studies.

Finally, this study is an empirical study in the real-life teaching settings. It adopts a practical research method called Design-Based Research (DBR). This research method enables teachers to conduct research in daily teaching environments with unlimited space to improve it. This study anticipates to shed light on empirical research of CFL pedagogy.

Since the neutral tone involves controversies and lacks universal performance even among native speakers, it will not be a focus of this study. The current research focuses on the four standard lexical tones; therefore, neutral tone is not addressed. As the present study does not aim at providing linguistic analysis but rather offer pedagogical assistance to Chinese teachers and educators, it does not include duration and F0 in order to keep the teaching method simple, acceptable, and practical. Tonal variation will be briefly introduced in the research, but not a focus in this study. Because the present study focuses on the tonal production of Chinese learners, the researcher would like to keep the tonal rules as stable as possible to prevent any confusion. Some high frequency tonal variation rules such as “一 yī, yí or yì” and “不 bú or

bù”and T3 combinations will be included in the pedagogy; other than that, tonal variation rules are not addressed in the research. The detailed research questions are as follows.

### Research Questions

The current research is to answer the following questions:

Q1. Is the designed method effective to improve the tonal accuracy of English speaking K-12 children and adult learners?

Q2: What are English speaking K-12 children’s attitudes toward the designed method?

Q3: What are adult learners’ and teachers’ attitudes toward the designed method?

The designed model includes two components. One is a tonal map book mark; the other is a 30-minute lesson plan. The book mark has two sides, the front is a tonal map designed for younger and older learners separately (see Figure 10 and 11), and the back side (see Figure 12) presents the most frequent tone sandhi rules of Mandarin Chinese.

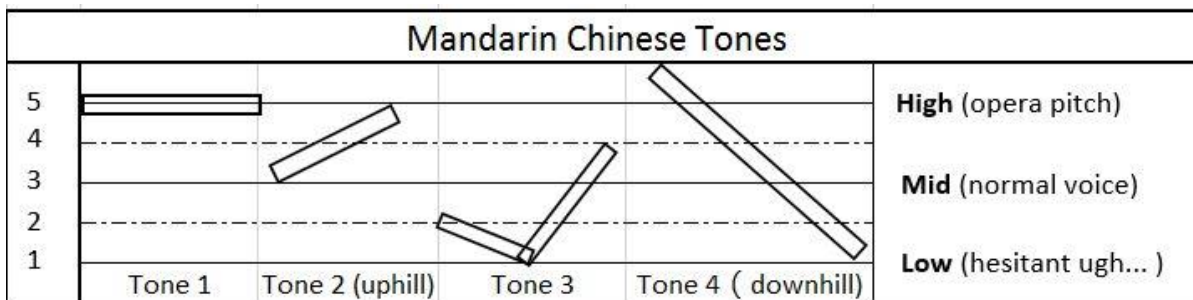


Figure 10. The front of the Chinese tones bookmark designed for younger Chinese learners.

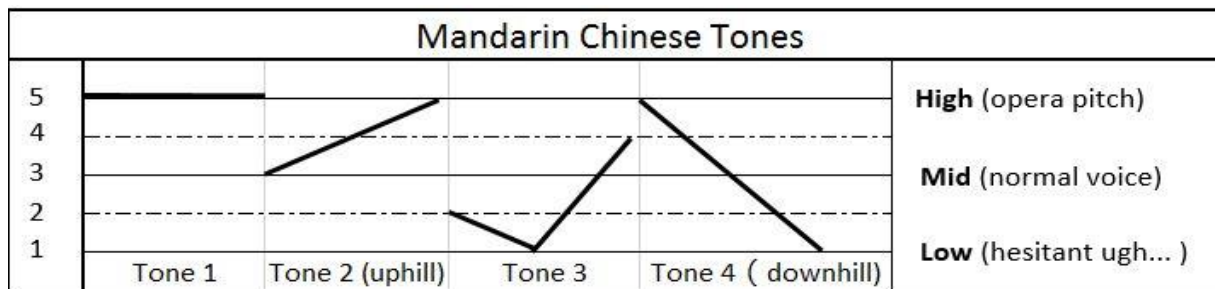


Figure 11. The front of the Chinese tones bookmark designed for older Chinese learners.



\*Two 3<sup>rd</sup> tones in a row, the first one becomes 2<sup>nd</sup> tone. e.g. 你好 (*nǐ + hǎo = ní hǎo*)

\*不 (*bù*) is 4<sup>th</sup> tone except when followed by another 4<sup>th</sup> tone, when it becomes 2<sup>nd</sup> tone. e.g. 不对 (*bù+duì = bú duì*)

\*一 (*yī*) is 1st tone when it represents the ordinal "first". e.g. 第一个 (*dìyīgè*). It changes when it represents the cardinal number "1", following a pattern of 2<sup>nd</sup> tone when followed by a 4<sup>th</sup> tone, e.g. 一个 (*yī + gè = yí gè*), 一次 (*yī + cì = yí cì*), 一半 (*yī + bàn = yí bàn*), 一会儿 (*yī + huìr = yí huìr*). \*It changes to 4<sup>th</sup> tone when followed by any other tone. e.g. 一般 (*yī + bān = yì bān*), 一毛 (*yī + máo = yì máo*).

Figure 12. The back of the Chinese tones bookmark.

In conclusion, the current study aims at providing CFL educators a handy and effective teaching method on Chinese tones, and this method is deliberately designed with the essence of prior research and the researcher's knowledge and experience. The research design will be elaborated in the next chapter: Methodology.

## **Chapter Three**

### **Methodology**

The seven purposes of this section are to (1) describe the epistemological considerations of this study; (2) explain the research methodology; (3) explain the research model and design; (4) elaborate participants; (5) describe the procedure used in designing the instrument and collecting the data; and (6) provide an explanation of the data collection and analysis procedures.

#### **Epistemological Considerations**

Epistemology is the theory of knowledge embedded in the theoretical perspective and thereby in the methodology (Crotty, 1998, p. 3). It is the philosophical view about the nature of knowledge, that is, with questions of what we know and how we know it. Epistemology matters in both research and teaching. The researcher believes that theory is more decisive than data itself because epistemology affects the research in substantial ways. For example, it determines what kind of research we do; how we value the scholarship of others; how we understand the thinking and knowledge of our students; how we teach them; etc.

Because of the importance of epistemology, it is necessary to elaborate the epistemological belief which shapes the current study (ter Haseborg, 2005). This study is based on the belief that meaning is “constructed by human beings as they engage with the world they are interpreting” (Crotty, 1998, p. 43). This epistemological view admits that objective meaning exists, although it depends on the perceivers to find out the real meaning to them. Constructivism has a profound influence on second language teaching field. The constructivist paradigm is a view of instruction which focuses on using what the learner already knows and adding new understandings to construct meaning. The learner’s strengths and needs are the center of the instruction.

#### **Mixed Method of Quantitative and Qualitative**

Based on DBR process, a mix method of quantitative and qualitative is adopted in this study. The reason of choosing mix methods was because that mixed methods research is an approach to inquiry that combines or associates both qualitative and quantitative forms. It involves philosophical assumptions, the use of qualitative and quantitative approaches, and the mixing of both approaches in a study. Thus, it is more than simply collecting and analyzing both kinds of data; it also involves the use of both approaches in tandem so that the overall strength of a study is greater than either qualitative or quantitative research (Creswell & Clark, 2007).

In the current study, the quantitative research and qualitative research were interwoven throughout the whole process. They inform and influence each other. On the quantitative side, the sampling will be systematic sampling from target learners' groups. The data analysis will be paired samples T-test because of the normality of the bell shape distribution of the student's grades. The result of the T-test will shape the interviews. For example, if the improvement is significant, the interview questions will include "which part of the training you think is most useful for you?" and "if you think the training was successful, in what way the training has helped you?" On the other hand, if the improvement is not significant, the interview questions will be "why do you think the training is not as successful as it could be? How could it be better?" In return, the qualitative research also informs the quantitative method. For example, if the students think the training should include more exercises and activities, the quantitative method may include more than one T-test in order to monitor the influence of the exercises on the learning outcome.

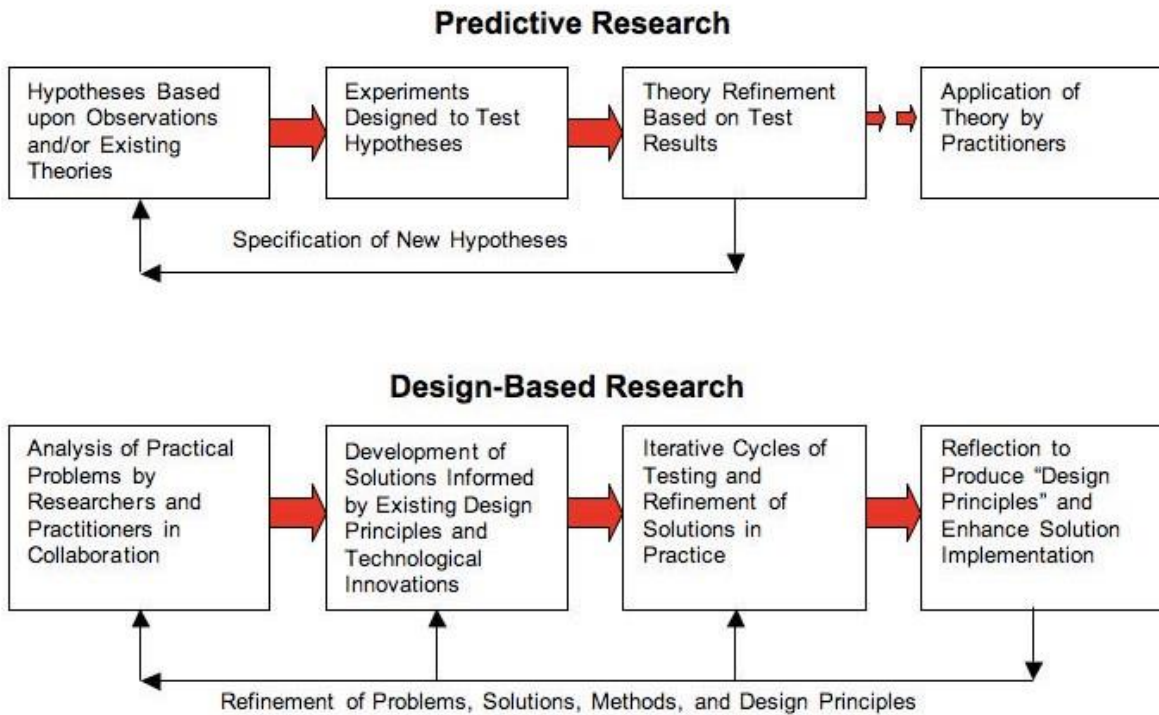
### **Design-Based Research**

Holding this epistemology, this study adopts a research method called Design Based Research (DBR). As Constructivism suggests, meaning is continuously constructed between the

knower and the known. Many existing studies set up “fake” experiments to test learning theories or methods. For example, they teach non-existent languages, or teach a real language but put the learners in an experimental environment. The result of these studies is often questioned regarding their effectiveness in a real-life teaching practice. This kind of “fake” experiment may construct an incorrect meaning to the learners. For example, the control group which is treated without any tonal strategy may lose their critical period of time in learning Chinese tones, or they may assume that Chinese tones are not important thus don’t require special attention. DBR provides the methodology which is smoothly integrated into the daily teaching practice. DBR is a methodology which is meant to be conducted in the real-life settings where most learning occurs. Furthermore, DBR’s Design-Enactment-Redesign cycle helps the researchers generate their own theories in the end.

DBR is a research method with the expectation that researchers would systematically adjust various aspects of the designed context so that each adjustment serves as a type of experimentation that allows the researchers to test and generate theory in naturalistic context (Barab and Squire, 2004). Reigeluth and Frick (1999) declared that DBR is formative research in a naturalistic case. They argued that DBR is a kind of developmental research or action research that is intended to improve design theory for designing instructional practices or processes (Reigeluth & Frick, 1999, p. 633). Brown (1992) and Collins (1992) described DBR as a methodology that requires addressing complex problems in real contexts in collaboration with practitioners. DBR highlights authenticity of settings and the flexibility of the procedure. During the procedure, DBR frequently faces variables and involves flexible revision (Barab and Squire, 2004). Because of the authenticity of DBR, participants in DBR studies are treated as co-researchers instead of experimental subjects. In addition, DBR allows the researchers to take

multiple roles such as classroom teachers, designers, and practitioners. Edelson (2001, 2002) indicated that DBR offers the researchers chances to improve their educational practice continuously and naturally. Reeve (2006) illustrated the cycling feature of DBR by the chart as follows:



*Figure 13.* Predictive and DBR in educational technology research (copied from Reeves, 2006, cited in Herrington, 2007, p. 4090).

As shown in Figure 13, DBR has no ending point for a theory, a model, or a teaching method. It could be a continuous research with numerous cycles. These characteristics of DBR enable the in-field teachers and researchers to continuously test and refine their hypothesis, which is in fact implemented by almost every teacher. In conclusion, DBR offers the current researcher, who is both a classroom instructor of Chinese and a researcher of teaching Chinese

tones to English speakers, a great chance to test theories and to yield a more refined theory in a real-life setting.

### **Participants**

Since the designed model was targeting on K-12 CFL learners and adult learners, non-heritage Chinese students who enrolled in the Chinese classes of two public schools (Suncrest Middle School, Morgantown High School) and non-heritage students and a parent of Morgantown Chinese School (a Sunday school affiliates with WVU Continuing Education department) were recruited for the study. In addition, WV public school Chinese teachers who were registered in WVU Confucius Institute Teacher's Program were also recruited as participants. These teachers participated in the research as both trainees and Chinese teachers. They provided opinions on the teaching model from the perspective of adult learners and K-12 Chinese teachers. All of the adult Chinese learners were American citizens. Most of the K-12 learners were American citizens and all spoke English as their first language.

The researcher initially proposed 50 to 60 participants for the study. These participants covered a wide range of age groups of CFL learners. At the end, 31 participants were involved in the research. It included 28 Chinese students, 2 Chinese classroom teachers and 1 parent. Altogether, 28 participants completed the entire research process including the tonal training session and two recordings before and after the training. They included 6 elementary students, 10 middle school students, 6 high school students, and 6 adult students. The 6 adult students from the WVU Confucius Institute West Virginia Chinese Language Learning and Certificate Program had twofold roles in the research: Chinese learners and future Chinese teachers. Although the sample size was not ideal, it covered a good age and level span, therefore laid a good population foundation for the designed model. If the model worked for all of the four

participant groups, it may be safe to assume that this method might be effective to all K-12 CFL learners and adult learners of English L1 background. The distribution of participants can be shown as below:

Table 6  
*Participants Size and Sources*

Participants Sources	Morgantown Chinese School	Suncrest Middle School	Morgantown High School	WVU Confucius Institute	Chinese Teachers	Total
Number	8	9	6	6	2	31

The two Chinese teachers were involved in the training design, recording collection, and in-depth feedback interviews. In addition to the teachers, Daisy Nichol (pseudonym, all the names showed in this study were pseudonyms), Coordinator of World Languages Office of Middle/Secondary Learning for the West Virginia Department of Education also participated in the training on WV Foreign Language Association Conference and gave meaningful feedback.

Table 7 shows all the participants in the study including Chinese students from three different institutes and Chinese teachers and parents who were involved in the study. The average age was 23. For the adult participants, the average age was 50 years old; for the school student participants, the average age was 12 years old.

Table 7  
*Participants (including Chinese Teachers and a Parent) in the Study by Role*

Gender	Age	Source
Female	48	Teacher Program 1
	39	Teacher Program 3
	53	Teacher Program 3
	13	Middle School
	13	Middle School
	12	Middle School
	12	Middle School
	12	Middle School
	12	Middle School

		16	High School
		16	High School
		16	High School
		11	Middle School
		11	Elementary School
		10	Elementary School
	16	7	Elementary School
<hr/>			
	Male	40	Instructor of the WVU Confucius Institute
		30	Chinese Teacher of Middle and High School
		47	Parent from Morgantown Chinese School
		47	Teacher Program 1
		69	Teacher Program 3
		52	Teacher Program 3
		13	Middle School
		13	Middle School
		12	Middle School
		16	High School
		14	High School
		14	High School
		10	Elementary School
		10	Elementary School
	15	8	Elementary School
<hr/>			
Total	31	Mean=23	

Table 8 only shows the 28 participants who were the Chinese students from the three involved institutes who completed the whole process of the study including pre and post-training recordings and the training. The mean Chinese learning experience was 16 months. The mode was 12 months. The learning experience can signify, to some extent, participants' Chinese proficiency. However, overall, the participants' Chinese proficiency level was beginning and intermediate. More than 80 percent of the participants had musical backgrounds such as musical instruments, choir, or orchestra experience and could read the musical notes on the five-scale staff.



Table 8

*Participants (excluding Chinese Teachers and Parents) in the Study by Chinese Learning Experience*

	learning experience (Month)	Source
Beginning	1	Elementary
	2	Middle
	2	Middle
	2	Middle
	2	High
	2	High
	2	High
	2	High
	2	High
	2	High
	6	Confucius Teacher Program 1
	12	Confucius Teacher Program 1
	12	Confucius Teacher Program 3
	12	Confucius Teacher Program 3
	12	Middle
	12	Elementary
	15	Confucius Teacher Program 3
	18	Middle
	19	21
	139	
Intermediate	24	Middle
	24	Middle
	24	Middle
	24	Elementary
	36	Middle
	36	Elementary
	36	Elementary
	48	Elementary
	9	60
<b>Total</b>	28	Mean=16 M

### Data Collection and Analysis

The current DBR study included a design with pretest and posttest data collection, both quantitative and qualitative. The qualitative phase and the quantitative collection were interwoven and inform each other.

The study was designed in a way that allowed for a simultaneous mixed methods design. The quantitative portion of data was collected through two accuracy rate calculations on students' audio recording.

The first data collection instrument was audio recordings before and after the training. Students recorded themselves or were recorded by the researcher on reading aloud a text which was from their textbook before and after training. The purpose of collecting these two recordings was to examine and compare the tonal production accuracy rate before and after the training.

The second type of instruments of data collection were structured/semi-structured interviews and/or surveys after training. The interviews were designed to get the students' comments and suggestions on the training. For example, one of the interview questions (see Appendix 1) was: Do you think our tonal training is useful? If you rate from 0-10, 0 is nothing, 10 is extremely useful, what's your rank for the training session? This question was designed for eliciting the trainee's attitude on the training. The mean was calculated. If the mean rating is above 8, it would conclude that the overall attitude on the method is "satisfied," below 6 would be "dissatisfied," in between was medium. The interviews were audiotaped and transcribed. Reigeluth and Frick (1999) mentioned that three techniques for collecting the formative data are observations, documents, and interviews. The most useful data come from one-on-one interviews with participants during the implementation of the design instance, because it avoids the memory-loss problem of interviews (p. 640).

The third instrument of data collecting was class observations administered during each enactment phase. The purpose of the class observation was to examine the trainees' attitude on the training. For example, if the students were motivated and highly involved in the training. Audio and video recordings were adopted to help the instructor review the class. During the training, the students' original Chinese teachers were kept in the room to observe and help the class. After the class, the teachers were interviewed about what they thought their students' engagement and attitudes on the training.

The study was designed to identify the effectiveness of a method of teaching Chinese tones. To determine the effectiveness of this method, the accuracy rates in tone production of students' recorded text reading before and after the training were calculated and compared. Two native adult raters evaluated the tonal products. Based on the data collected over the entire course of this study, the paired samples t-test was run on the pretest and posttest accuracy rate. For the students and teachers' attitude on the training, the interview with a satisfaction survey, and the observation comments of the classroom teacher were used. The corresponding data collecting instruments and analysis method for the research questions are illustrated as below:

Table 9

*Research Questions and Analysis Tools*

Research Questions	Data Sources	Analysis
Q1: Is the designed method effective to improve the tonal production accuracy of English speaking K-12 children and adult learners?	Audio recordings	Paired samples t-tests
Q2: What are English speaking K-12 children's attitudes toward the designed method?	Structured interviews/surveys on students and teachers; class observation	Transcribe and satisfaction scores calculation

Q3: What are adult learners and teacher's attitudes toward the designed method?	Semi-structured interviews /surveys on teachers and class observation	Transcribe and satisfaction scores calculation
---	---	--

### **Raters and Inter-Rater Reliability**

Two raters were assigned to evaluate the accuracy of the recordings. One is the researcher per se, the other is a native Chinese without any linguistic knowledge. The reason to choose a non-linguist as the rater was to evaluate the tonal production from a native judgment. The researcher originally planned to ask another Chinese teacher to be the rater. However, after several trials, the researcher found out that Chinese teachers, including the researcher herself, tended to be stricter than people individuals without a background in linguistics. Therefore, the non-linguist rater was involved to mitigate the bias and to balance between the professional evaluation and “natural street” evaluation. A simple explanation about the rating was given to the new rater. After the rating, the correlations between two raters on two recordings were calculated and the correlations. The two variables were strongly correlated,  $r(26) = .73, p < .01$ . for recording before training. The correlation between the ratings for recording before the training indicated a moderate level of inter-rater reliability  $r(26) = .73, p < 0.001$ , while the one for recording after the training was observed to be lower,  $r(26) = .54, p = 0.003$ .

### **Teaching Model and Lesson Plan**

As defined in Figure 13, DBR is composed of cycling four steps. Because the research questions and rationales have already been elaborated in the previous sections, the research design will only include the latter three steps: design, enactment and redesign.

#### **Phase One: Design.**

The design included two main components: one was the Mandarin Chinese tonal map (see figure 15); the other was the mini-course design with using this map. The researcher

hypothesized that the map and the mini-course would help the learners to locate the correct pitch and contour of each tone, thus significantly improving the accuracy rate of their tonal production. As such, this research would add a meaningful repertoire to the futile CFL tone teaching strategies and would benefit CFL teachers and learners.

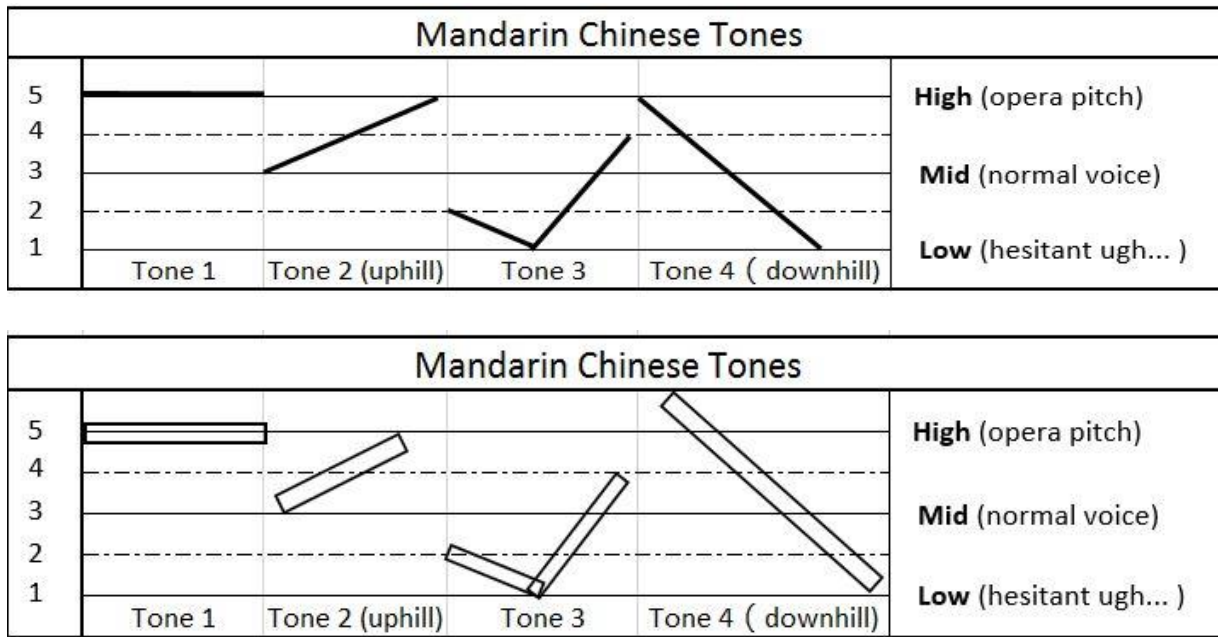


Figure 14. Bookmarks

The above maps were used as visual aids for teaching Chinese tones to English speakers. They were printed on hard paper and were handmade into bookmark shape with a Chinese ribbon at one end. The blocks of the tone shape were designed for younger learners, who were supposed to fill the blocks with their representative colors. The finished map may look like figure 15. From the teacher’s experience, Tone 1 might be filled in red because red represents the highest-level pitch. Yet red may not be a necessary color for individual students, students would have freedom to choose their own representative color for a high-level pitch. It was hoped younger learners would remember the tonal shapes better by using their own mnemonic symbols for tones.

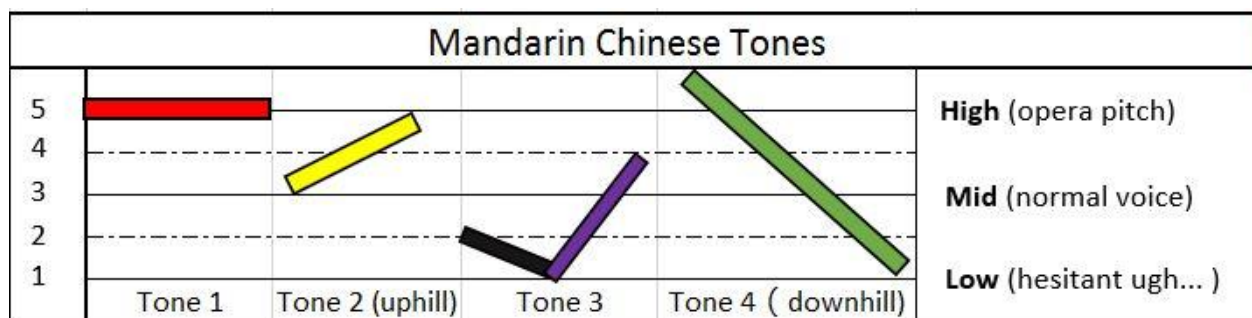


Figure 15. Example of finished Mandarin Chinese tones map for younger learners.

\*Two 3<sup>rd</sup> tones in a row, the first one becomes 2<sup>nd</sup> tone. e.g. 你好 (*nǐ + hǎo = ní hǎo*)  
 \*不 (*bù*) is 4<sup>th</sup> tone except when followed by another 4<sup>th</sup> tone, when it becomes 2<sup>nd</sup> tone. e.g. 不对 (*bù+duì = bú duì*)  
 \*一 (*yī*) is 1st tone when it represents the ordinal "first". e.g. 第一个 (*dìyīgè*). It changes when it represents the cardinal number "1", following a pattern of 2<sup>nd</sup> tone when followed by a 4<sup>th</sup> tone, e.g. 一个 (*yī + gè = yí gè*), 一次 (*yī + cì = yí cì*), 一半 (*yī + bàn = yí bàn*), 一会儿 (*yī + huìr = yí huìr*).  
 \*It changes to 4<sup>th</sup> tone when followed by any other tone. e.g. 一般 (*yī + bān = yì bān*), 一毛 (*yī + máo = yì máo*).

Figure 16. The back of Mandarin Chinese tones map.

This tonal map design was based on Chao's (1972) five-point scales and was also inspired by the theory about tones and music. However, mostly, it was derived from the researcher's innovation, which is explained as follows.

First, the five lines symbolize the five-point scale from low to high in Chinese tones. For music learners, it can be linked to musical scale which directly demonstrates the hierarchical pitch. For non-musical learners, the numbers (1-5) on the left side, and the words (high, mid, low) at the right hand are the cues to understand the meaning of hierarchical pitch of Chinese tones. Furthermore, this design also adopts the idea of simplifying the five tonal levels to three levels: low, mid, and high. In the map, line 2 and line 4 are broken and deemphasized. And line 1, 3, and 5 are annotated with bold words High, Mid, and Low.

Secondly, English letters and schemata knowledge in real-life are used to activate students' consciousness toward their own pitch range. As we perceived from the previous literature, English speakers tend to have much narrower pitch range than Chinese speakers. In order to stretch their pitch range, English words such as opera pitch, normal and hesitant “ugh” are cues for students to widen their pitch range. The researcher believes that students' L1 knowledge cannot be avoided but can be beneficial to L2 learning. Bridging between L1 and L2 may be effective for them to learn a “strange” concept in L2.

Thirdly, some research reported that students have confusion between tone pairs such as T2-T4 and T2-T3. From my teaching experience, young learners often get confusion on the T2-T4 pair by pronouncing them interchangeably. In order to mark the difference of T2 and T4, T2 is referred to as an uphill pitch since it is a mid-rising pitch; and T4 is referred to as a downhill because it is a high falling tone.

In the real classroom, gestures are also adopted to augment the map. Simple hand gestures are used to signify the tone shapes and serve as a reminder when students forget or produce a wrong tone. When a student forgets the tones, or says the tones wrong, the instructor would provide feedback with the hand gestures without saying anything. This is a popular way of feedback widely used in CFL classrooms.

In addition to the map, the research design includes a 30-minute training session. The course length adjusts according to the school arrangement. Basically, 30 minutes is for elementary school students, 45 minutes for middle school students, and 50 minutes for high school students and up. The general lesson plan is as below:

Table 10  
*General Lesson Plan for a Tonal Training Session*

Minutes	Procedures	Tools	Considerations
2	Introduction to Chinese tones	PPT, Video	Raise consciousness to tones
8	Intro of tonal shape and pitch	Tonal map, gestures	Concept about 4 tones
5	Find pitch range	Tonal map, demo	Locate the highest, mid, and the lowest pitches
5	Practice each tone in context	PPT, tonal map	Focus on pitch register/shape
5	Tone sandhi rules (yi/bu/T3)	PPT, demo	Treat T3 as low, yi/bu variation
5	Written/coloring practice	PPT, color markers	Learning a word with its tones; remember tones by drawing

Specifically, during the training, the instructor first introduced the tonal features of the tonal and intonation languages by contrasting English and Chinese. The instructor emphasized that Chinese is a tonal language, which means a slight difference in tones will change the meaning of words. In addition, Chinese has four tones. With this explanation, it was hoped that the trainer would raise the consciousness of the importance of correct tones of Chinese. Students watched a short video about “wrong tones make trouble” regarding an American traveler who got into trouble by a slight tonal error. Then the above tone map was shown to the students, and the students visualized the contour of each tone. Afterwards, the instructor helped the students to find their own pitch range and set up their own high, middle and low pitch. The instructor asked them to find the highest pitch by singing an opera; to find their middle pitch by uttering a normal voice such as regular talk; and to locate their lowest voice, which sounds like “ugh” when they hesitate to answer an uncertain question.

After the students found their pitch range, the instructor helped the students to shape the pitch contour of each tone following the sequence from Tone 1 to Tone 4. Tone 1 is stably



staying on the highest pitch, like an opera pitch. Tone 2 changes from the middle pitch to the highest. Tone 3 must dip to the lowest “ugh” sound and then raise up. Here, the instructor should also mention that the Tone Sandi rules for Tone 3 are complicated. Most of the time, Tone 3 just stays at the bottom pitch and does not go up if it is followed by any other tones than another Tone 3. By emphasizing this, the students learned that sinking into the lowest pitch is most important for uttering a Tone 3. Tone 4 was introduced in a way similar to the students uttering a sharp and short sound as they are being scared.

After the students produced the tones correctly, the instructor handed out the bookmarks to the students and asked them to fill in the tone contour blocks with their own representing colors.

### **Phase Two: Enactment.**

Phase Two was supposed to be the enactment of phase One. There were altogether five DBR cycles in the research and the general process for each cycle was kept identical. Before the training, students’ recording 1 were collected by themselves (adult learners) or their classroom teachers (K-12) or the researcher herself. After the recordings had been collected, the trainings were scheduled at the regular class time. The training was divided into lecture and class practices. After the enactment, the tonal accuracy rate of students’ production on a familiar passage was analyzed and compared. The tonal production may be collected purposefully for this research or collected naturally as students’ homework. Analysis on data was conducted as the next step. If the significance of the paired samples T-test would be lower than 0.05, it would signify that the difference between the pretest and the posttest was significant; therefore, the tone training would be deemed as effective. If it were greater than 0.05, the difference was not significant, and the training method would be deemed as not effective.

Besides the quantitative method, semi-structured interviews and surveys were implemented. The interview outlines were as Appendix A and B. On the basis of the data analysis, amendments to the lesson plan and/or to the bookmarks would be considered. Since this research had a few different groups at different times, the researcher analyzed the data from the earlier group and may amend relevant designs to the next group. For instance, after enacting with the middle school students, if the researcher found out that the short passage in the practice did not fit in the training session, it might be deleted from the later high school students' group.

During the enactment phase, the cooperation of the Chinese teachers in the target schools was critical. They were requested to help the researcher to hand out and collect the assent/consent forms. They may need to assist the researcher to collect audio clips before and after the training and may be needed to record video and audio of the training session while the instructor was lecturing. Fortunately, the researcher was quite familiar with these Chinese teachers since they had been working in the same summer camp every year and had the same supervisor. When the researcher mentioned the current research during a meeting, both her supervisor in the WV Education Department, and her colleagues of Chinese teachers expressed strong support to her.

### **Phase Three: Redesign.**

This research strictly followed the cycle of DBR: “the overall goal of research within the empirical tradition is to develop long-lasting theories and unambiguous principles that can be handed off to practitioners for implementation. Development research, on the other hand, requires a pragmatic epistemology that regards learning theory as being collaboratively shaped by researchers and practitioners” (Kacin, 2013). The overall goal of development research is to solve real problems while at the same time constructing design-principles that can inform future

decisions. In Kuhn's terms, these are different worlds (Reeves, 2000). Based on the result of enactment and the theory, after the design and enactment phase, the researcher completed the third step of DBR: redesign the activity. In fact, the current bookmarks and lesson plan had already been amended a few times. Almost after every round of implementation, the instructor found some flaws and made changes on it. For example, the last version of the tonal map (bookmark), the highest pitch was depicted as a sound your doctor checks tonsil and asks you to make a "ah" sound. It did not work for the college students because they do not make any sound when checking tonsil or make a regular ah sound when doing it. When the researcher came home, and talked with her eldest son, who was then a college student and came to North America when he was five. He suggested for me to use "opera pitch." The researcher then tried this to the college students again, it worked very well. In the current research, every participating class will form a cycle of DBR, the analysis and feedback from the prior cycle(s) may inform and modify the next cycle of the experiment.

To recap, the Methodology chapter described the epistemological considerations of this study; explained the research methodology; elaborated the research model and design; introduced participants; described the procedure used in designing the instrument and collecting the data; and provided an explanation of the data collection and analysis procedures. Chapter Four will elaborate the research implementation process and its results.

## **Chapter Four**

### **Results**

This chapter describes the DBR processes, and the presentation of the results related to the research questions.

#### **DBR Processes**

##### **General DBR process.**

There were altogether five DBR cycles in the research and the general process for each cycle was kept identical. Before the training, students' recording 1 were collected by themselves (adult learners) or their classroom teachers (K-12) or the researcher herself. The recording scripts were based on students' class levels and their recent learning materials, so each class may have different recording scripts (see Appendix C to J). Students should be familiar with the content. For example, the middle school and high school students were learning Halloween vocabulary and expressions after training, so their recording 2 was about Halloween with the vocabulary and sentence structure they have learned. While students of Morgantown Chinese School were learning about family then, so their recording was about family. The WVU Confucius teachers' program level 3 class had a longer script and more difficult vocabulary because they had already passed the HSK 2 test and were at the intermediate level. Although the content and difficulty level varied according to students' level and curriculum, the two recordings for the same participant were designed to be at the similar length and difficulty level. In addition, the scripts tried to balance among the four lexical tones. For example, in a one-hundred-word text, each tone was allotted for about twenty words.

After the recording 1 had been collected, the trainings were scheduled at the regular class time. In some classes, such as Morgantown Chinese School and WVU Teachers' Program, all

students submitted the consent/assent forms, so all of them joined in the training. However, in some classes, such as Morgantown High School and Suncrest Middle School, only part of the students submitted the agreement, so the classes were divided into two groups: one group took training with me, and the other group studied with their classroom teachers. The length of the training varied due to the original class time. For example, the adult learners' and Morgantown Chinese School classes were 50 minutes long while Morgantown High and Suncrest Middle were 45 minutes long. The classes were usually divided into 35-40 minutes training and 5-10 minutes survey/interview time. The training was presented in a 15-19 slides PowerPoint (see Appendix J). The first four pages introduced the general concept of tonal and non-tonal languages. Slide five was a video titled "Killing Panda," which presented an English-speaking man who mixed up two Chinese words by tones and so ruined a relationship. This slide also gave a pair of examples "dàmá (大麻, marijuana) vs. dà mǎ (大马, big horse). Slide 6 introduced the four tones and their features. Slide 7 demonstrated for students how to widen their pitch range by stretching their voice to opera pitch and hesitant "ugh" sound. The bookmarks were showed on the next slide and were handed out to the students. The next few pages were two practices; the first practice was an oral production practice on their recording 1. This practice was designed to help students utter the four tones correctly. Students took turns reading the script, and the researcher guided them towards the correct tone when mistakes were made. For example, when they pronounced the first tone too low, the researcher may say opera pitch, or give a high and level gesture. If the indirect guidance failed, then the researcher would say the tone with "en" sound, or directly said the word out. The detailed implementation cycles are described after the lesson plan table. The second practice was a written production practice on the tones of the words they have just learned. The Pinyin without the tones of the words in context were

displayed in the practice, students were requested to add tones to the Pinyin by memory. This practice was designed to test if students memorized tones as an inseparable part of a word. The sample of a student's written practice is demonstrated as follows.

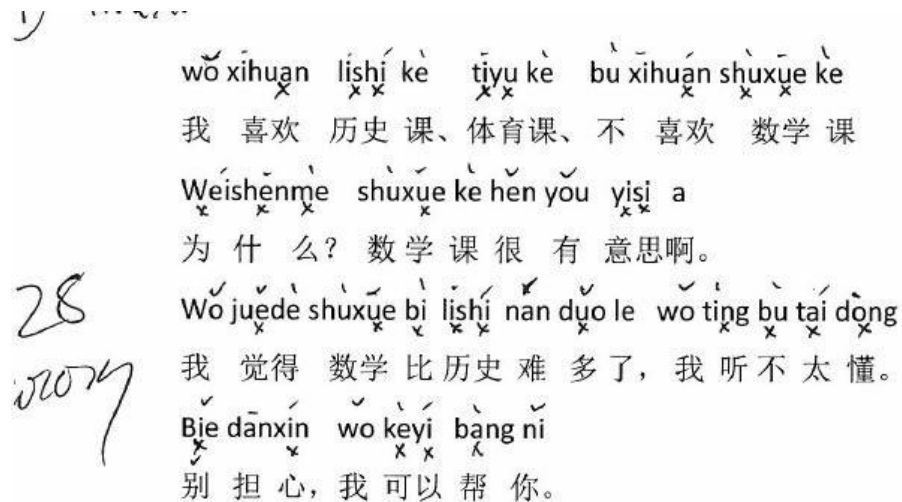


Figure 17. Sample written practice

The general lesson plan was designed to be thirty minutes as follows:

Minutes	Procedures	Tools	Considerations
2	Introduction to Chinese tones	PPT, Video	Raise consciousness to tones
8	Intro of tonal shape and pitch	Tonal map, gestures	Concept about 4 tones
5	Find pitch range	Tonal map, demo	Locate highest, mid, and lowest
5	Practice each tone in context	PPT, tonal map	Focus on pitch register/shape
5	Tone sandhi rules (yi/bu/T3)	PPT, demo	Treat T3 as low, yi/bu variation
5	Written/coloring practice	PPT, color markers	Learning a word with its tones; remember tones by drawing

For classes with longer training sessions, more time was allotted to the exercise part. For example, for a 50-minute class, 10 minutes was allotted to the practice of each tone in context, and 20 minutes were distributed to the written practice. After the training, recording 2 was collected in the same way as recording 1. Data from the recording and surveys and interviews were analyzed in a timely manner to gain insight for the next cycle.

The general DBR process can be illustrated as Figure 18.

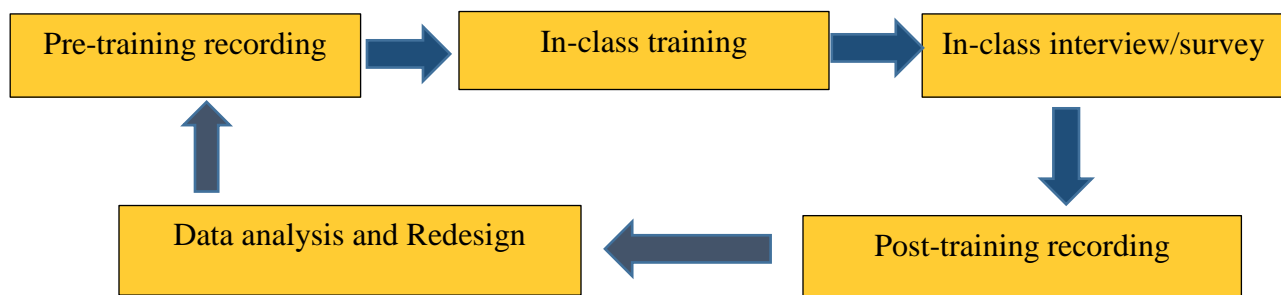


Figure 18. General DBR process

### **DBR Cycle 1: WVU Confucius Institute Chinese Teacher Certificate Program 1.**

The current research began with the WVU Confucius Chinese teacher Certificate Program level 1 class. The researcher hoped that this adult future Chinese teacher class would provide important feedback, which would be beneficial to the later research. The WVU Confucius Institute West Virginia Chinese Language Learning and Certificate Program started in 2016. The students were all current WV teachers of other subjects than Chinese including Spanish, French, and Russian teachers and sports coaches. They participated in the teachers program due to various reasons. Some were just from personal interest. For example, a student, who was then an art teacher, had been practicing Taichi for over ten years with a famous Chinese Taichi master. Since then, he had been interested in learning Chinese language and culture. All of them have

interest in teaching Chinese language in schools when they graduate from the program. They would be qualified to teach Chinese if they graduate from the program. At the time the current research was conducted, the WVU Confucius Chinese teacher Certificate Program had two classes: level 1 and level 3. The level 1 class was based in Morgantown, while the level 3 class was at Charleston, which is a three-hour drive from Morgantown.

**Phase 1: Design.**

This class had two students: one male and one female. One was the mentor of the WV Chinese guest teachers, and the other student was a football coach of a high school. Besides the opportunity of becoming Chinese teachers, they had personal reasons for learning Chinese as a foreign language. The mentor wanted to learn Chinese because she needed to communicate with Chinese teachers and she had interest to know more about Chinese language and culture. The coach had long been interested in Chinese culture and took this chance to learn more about China. Both students were in their late forties.

Since this was an adult class, the researcher chose the line bookmark, which was designed for older learners, although the later research demonstrated that this may not be right (the later of the chapter will elaborate on this).

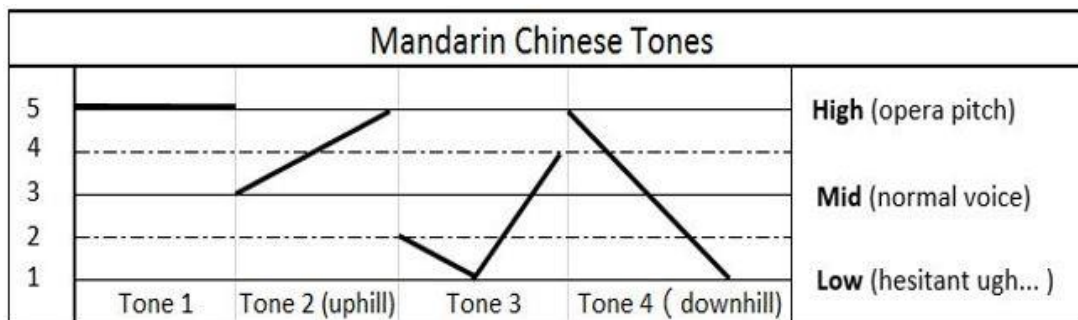


Figure 19. The front of the bookmark used for the teacher’s program level 1



### Tonal Variation Rules

- Two 3<sup>rd</sup> tones in a row, the first one becomes 2<sup>nd</sup> tone. e.g. 你好 (*nǐ + hǎo = ní hǎo*)
- 不 (*bù*) is 4<sup>th</sup> tone except when followed by another 4<sup>th</sup> tone, when it becomes 2<sup>nd</sup> tone. e.g. (*bù+duì = bú duì*)
- 一 (*yī*) is 1<sup>st</sup> tone when it represents the ordinal "first." e.g. 第一个 (*dìyīgè*). It changes when it represents the cardinal number "1", following a pattern of 2<sup>nd</sup> tone when followed by a 4<sup>th</sup> tone, e.g. 一个 (*yī + gè = yí gè*), 一次 (*yī + cì = yí cì*), 一半 (*yī + bàn = yí bàn*), 一会儿 (*yī + huìr = yí huìr*). It changes to 4<sup>th</sup> tone when followed by any other tone. e.g. 一般 (*yī + bān = yì bān*), 一毛 (*yī + máo = yì máo*)

Figure 20. The back of the bookmark used for the teacher's program level 1

There were two practices in the training, one was the production practice, and the content was usually part of the recording they did before the training as following.

Nǐhǎo, wǒ jiào wǒ shì lǎo shī , hěn gāo xìng rènshi nǐ Wǒ hěn xǐ huān xué  
 你好, 我叫-----我是老师, 很高兴认识你。我很喜欢学  
 zhōng wén. xué zhōng wén hěn nán, dàn shì wǒ huí jiā yì yǒu shí jiān jiù fù xí  
 中文。学中文很难, 但是我回家一有时间就复习。  
 Wǒ yí kàn jiàn zhōng guó rén jiù dǎ zhāohu  
 我一看见中国人就打招呼。  
 Kāi xué dì yī tiān, wǒ gēn yí ge zhōng guó xué shēng shuō nǐ hǎo, tā bù lǐ wǒ.  
 开学第一天, 我跟一个中国学生说你好, 她不理我。  
 Hòu lái wǒ cái zhī dao tā bú shì zhōng guó rén, tā shì rì běn rén  
 后来我才知道她不是中国人, 她是日本人。  
 Wǒ xiǎng yíhuìr qù mǎi xiē píng guǒ hé cǎo méi Kě shì, wàimian hěn lěng  
 我想一会儿去买些苹果和草莓。可是, 外面很冷,  
 wǒ hái shì zài jiā kàn diànshì suàn le  
 我还是在家看电视算了。

The second practice was a written output practice: marking the tones on the word. It was exactly the same text they recently learned as following.

míng tiān xīng qī liù nǐ qù xué xiào ma  
 A: 明天星期六, 你去学校吗?  
 wǒ qù xué xiào  
 B: 我去学校。  
 Nǐ qù xué xiào zuò shénme  
 A: 你去学校做什么?  
 Wǒ qù xué xiào kàn shù

B: 我 去 学 校 看 书

### **Phase 2: Implementation.**

The training was on October 14, 2017 at the WVU Business & Economics building. Both of the students presented on time. The classroom teacher, Dr. Zhao, helped record the training. The research mentor of the researcher, Dr. Edwin , observed on the training and was actively involved in the interview after the training.

The training was following the sequence of the PowerPoint. Students were attracted by the content, especially the slide of the video. For the practice 1, because of the time, we did not finish the whole reading, only one third, but students felt it was very useful. In the practice 2 of marking tones, both of the students got less than half right. They felt a little shocked because this was the very simple text they had just learned. They felt that they had not given enough focus on remembering the tones when learning a new word. The students said the method helped them find a bridge between English and Chinese, such as: opera, and “boo” sound. They never heard or thought they needed to stretch to opera sound in pronouncing Chinese tones before and had never known Chinese has a wider pitch range than English. One student commented that Chinese tones are like old time blues music, which can go very high. He said he played a little music, so he did not feel strange producing Chinese tones, although it sounded a little over exaggerated. The students mentioned that, in English, changing tones often means changing the underlying message, to imply anger, hesitation, confusion and so on, therefore they felt cautious to make pointed tones in Chinese. However, they now understood it was normal to be sound fluctuating while speaking mandarin Chinese. They realized that they needed to expand their voice range beyond the middle range. One student said he caught himself on the high pitch, trying to adjust to the normal pitch. One student complained she had hearing loss, and sometimes could not hear

the tonal difference. The whole training lasted for 35 minutes, and the interview lasted for about 10 minutes. In practice 2, out of a 30-word text, the average accuracy rate of the written practice was 37%.

**Phase 3: Redesign.**

Through the implementation and the feedback from the students and the teachers, three changes had been made to the original design.

First, in the original bookmark design, T3 as a half low-dipping tone was not reflected. So, students still tried to pronounce it as a full T3. In the revised bookmarks, T3 was represented by a solid line (block) on the going down side, and a broken line (block) for the going up side. This new design was to remind students that in most of the scenarios, T3 is just a half low-dipping sound without a subsequent rise afterward (see figure 21).

Second, word description for T1 and T3, were added to the bookmarks. Basically, the research added “High” to T1 and “low” to T3, to flag the most important features of these two tones. The new design of the bookmarks was as follows.

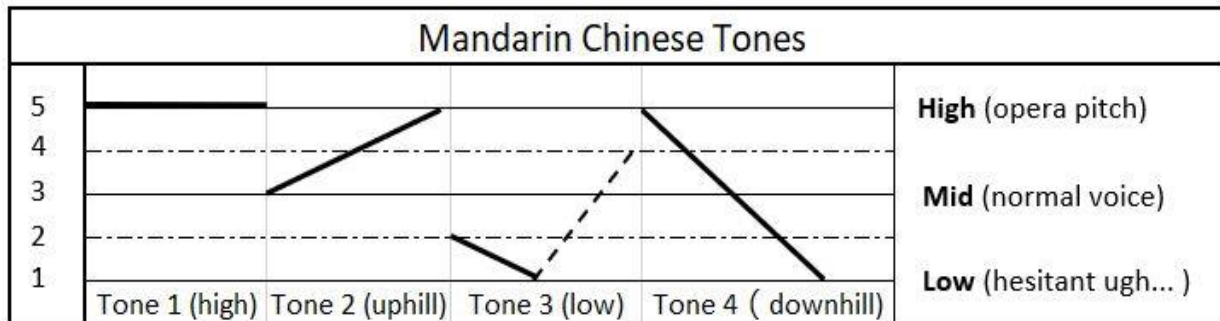


Figure 21. The first revision of bookmark for older learners.

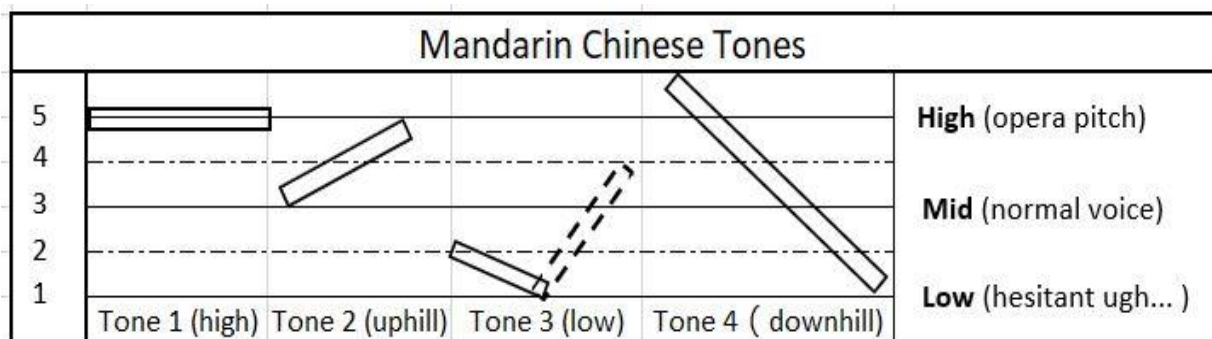


Figure 22. The first revision of bookmark for younger learners.

Furthermore, during the training, the researcher found out the wording for the tonal variation rules was too complicated, so explanations of the Tonal variations were simplified and complemented with more examples.

Most Frequently Used Tonal Variation Rules
<ul style="list-style-type: none"> <li>• Two 3<sup>rd</sup> tones in a row, the first one becomes 2<sup>nd</sup> tone. e.g. 你好 (<u>nǐ</u> + <u>hǎo</u> = <u>ní</u> <u>hǎo</u>)</li> <li>• 3<sup>rd</sup> tone is a low-dipping tone when followed by any other tones (Tone1,2,4) than <u>no</u>ther Tone 3.</li> <li>• 不 (<u>bù</u>) becomes 2<sup>nd</sup> tone when followed by another 4<sup>th</sup> tone. e.g. (<u>bù</u>+<u>duì</u> = <u>bú</u> <u>duì</u>)</li> <li>• 一 (<u>yī</u>) is a 1<sup>st</sup> tone when it represents the ordinal "first". e.g. 第一个 (<u>dì</u><u>yī</u><u>gè</u>). It is a 2<sup>nd</sup> tone when followed by a 4<sup>th</sup> tone, e.g. 一个 (<u>yī</u> + <u>gè</u> = <u>yí</u> <u>gè</u>). It is a 4<sup>th</sup> tone when followed by any other tones (T1, 2, 3). e.g. 一般 (<u>yī</u> + <u>bān</u> = <u>yì</u> <u>bān</u>), 一毛 (<u>yī</u> + <u>máo</u> = <u>yì</u> <u>máo</u>), 一起 (<u>yī</u>+<u>qǐ</u> = <u>yì</u> <u>qǐ</u>)</li> </ul>

Figure 23. The revision of the back of the bookmark.

The fourth change was made to the lesson plan: instead of one practice on production, two rounds of exercises, one production and one perception of tones, were added to the lesson plan. In cycle one, the class practice requested the students to mark the tones to the text. The procedure had been changed to two rounds of the exercises with the advice of the classroom teacher and Dr. Edwin. They suggested that after the students marked the tones without any input, the trainer would read it out and the students would mark the tones according to what they heard. This practice would help testing the tonal perception of the students. The lesson plan was revised to be as follows.

Table 13 <i>Revision 1 of Lesson Plan</i>			
Minutes	Procedures	Tools	Considerations
5	Introduction to Chinese tones	PPT, Video	Raise consciousness to tones
5	Intro of tonal shape and pitch	Tonal map, gestures	Concept about 4 tones
3	Find pitch range	Tonal map, demo	Locate highest, mid, and lowest
5	Practice each tone	PPT, tonal map	Focus on pitch register/shape
5	Tone sandhi rules (yi/bu/T3)	PPT, demo	Treat T3 as low, yi/bu variation
7	Two rounds of Written practice /coloring practice	PPT, color markers	Learning by doing

Table 13: Revision 1 of Lesson Plan

### **DBR Cycle 2: WVU Confucius Institute Chinese Teacher Certificate Program Level 3**

This class was in the same program of the WVU Confucius Institute. But the students in the level 3 class were at a higher level than the level 1 class. These students had already passed level 1 and 2 tests of Hanyu Shuiping Kaoshi (HSK), China's only standardized test of Standard Chinese language proficiency for non-native speakers. HSK tests rank from level 1 to 6, and include listening and reading, but do not contain writing until level 4. Speaking proficiency is not evaluated in throughout the whole HSK levels. For the students who had already passed level 2, they were supposed to reach low-intermediate level and would be able to use Chinese in a simple and direct manner, applying it in a basic fashion in their daily lives (Hanban, 2018).

#### **Phase 1: Design.**

The teacher certificate program level 3 class was at Charleston, the capital city of West Virginia and was three hours' drive from West Virginia University at Morgantown. Once a month on a Saturday, the students of level 3 attended the class at a conference room at Hilton

Hotel from close by counties. Dr. He of level 1 class was also the instructor of level 3. He traveled to Charleston to give them a whole day lecture once a month.

According to the observation of the first cycle, this cycle used the revised bookmark (see Figure 21, 22 and 23) and lesson plan (see Table 13).

The class practice 1 was from the recording 1 (see Appendix H), because of the time restriction, only part of the recording text was designed as follows.

Fúwùyuán, wǒ men zhè shǎo le yì shuāng kuàizi hé yíge wǎn,  
A: 服务员, 我们这少了一双筷子和一个碗,

háiyǒu, bǎ cài dān yě ná guò lái Wǒ men yào zài diǎn liǎng ge cài.  
还有, 把菜单也拿过来, 我们要再点两个菜。

Bié diǎn le, lái bù jí le. Bǐ sài hái yǒu yíhuìr jiù kāi shǐ le  
B: 别点了, 来不及了。比赛还有一会儿就开始了。

Zài shuō, cài yǐ jīng gòu le  
再说, 菜已经够了。

The second practice for the written production was exactly the same as their recent text as below:

Wǒ xǐhuan lìshǐ kè tǐyù kè bù xǐhuan shùxué kè  
A: 我喜欢历史课、体育课、不喜欢数学课

Wéishénme shùxué kè hěn yǒu yìsi a  
B: 为什么? 数学课很有意思啊。

Wǒ juéde shùxué bǐ lìshǐ nán duō le wǒ tīng bù tài dòng  
我觉得数学比历史难多了, 我听不太懂。

Bié dānxīn wǒ kěyǐ bang nǐ  
B: 别担心, 我可以帮你。

## **Phase 2: Implementation.**

It was in the morning of Saturday, October 21 at a conference room of Hilton Hotel at Charleston. Four students showed up to the training. The training and the interview lasted for 50 minutes. The students were actively involved in the training. Taken the revision from cycle 1, Practice 1 on oral production was shorter, only one-third of the text of the recording 1. The second practice on written production was given twice: one for written production without any input, the other was written output with input stimuli: Dr. Zhao, the classroom teacher read the text, and the students marked the tones upon perception. In the interview, students mentioned that they felt musical background had benefit in understanding Chinese tones. They also mentioned that they felt silly when they exaggerated their pitch range. And they wanted to have more and longer trainings on tones. The training ran out of the time because of the discussion. Students really wanted to discuss and to prolong the training session. Both students and the teachers commented the video and the examples were funny and alarming enough for them to raise the consciousness of the importance of the Chinese tones.

In the written practice of a 50-word text, the average accuracy rate of the first exercise was 26%. In the second practice, Dr. He read the text, and the students marked the tones again on the same text. The accuracy was higher for the second practice at 41%. It may signify that their perception on the tones was better than their memory of the words.

### **Phase 3: Redesign**

This cycle went smoother than cycle 1. Dr. Zhao, the teacher of both classes, commented this class was more effective because of the more sufficient time on practice. There had no major revision in this cycle. However, because the first two cycles were implemented with adult learners and with longer and more flexible timeline, it needed to adjust the lesson plan to accommodate for the upcoming shorter and more time-fixed classes in public schools. The

PowerPoint (PPT) slides needed to be shortened to about 15 pages instead of 19 pages now. And animations in the PPT were also adjusted to be more concise.

### **DBR Cycle 3: Suncrest Middle School**

In Suncrest middle school, Chinese classes were available as an optional foreign language for students of seventh grade and up. The teacher, Mr. Lan, was a guest teacher from China and had been teaching in the school for over one year.

Two back-to-back afternoon training sessions were implemented with the 7<sup>th</sup> and the 8<sup>th</sup> grade Chinese class students. Although these were two separate trainings, they were implemented at the almost the same time henceforth there was no time for revision between these two classes, so it was regarded as one DBR cycle.

#### **Phase 1: Design.**

Besides the regular class schedule and the material, one special consideration on this cycle was the bookmark. Because the students' age was approaching puberty, the researcher was not sure if they would prefer the block bookmark which was designed for the younger learners, or the line bookmark, which was designed for the elder learners. Therefore, the researcher prepared half block bookmarks and half line bookmarks.

The oral practice was as below:

Nǐhǎo, wǒ jiào ... wǒ shì xué shēng, hěn gāo xìng rènshi nǐ.

你好，我叫XXX我是学生，很高兴认识你。

Wǒ hěn xǐ huān xué zhōng wén. xué zhōng wén hěn nán,

我很喜欢学中文。学中文很难，

dàn shì wǒ huí jiā yì yǒu shí jiān jiù fù xí.

但是我回家一有时间就复习。



The written practice was as follows:

Da jia hao wo jiao hou yi wo shi ying xiong wo hen li hai  
大家好, 我叫后羿, 我是英雄, 我很厉害。

Yi qian tian shang you shi ge tai yang  
以前天上有十个太阳,

Wo she xiao le jiu ge xian zai zhi you yi ge tai yang le  
我射下了九个, 现在只有一个太阳了。

### **Phase 2: Implementation.**

The two back-to-back trainings were implemented on Wednesday, October 25, 2017 from 1:15 to 2:45 p.m. with the seventh-grade class first and the eighth-grade class later. The seventh-grade class had five students who participated in the research. The seventh-grade students did not take the written practice because the text did not match their recent coursework, so they had not learned the written practice material yet. Out of the researcher's estimate, the five seventh grade students all requested for the block bookmark and said they would love to color the bookmark with their own design. The training lasted for 35 minutes and the survey took 5 minutes.

After a very short interval between the seventh-grade class and the eighth-grade class, four eighth graders participated in the training. They also wanted the block bookmark, but there was no more block bookmark. So, they all took the line bookmarks. They did both the oral and the written practices, but only once for the written practice, which was marking the tones from memory. The average accuracy rate of this written practice was 45%.

During the implementation of the two middle school classes, most of the students showed interest and were involved in the training actively. There were two girls of the seventh-grade class who did not participate in the training but were also attracted by the training and tried to

peek on the training. They commented in the survey that the training was useful and wanted the training to be longer and proceed through the rules slower.

### **Phase 3: Redesign.**

From this training, the researcher believed that the younger learners would like to color their own bookmark and the middle school students should still be deemed as young learners. The result of this two classes proved that they liked their bookmark to be filled in their own colors and styles. So, in the later research, more block bookmarks were prepared for the younger learners.

### **DBR Cycle 4: Morgantown High School**

Morgantown High School offered Chinese as an optional second language for students of all grades and distributed them into three classes (Chinese 1, 2 and 3) in terms of their proficiency level. However, the Chinese teacher, Mr. Lan, who was also the Chinese teacher of Suncrest Middle School, commented that the students were not placed into the different classes by their language level, but by fitting their school schedule. They chose the class based on their other class schedule, so the same class was mixed with students with large discrepancies in proficiency. In Mr. Lan's opinion, Chinese 1 students were comparatively younger and more positive. And this was the only class that agreed to have the training, the other two Chinese classes did not want to take the training or did not take it seriously so did not get the consent/assent forms back on time.

### **Phase 1: Design.**

Because the high school had the same text for recording 1, the oral practice was the same as the middle school. The researcher brought six block bookmarks and six line bookmarks for the class.

The written practice was from their recent class as follows:

Wo men yao bu yao qu he ka fei  
我 们 要 不 要 去 喝 咖 啡?

Hao a shen me shi hou qu  
好 啊, 什 么 时 候 去?

Ming tian xia wu zen me yang ni ming tian ji dian neng hui lai  
明 天 下 午 怎 么 样? 你 明 天 几 点 能 回 来?

San dian duo  
三 点 多。

The other design was the same as the last cycle.

### **Phase 2: Implementation.**

The training with Morgantown High School's Chinese 1 class was implemented in the morning of Wednesday, November 1, 2017. The class was 45 minutes. Half of the class, six students, three boys and three girls, participated in the training. The other half of the class had not participated but sitting in the other corner of the classroom doing some assignment with their teacher.

At the beginning of the training, one girl was not attending to the training seriously, she was drawing on a paper. After the reminder of the trainer and Mr. Lan, the classroom teacher, she started to pay attention. But this student gave very negative feedback in the later survey.

The projector and the screen in the classroom were small and vague so students complained that they could not see the Pinyin, especially the tone marks clearly. The researcher zoomed in and made the icons larger but still not the ideal clarity. Five students asked for the block bookmarks, and one boy asked for the line bookmark. The students liked the practice and wanted to do more practice after three practices in total. The overall accuracy rate for the written practice 1 was 40%, 60% for practice 2 on the perception of the teacher's input.

### **Phase 3: Redesign.**

The only revision after this cycle was on the lesson plan. Because students liked the practice and gained rich insight through doing the exercises in class. The lesson plan was adjusted to spend more time on the later part of practice and compress the first part of the theoretical explanation.

### **DBR Cycle 5: Morgantown Chinese School**

Morgantown Chinese School (MCS) was founded in 1998 and it is a self-supporting, non-profit Sunday school. Its primary purpose is to enhance the education of the Chinese language and culture for school-age Chinese descendants living in Morgantown, West Virginia. MCS has been affiliated with WVU Continuing Education Department since 2017. The school offers two programs to the community: the heritage Chinese program and the non-heritage Conversational Chinese Program. The students of the non-heritage Conversational Chinese Program were the target participants of this research. This program had four proficiency levels: 101 to 404 and four sub-levels under each level such as 101 through 104. At the time of this research, there were two classes enrolled in the non-heritage program, 103 and 202. Class 103 had five students who were at the beginning level. Three of them had been studying with the program for two semesters, and two students were just placed in the class. Class 202 had two low-intermediate level students who had been learning Chinese with MCS for three years and they had passed the HSK level 1 test. Both of the classes were scheduled on Sunday afternoons and each class was 50 minutes long. The researcher was the instructor of both classes.

### **Phase 1: Design.**

The PPT and the lesson plan were similar to the prior cycles. The oral practice was as follows:

Nǐhǎo, wǒ jiào ... jīn tiān shì shí yī yuè wǔ hào xīng qī tiān shàng zhōu èr shì  
你好 我叫... 今天 是 十一 月 五 号 星 期 天。上 周 二 是

Wàn shèng jié wàn shèng jié shì wǒ zuì xǐ huān de jié rì yīn wèi wǒ kě yǐ chuān hǎo  
万 圣 节。万 圣 节 是 我 最 喜 欢 的 节 日，因 为 我 可 以 穿 好

wán de yī fu hái kě yǐ hé péng yǒu yì qǐ chū qù yào táng qù nián wǒ yào dào le hěn duō  
玩 的 衣 服，还 可 以 和 朋 友 一 起 出 去 要 糖。去 年 我 要 到 了 很 多

táng kě shì māma bú ràng wǒ chī pà wǒ de yá chǐ huì huài diào qí shí wǒ měi tiān cái  
糖，可 是 妈 妈 不 让 我 吃，怕 我 的 牙 齿 会 坏 掉。其 实 我 每 天 才

chī yì liǎng kē táng duì yá chǐ yīng gāi méi yǒu huài chù suǒ yǐ jīn nián wǒ dǎ suàn  
吃 一 两 颗 糖，对 牙 齿 应 该 没 有 坏 处。所 以 今 年 我 打 算

cáng qǐ lái yì bàn táng bú ràng wǒ māma kàn jiàn.  
藏 起 来 一 半 糖 不 让 我 妈 妈 看 见。

The written practice was the excerpt from their recent text as follows:

Ni hao wo jiao wo xi huan Zhong wen

你好，我 叫-----，我 喜 欢 中 文。

Xing qi yi wo you Zhong wen ke he fa wen ke

星 期 一 我 有 中 文 课 和 法 文 课，

Xing qi er wo you ying wen ke he ti yu ke

星 期 二 我 有 英 文 课 和 体 育 课。

Xing qi san he xing qi si wo ye you ying wen ke he Zhong wen ke

星 期 三 和 星 期 四 我 也 有 英 文 课 和 中 文 课。

Xing qi liu wo mei you ke

星 期 六 我 没 有 课。

## **Phase 2: Implementation.**

The training was implemented on Sunday, November 12 at a regular class of the Chinese School. The researcher combined the two classes, 103 and 202, to take the training together.

Seven students, three boys and four girls, participated. Although the researcher had not fulfilled the complete training to any of these classes, the older students of the 202 class were exposed to some similar teaching materials including the video and the tonal map. They were excited and showed off to the younger class and shouted “I knew this, I learned this before...” One student who was learning violin commented that the five scales were similar to the musical scales.

However, in the practice, the older class had not showed advantage in both the oral practice and the written practice. On average, the accuracy rate of the first written practice of the two classes was 50%, and 65% for the second written practice with input. To my surprise, the new 103 class did better than the 202 class.

At the end of the training, five students asked for the line bookmarks, and only two students wanted the block ones. One student colored the bookmark as the image below. The student used red for the highest pitch highest and purple for the lowest pitch. She used multiple colors for one tone, except Tone 1, to signify the changing pitch level within a tone.

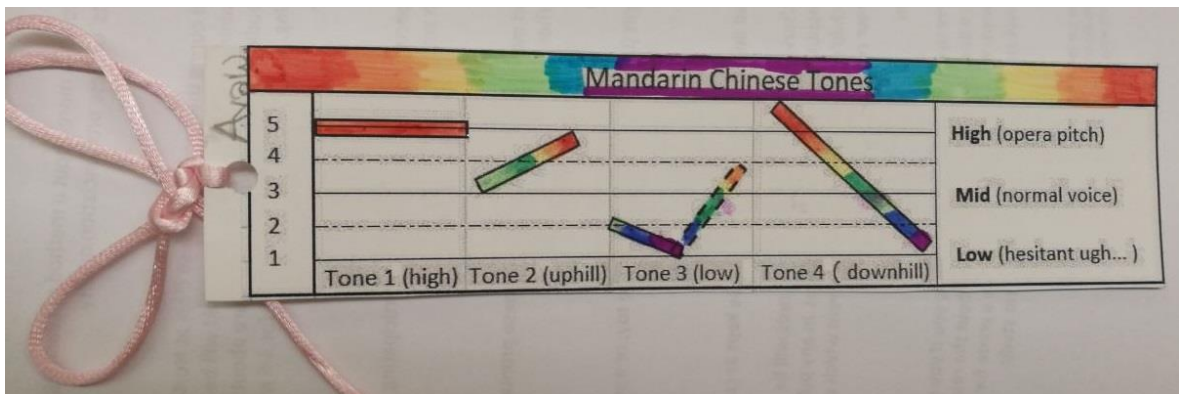


Figure 24. Finished block bookmark colored by the student

### Phase 3: Redesign.

The redesign of this cycle was the revision after the above five cycles of implementations. Except for the four main revisions from cycle 1, one more major revision was applied to the

bookmark, which was replacing “Mid” by “Middle C” for the middle musical line. This change was inspired by a few students mentioning the musical scales. When the researcher informed the students that the normal voice was like “Middle C in the music scales,” they suddenly understood. Although not all students had musical backgrounds, from the researcher’s survey and observation, more than 70% students understand about the musical scales.

After five cycles of DBR, the final version of the model of teaching English speaking learners to produce Mandarin-Chinese tones were illustrated as follows.

First, the bookmarks were finalized to be as follows.

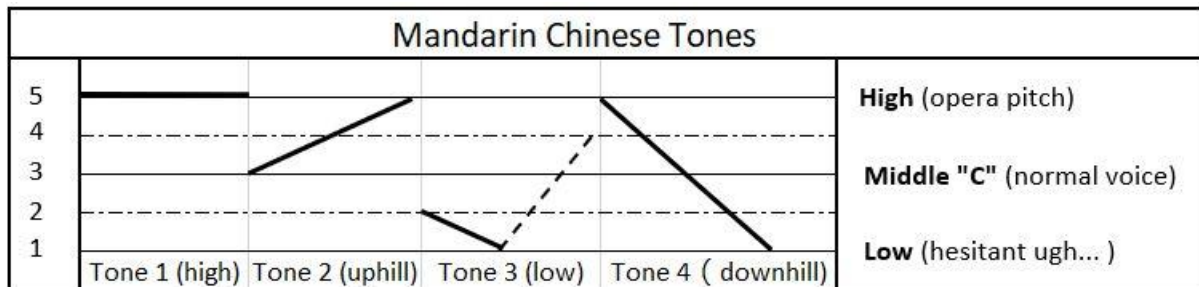


Figure 25: The finalized line bookmark.

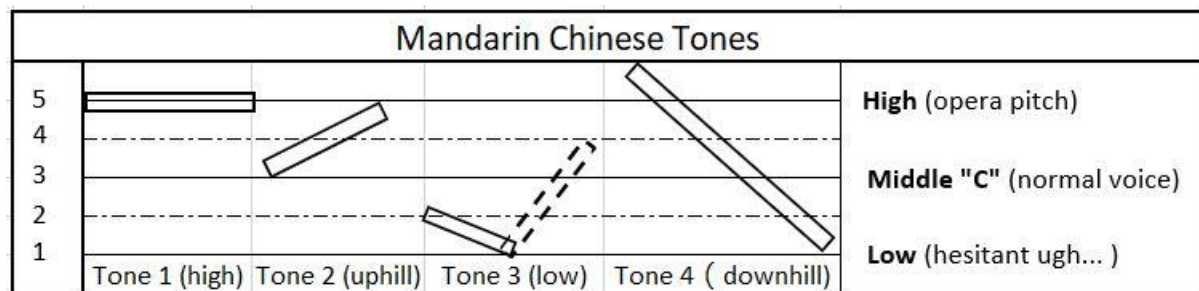


Figure 26: The finalized block bookmark.

Although two versions of the bookmarks, the line bookmark and the block bookmark, were still kept, they were not necessarily designed for a certain age group. The option of the bookmarks would depend on students’ favor and learning style but may not be related to the age.

Second, the final lesson plan was adjusted to be more flexible for a 30 to 50 minutes class. In addition, more time was allotted to the practice.

Table 14  
*Finalized Lesson Plan*

Minutes	Procedures	Tools	Considerations
5	Introduction to Chinese tones	PPT, Video	Raise consciousness to tones
2-5	Intro of tonal shape and pitch	Tonal map, gestures	Concept about 4 tones
2-5	Find pitch range	Tonal map, demo	Locate highest, mid, and lowest
3-5	Tone sandhi rules (yi/bu/T3)	PPT, demo	Treat T3 as low, yi/bu variation
8-15	Oral practice in context	PPT, tonal map	Focus on pitch register and shape
10-15	Two rounds of Written practice /coloring practice	PPT, color markers	Learning by doing

### Summary of DBR Cycles

The whole process of this DBR research lasted for two months, from September to December 2017. Altogether, five cycles were implemented. The researcher concluded the insights from the research as follows:

1. DBR is a strong research method for conducting research in a real-life educational setting. It facilitates the research with a good span of flexibilities in both procedure and content.
2. In this DBR research, the most important changes were made after the first cycle and the last cycle. It was because that the first cycle offered the most insight and the last cycle accumulated and proved the potential changes throughout the whole procedure.
3. In the current research, two insights needed to be mentioned. Instructors should not assume that certain age groups have fixed preference on the learning styles. For example, not all ages of students may like the block bookmark or the line bookmark. The



preference lies in the individual, not in the certain groups of age, gender, etc. Therefore, the instructor should prepare both types of the bookmark for any group of students.

4. If the training time is limited, the instructor should put more emphasis on the practice and less on the lecture. All the rules must be enhanced through the practices.
5. The researcher was aware of the weaknesses of implementing DBR cycles in various unidentical settings. This implementation put strength and weakness of the research. The strength was the designed model might be applicable to various settings after the research, and the weakness might be the possibility of the revisions based on one setting not being useful for those in other settings. With this consideration, the researcher had only taken the universal feedback into the revision of the teaching model. For example, the adult learners found it embarrassing to say the high pitch, which may not be universal and not applicable to the younger learners. Therefore, it was not adopted to the revision of the teaching model. However, confusion between the second tone and the fourth tone was regarded as a common problem across the other groups of students. Henceforth, the uphill and downhill reference were added to the model to address this confusion.

### **Data Analysis and the Results**

Through the above five cycles, both quantitative and qualitative data had been collected.

The overall improvement of the tonal accuracy was

#### **Finding for Research Question 1: Is the designed method effective to improve the tonal production accuracy of English speaking K-12 children and adult learners?**

Two recordings, before and after training, of the subjects were collected and compared.

The data analysis used a paired samples t-test to determine the significance of the difference of the means of the accuracy rate on learners' tonal production in the two recordings of the same

text. To conduct a paired samples t-test, the distribution of the data was examined. The average rating of the two recordings were closely normally distributed.

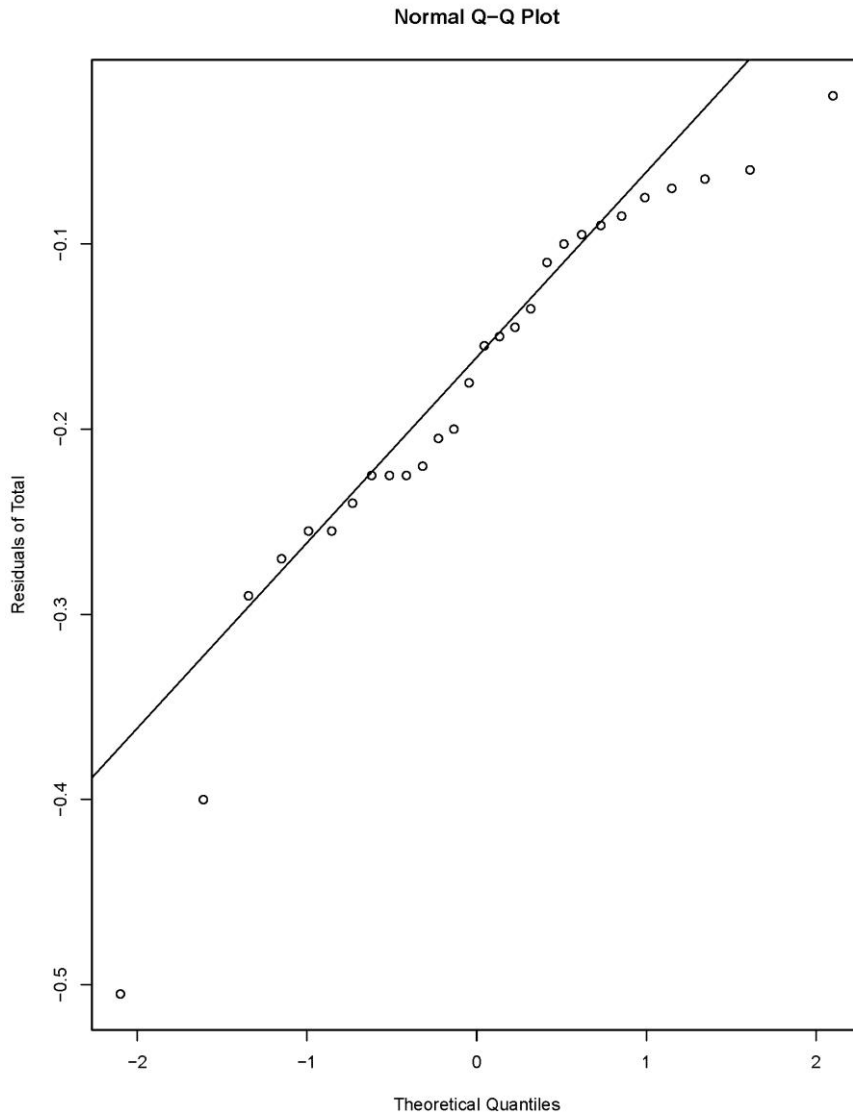


Figure 27. Q-Q Plot of the means of two recordings.

Then three paired-samples t-tests were conducted to compare the tonal accuracy rate before and after training. Three paired t-test were conducted. One was between recording 1 (before training) and recording 2 (after training) by rater 1. Second was between recording 1 and recording 2 by rater 2. And the third paired t-test was between the average of rater 1 and rater 2.

Table 15

*Paired Samples Statistics*

		Mean	N	Std. Deviation	Std. Error Mean
Rater 1	Pre	0.4022	28	0.21087	0.03985
	Post	0.6496	28	0.20155	0.03809
Rater 2	Pre	0.6371	28	0.15277	0.02887
	Post	0.7498	28	0.1077	0.02035
Average	Pre	0.5197	28	0.16954	0.03204
	Post	0.6997	28	0.1375	0.02599

Table 16

*Paired Samples Test for Rater 1, 2 and Average*

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Rater 1	Pre-post difference	-.24745	.16580	.03133	-.31174	-.18316	-7.897	.000
Rater 2	Pre-post difference	-.11261	.11876	.02244	-.15866	-.06656	-5.017	.000
Average	Pre-post difference	-.18003	.10697	.02022	-.22151	-.13855	-8.905	.000

As seen in Table 16, there were significant differences in all three paired samples t-test of the scores of tonal accuracies rate before and after training. Therefore, the researcher adopted the average of the two raters for the final report. Participants had a statistical significant higher level of tonal accuracy after training ( $M=.70$ ,  $SD=.14$ ) than before training ( $M=.51$ ,  $SD=.14$ ),  $t(27) = -8.91$ ,  $p < 0.001$ , Cohen's  $d = (0.6997 - 0.5197)/0.154354 = 1.166154$ , indicating a large effect

size. These results suggest that the training really did have an effect in improving the learners' Mandarin Chinese tonal accuracy.

Although the sample size for both groups was not ideal, it may still be concluded that the designed method was effective in improving the tonal production accuracy of English speaking K-12 children and adult learners.

### **Findings for Research Question 2: What are English speaking K-12 children's attitudes toward the designed method?**

After the training, a short survey or interview (see appendix A and B) were conducted with the students. In the interview or survey, one question was "Do you think our tonal training is useful for you and your students? If you rate from 0-10, 0 is nothing, 10 is extremely useful, what's your rank for the training session? The average rating for the training of the 22 subjects was 8.7 out of 10 points. The elementary school students rated 8.9, the middle school students rated 9.0, and the high school students rated 8 (one student who was absent-minded rated 5 for the training).

For Question 5 of the survey: In what way, do you think the training would help you or your students in the tones?

- 1) Raising awareness of the importance of tones
- 2) The technique of producing Chinese tones correctly such as widening the pitch range and tone variation rules
- 3) Noticing the tone when learning a new word
- 4) And/or other \_\_\_\_\_

Thirty-two percent of the participants chose 1, raising awareness of the importance of tones. Seventy-two percent of the subjects chose 2, the technique of producing Chinese tones

correctly such as widening the pitch range and tone variation rules; and 61% chose 3, noticing the tone when learning a new word. One student did not answer this question and commented s/he had not learned Pinyin well, so it would be better to get training on tones when s/he gained basic pronunciation knowledge.

Some students commented in the open suggestion area that the training was “fun” and “great”. Quite a few students wanted the training to be longer, go a little slower, and include more practices. They believed this training was “necessary to fluency.” During the interview, one commented

*It was so fun! I don't know “xiongmao” have different meanings, and “ma.” It's horrible if I get these words wrong when I go to China, isn't it? Last weekend, I went a Chinese restaurant and told the waitress I wanted “shui” but she did not understand me until I pointed to the cup. That must because my tone was wrong...I need to do better on it.*

From the rating and the comments of the participants, the conclusion can be drawn that the English-speaking K-12 children's attitudes toward the designed method was positive and satisfied.

### **Findings for Research Question 3: What are adult learners and teacher's attitudes toward the designed method?**

The answer to this question was based on the survey and interview on six adult students of the WVU Confucius Institute West Virginia Chinese Language Learning and Certificate Program, two Chinese teachers whose classes were involved in this research, and the Coordinator of World Languages Office of West Virginia Department of Education.

The six adult learners showed great interest during the training. All of them rated 10 points for the training and commented it was “extremely helpful” for themselves and their future

Chinese students. They wanted to have more trainings on tones in the future. When they answered the question “in what way, do you think the training would help you or your students in the tones,” five students remarked that the technique of producing Chinese tones correctly such as widening the pitch range and tone variation rules helped them the most. One student commented that the technique of “exaggerating the vocal range” was very useful for pronouncing Chinese tones correctly. Three students chose “raising awareness of the importance of tones”; and three students chose “noticing the tone when learning a new word” as the reason why they thought the training was very useful. One student mentioned that the training not only “helped with pronunciation but also with the listening comprehension.”

The researcher also interviewed the two instructors of the WVU Confucius Teacher’s program, Dr. Zhao, and the Chinese teacher of Suncrest Middle School and Morgantown High School, Mr. Lan. Both of them were then guest teachers from China. Dr. Hewas an associate professor in Teaching Chinese as a Foreign Language at a university in China and had been teaching in the WVU Confucius Institute since 2016. Mr. Lan was an English teacher at a high school in China. Both of them were deeply involved in the research including practice design, recording collection, and the training. They reported that they had observed the changes in the students after the training, especially in the students who had strong motivation in learning Chinese. They found that these students started to slow down in speaking and tried to utter Chinese in a “zì zhèng qiāng yuán” (字正腔圆, meaning with clear articulation and tune) way.

*“Some students have begun to consciously fix their tones as soon as they realize they make mistakes, especially for the first tone. I also remind them of opera pitch. Some students have obviously better tones after training. Students always bring the bookmarks*

*and put the bookmarks in their Chinese books (Zhao, XY., personal communication, December 2, 2017).*

Mr. Lan also commented that students' consciousness toward the tonal accuracy was noticeably improved after training. Some students, especially the middle school students, started to fix their tones while pronouncing consciously (Lan, J., personal communication, December 11, 2017).

Beside the changes of the students, both instructors acknowledged that they started to emphasize more in tones in their teaching than before. Dr. Headmitted that the training raised his attention on the importance of teaching Chinese tones. He said that he had not emphasized tones, or even the whole pronunciation before. This was partly because the teachers' program was a comprehensive course and was limited by timing and the curriculum. More importantly, the evaluation of this program was by the HSK test, which has no speaking evaluation. Dr. Hecommented that the curriculum of this program needed to pay more attention to the pronunciation.

*“If the program does not push students' quality tonal output now, when they become teachers, their output become students' input, then that will be a big problem if the input is in low quality. I think HSKK (the HSK speaking test) should be and will be introduced to the program to evaluate teachers' oral out-put. We should emphasize on tones and pronunciation for the teacher's program from now, because their output quality will dramatically influence their students. I believe this comprehensive course should teach tones and pronunciation throughout the whole program, although every teaching phase may have different focus. (Zhao, XY., personal communication, December 2, 2017).*

Since the training, Dr. Hehad started to emphasize more on tones and he found that the Teacher 1 class presented more improvement than the Teacher 3 class. Although he still did not correct students' tonal errors during their speaking, he pointed out the common mistakes and commented on students' overall tonal quality globally. In addition, when he taught the new vocabulary, he emphasized the tones much more than before and requested the students memorize the new words with the correct tones.

Mr. Lan favored the tone map thus he asked a student to draw a big bookmark and hung it up in the classroom (see Figure 28). He considered that the bookmark was simple and easily approachable.

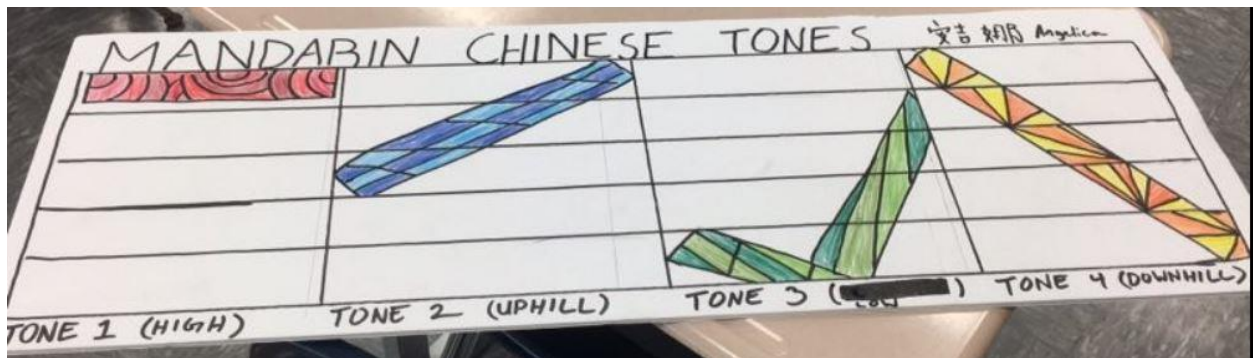


Figure 28. The bookmark Mr. Lan asked a student to make and hung in the classroom.

Regarding the improvement of their students, both teachers believed that the newer enrolled students made more improvement than the older enrolled students. For example, the middle school students showed more progress than the high school students, and the Teacher 1 class showed more progress than the Teacher 3 class. These observations matched the data of tonal accuracy rate before and after training of these classes. For example, the average increase in the tonal accuracy of middle school students was higher than the high school students. The teachers concluded that the earlier the instructor could focus on Chinese tones, the better effect it would have.



*“We must emphasize the pronunciation at the beginning phase. If we don’t do this now, my successor (The teachers of the WVU Confucius Institute had a 2-3-year tenure, after the tenure, they go back to China) would have big trouble in fixing tonal problems after my tenure. That is why I should put increasingly strength in the tonal training at the beginning phase of the program (Zhao, XY., personal communication, December 2, 2017).*

In terms of the rating and suggestions to the training, both teachers believed that the training was scientific, systematic, and had a logical theoretical frame. Dr. Herated 8.5 for the training. He considered the teaching plan was considerate and took both students’ input and output into consideration. The timing of the training was flexible and well controlled. Mr. Lan rated 7 points for the training. He believed that the research would be more effective if it provided more systematic practices instead of a one-time training. He suggested that the research have a longer term and offer more follow-up trainings or design more related exercises for the classroom teachers to continue with the routine training. Dr. Hesuggested expanding the participants’ size by taking use of the social media, for example, posting the training video to YouTube and calling for more Chinese learners to participate in the research. He believed that would help collecting more data, therefore generalizing an even better teaching method on Chinese tones.

Finally, was the interview with Debora L. Nicholson, Coordinator of World Languages Office of West Virginia Department of Education. The interview was during lunch time with Debora in December 2017. Debora participated in the presentation about the research during the West Virginia Foreign Language Association Conference in October 2017. The researcher made a presentation about this research to the teachers from all over West Virginia. The presentation

was similar to the training but with more theoretical explanation and less practices. Debora commented the presentation was necessary and meaningful to Chinese teachers. She was impressed by the written practice because she had learned Chinese for a few months but committed tonal errors in more than half of the practice exercises.

To sum up, the average rating on the teaching method of adult learners was 10. The conclusion can be drawn that adult learners and teachers' attitudes toward the designed method was positive and satisfied.

### **Summary**

The data collecting process of this research had gone through three months and five DBR cycles. Altogether, 31 subjects participated in the research including 22 K-12 students, 6 adult learners, 1 parent and 2 Chinese teachers.

Through the paired t-test on tonal accuracy, differences between pre-training and post-training for K-12 students and adult students were significant. It may be concluded that the designed method was effective in improving the tonal production accuracy of English speaking K-12 children and adult learners.

Through surveys and interviews, the average rating by K-12 students was 8.7 and the average rating of the adult learners and teachers was 9.4. The conclusion can be drawn that K-12 and adult learners and teachers' attitudes toward the designed method was positive and satisfied.

## **Chapter Five**

### **Discussion**

The research was designed to test if the model of teaching Mandarin Chinese tones to English speaking learners is effective and if both the students and Chinese teachers like the teaching method. The results showed that the method effectively improved the learners' tonal accuracy. In addition, both the teachers and the students liked the method and wanted to learn more about it. In this chapter, the theoretical and pedagogical implications, limitations, and recommendations for further study are discussed.

#### **Theoretical Implications**

The method was demonstrated to be effective, so the reasons of the success was explored. In this section, the researched is to explain the design philosophy behind the model and the reasons why the designed method was effective.

#### **Raising the Consciousness**

In the survey or interview after the training, participants were requested to give the reasons why they think the training is useful for them to increase the tonal accuracy rate. Three options and an open suggestion were given to the subjects. The three options were 1) Raising awareness of the importance of tones; 2) The technique of producing Chinese tones correctly such as widening the pitch range and tone variation rules; and 3) Noticing the tone when learning a new word. Participants were allowed to choose more than one answer. As a result, 30 percent of the participants believed that the training raised their consciousness. After the training, all participants answered “yes” to the question “Do you think tone is important for learning Chinese now?”

This result can refer to the study of Yang (2015) which found out that most of the students believed speaking Chinese, including the tones, was relatively easy and not so important. Students expressed a remarkable confidence in their knowledge about tones, yet it turned out they tended to say the tones randomly when speaking (p. 285). If Yang (2015) can represent the general perception on the importance of Chinese tones, conclusions may be drawn that the current teaching model would solve this problem and dramatically raise students' awareness toward Chinese tones. Hu and Tian (2012) argue that although students tend to overlook the importance of the tones, they value their teachers' stress in teaching Chinese tones. This statement was consistent with the present study. The first step of the current teaching model was to raise the consciousness towards the importance of Chinese tones. During the training, the researcher emphasized that Chinese is a tonal language, which means a slight difference in tones will change the meaning of words by a real-life story of "wrong tones make trouble." Students claimed they were impressed by that video and all students believed that tones are critical to Mandarin Chinese since then.

Raising awareness does not only include the awareness of the importance of Chinese tones. It also includes the awareness of the gap between Chinese tones and English "tones." Noticing the gap is a theory of Schmidt and Frota (1990), which means learners have awareness of a mismatch between the input and their current interlanguage. Because English is a non-tonal language so that English sounds are only composed of initials and finals. On the other hand, Chinese Pinyin are composed of initials, finals and tones. The study found that American students tend to ignore tones in written Chinese. In all of the written tonal practice during the research, the overall accuracy was below 50 percent. Students expressed their feeling of being shock on their poor memory on the tones of the words. These students were surprised and

embarrassed to find that they did not know the tones for some words they just learned or frequently used such as *nǐ hǎo, wǒ jiào* (hello, my name is...). In the survey, 40 percent of the subjects believed the training was useful because it helped them notice the tones of the words. Most of the students admitted they started to notice the tones in listening after the training.

In conclusion, raising the awareness towards Chinese tones can be elaborated in three dimensions: the first element requiring awareness is the form of Chinese Pinyin, in which the tones are the inseparable part. The second to be aware of is the global sense of tone register and contour from native input. The third is the gap between the target tonal proficiency and learners' current production. With sufficient input and noticing, students can gain the sense to differentiate Chinese lexical tones from English pitch. For example, when students hear the second tone at the end of a sentence, they will not think it is a question. When they produce a question with a Tone 4 word at the end, they will not raise the tone of the word.

### **Break up Learners' Awkwardness in Pronouncing Chinese Tones**

When the students realize the importance of tones and notice the gap between Chinese and English and between native speakers and their own interlanguage, the next step is to break their awkwardness in speaking. As the literature discovers, Mandarin Chinese has a much wider pitch range than English. Chen (1974) found that the pitch range of Chinese speakers speaking Chinese was 1.5 times wider than English speakers speaking English. Specifically, native Chinese speakers are 25 percent higher and 25 percent lower than CFL learners of English L1.

As a result, English speaking learners, especially adult learners, feel strange and awkward when they speak Mandarin in a "fluctuating" way. One parent of the Morgantown Chinese School who learned Chinese together with his daughter in the researcher's class commented that

*“The tonal bit is REALLY a problem for easily embarrassed Americans, or so I believe. I love making voices, and vary the tone, pitch and cadence of my speech a lot more than the native English speakers I’m around day-to-day, so I thought I’d be o.k. with the tonal range in Chinese, but the high points... it makes me feel like I’m yelling. Finding where I should be in the range, without my voice cracking is difficult on the first day...How loud are we supposed to be? It feels awkward to raise your voice on purpose unless celebrating or being angry or calling out to someone (Marra, S., personal communication on February 4, 2018.)*

The awkward feeling was common to American learners, especially the older learners. Therefore, from the perspective of the researcher, the next step after raising the awareness toward the importance of the tones should be breaking the awkwardness of pronouncing Chinese tones in a noticeably different way. The most awkward feature of Chinese tones to English speaking learners, from the learners’ feedback, is the pitch height and pitch range of the tone, especially the high pitch with Tone 1, the finish point of Tone 2, and the start point of Tone 4. The younger students had been observed to have less awkwardness than the older learners. The adult learners complained about feeling “strange” and “silly” when speaking Chinese, and they consciously adjusted the tones to an “acceptable” pitch. In a general sense, the pre-training recordings from all the participants sound flatter than the recordings of post-training. The adult students acknowledged that even though they have noticed the tonal gap between the native speakers and their own production, they still felt awkward to speak with such “exaggerated” pitch and therefore tried to make themselves sound “comfortable.” The high school students were laughed at by their peers when they tried to utter an exaggerated sound, although it was correct.

The key point to break their awkwardness, from the researcher's opinion, is to provide audio or video input of Chinese learners of similar backgrounds as the learners. For instance, for younger learners, instructors can provide videos of American Chinese learners speaking Chinese. Contrastive (positive and negative) examples are ideal. The researcher had used two videos from three young Chinese learners who performed the Chinese poems “静夜思 jìng yè sī.” One was in a perfect tone and the other is in a “flat and English-like” way. The good example video clip showed that their mother pronounced “chuāng” instead of “chuáng,” the girls corrected her and said “it's chuáng, the bed, not chuāng, the window.” Students were impressed by the videos and were convinced that Chinese tones are really exaggerated and therefore break the awkwardness of producing the tones themselves. Dr. Heof the WVU Confucius teachers program also reported that when the students accepted the “exaggerating tones” from watching these videos, they became braver to speak.

### **Activate Schemata of Chinese Tones**

After learners raised their awareness on the importance of Chinese tones, noticing the gap between Chinese pronunciation and English, and breaking the awkwardness in speaking Chinese, the next step is the technique to help them pronounce Chinese tones in an accurate way. When students have enough attention on Chinese tones and reduce their awkwardness, they would be observed trying to pronounce the correct tones but in fact utter some non-existing Chinese tones (White, 1980, 1981), either with the wrong tone register or contour or both. It is like when children started to sing, they often are not on the right tune. Young students would be braver to try out new sounds which they think are right but older learners would be timid and awkward again if they produce the tones wrong. If this process becomes long and stagnant, learners either form their own interlanguage tones or lose confidence again. That is why three Chinese teachers

who were involved in the research, including the researcher per se have noticed that the newer learners tend to adapt to the correct tones better than the older learners, although the data had not supported this. Henceforth, efficient techniques which can help learners quickly find the right way to pronounce the tones are critical.

The efficient techniques must originate from the existing and transferable knowledge, or schemata, which is claimed to represent a person's knowledge and experience at all (Rumelhart, 1980). In the current teaching model, learners' schemata are expected to be activated and transferred to learning Chinese tones. For example, the musical staff, "opera pitch" and "Middle C" were expected to activate learners' music schemata; the "Ugh" and "Boo" sound were expected to activate their life experience; the "uphill" and "downhill" were expected to activate their life experience too. These multiple schemata interweaved and are hoped to provide a multi-dimensional transferrable technique on pronouncing Mandarin Chinese tones. The research findings revealed that the teaching method was effective to improve learners' tonal accuracy rate with just one training. Fifty percent of the participants believed that the technique of pronouncing the tones was the reason for the success.

### **Encouraging Output at Early Stage**

Output is the production of the learners. Developed by Merrill Swain (1995), the comprehensible output (CO) theory argues that learners acquire language forms only when they need to communicate or make themselves understood. CO states that learning takes place when a learner encounters a gap in his or her linguistic knowledge of the second language. By noticing this gap, the learner becomes aware of it and may be able to modify his output so that he learns something new about the language. Swain argues that CO facilitates second language learning in



ways that differ from and enhance input due to the mental processes connected with the production of language.

Scholars who argue against CO like Stephen Krashen claim that the basic problem with all output hypotheses is that output is rare, and comprehensible output is even rarer. Another difficulty with CO is that pushing students to speak in a second language may cause high anxiety especially when the tasks are inappropriate. It raises the affective filter, and thus hamper acquisition (Kreshan, 1994).

The researcher believes that output is necessary for learning Chinese tones and for any second language learning. In second language classrooms, learners acquire input from both the teachers and their classmates. Therefore, output and input are intertwined in a classroom, one's output is the other's input. Across a wide range of settings, including second and foreign language classrooms, language learners are frequently and increasingly each other's resource for language learning (Pica et al., 1996). For many L2 learners, opportunities for either extensive or wide-ranging interaction with native speakers is all too infrequent and often simply impossible.

Output is especially important for some programs such as the Chinese Teachers Certificate Program at the WVU Confucius Institute, because the students' output quality would directly influence Chinese learners' input quality. These present students will become future Chinese teachers in around three years. If these current students are not pushed to quality output, their future students may acquire low quality input from them.

Output does not only mean speaking production, it also includes writing and other forms of production. Teachers may easily assume that teaching tones is just about listening and speaking. However, from the research, we could find that multiple reasons account for the tonal errors, and one of them is that students don't remember the tones of the words. The overall

accuracy rate of the written practice of marking the tones on a short passage which they are familiar with is below 50 percent. The researcher has also observed that students tend to write Pinyin without tones for the complete sentence or the word phrase then put the tone marks on the words during her years' experience of teaching CFL. This may mean that students don't remember tones as a part of the pronunciation and have to "figure out" afterwards. Tsai (2011) pointed out that many students admit that they have difficulty remembering which tone goes with which word. This shows that they are still thinking of tones as not really being part of a word. For native speakers of Mandarin, tones are always part of a word, so it is not possible to learn a word and forget which tone it is.

In the third-year Chinese major class of WVU, students reported that the previous teachers ignored the tonal errors and sometimes did not count it an error at all when they wrote correct Pinyin with wrong tones in the quizzes or tests. The researcher believes that it is harmful to students' tonal and pronunciation quality if teachers don't enhance it in the classroom and through assessments. Chao (1972) indicated that saying Chinese tones wrong is just like saying English word "bed" for "bad." If a student spells "bed" for "bad", it would be strange if an English teacher still counted it right. Why can a Chinese teacher give scores to the wrong tones? Without enough attention on Chinese tones, students may ignore the tones and thus have wrong memory of the tones. Even if students have acquired techniques to pronounce the tones right, they still cannot achieve high accuracy of Chinese tones if their memory about the tones of the words are wrong. This was confirmed by the high error rate of the written practice in the research.

Output of Chinese tones should be encouraged as early as possible but should not be forced. Output readiness should be considered. The researcher was teaching a Chinese 101 class

of five young learners aged 7-8. In the beginning few weeks, two girls showed high anxiety when they were asked to read or to do Pinyin dictation. However, when the instructor involved them in a game called “hopping to the wall,” which allowed students to make a hop if they could answer a question correctly or ask a correct question, all students strived to give output including the two girls who were anxious at the beginning of the class.

### **The Influential Factors of Learning Chinese Tones**

This study revealed that a few factors might be influential to students’ Mandarin tonal production quality. In the literature review, Miracle (1989) surveyed the tonal production of ten beginning level college Chinese students of English L1 and found out the average tonal accuracy of beginning learners was 42.9 percent. He and Wayland (2010) compared nine ‘inexperienced’ American learners of Mandarin with three months of Mandarin learning experience and nine ‘experienced’ American with twelve months of Mandarin Chinese learning experience. They concluded that American learners’ production of Mandarin tones improves with Mandarin learning experience. The current study is consistent with previous literature in that learners with more years of classroom learning experience produced Mandarin tones with a higher accuracy rate than relatively less experienced learners. Although the data in this study showed that the average tonal production accuracy rate of the beginning and intermediate level students was not identical to the previous studies, the trend that experienced American learners of Mandarin had higher tonal production accuracy rate than inexperienced learners kept the same. In this study, the average tonal production accuracy rate of the inexperienced learners (learning experience < 12 month) was about 49 percent, and the average tonal accuracy of the intermediate learners (learning experience >12 month) was 59 percent before training. After training, the average tonal accuracy of the beginning learners (learning experience <12 month) was 66 percent and the

average tonal accuracy of the intermediate learners (learning experience >12 month) was 75 percent. However, this finding cannot negate the previous studies because the definition of “experienced” and “inexperienced” learners was not standard. For example, in He and Wayland (2010)’s study, learning Chinese for three months and under was deemed as inexperienced, while in the current study, 12 months and up was regarded as experienced. The point to be mentioned is the trend between learning experience and the tonal production accuracy rate. This study also showed the trend that American learners’ production of Mandarin tones improved with Mandarin learning experience. Another important finding was that three Chinese teachers in this research have observed that newer students tend to have bigger improvement than the experienced learners. As shown in Figure 29, we can find the highest accuracy rate lied in the two ends of the graph: under six months and beyond 24 months. This may indicate the newer learners are more open to the tonal training and Mandarin Chinese tones as a whole.

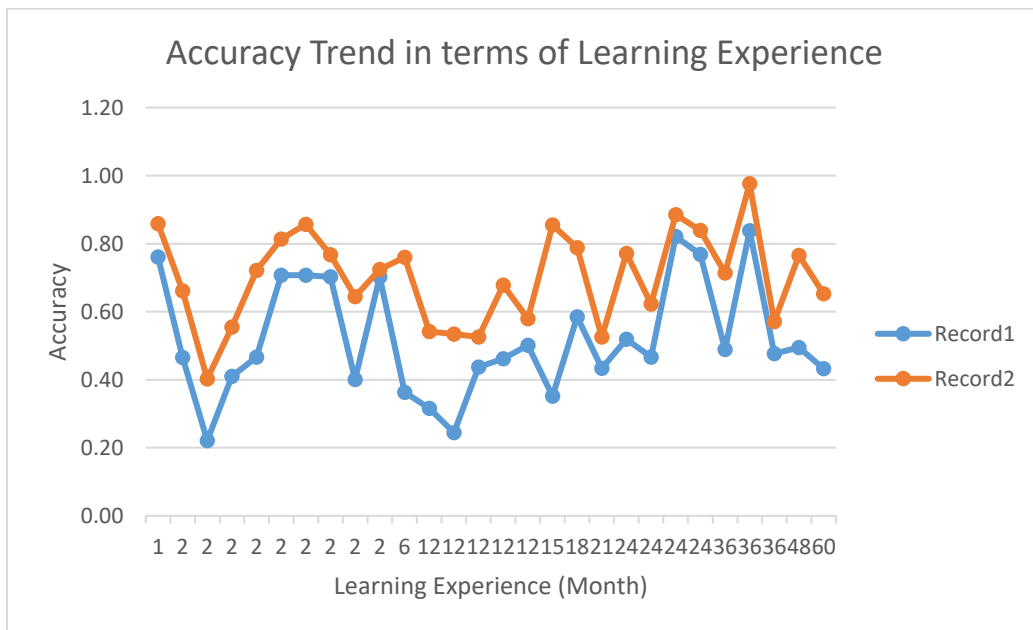
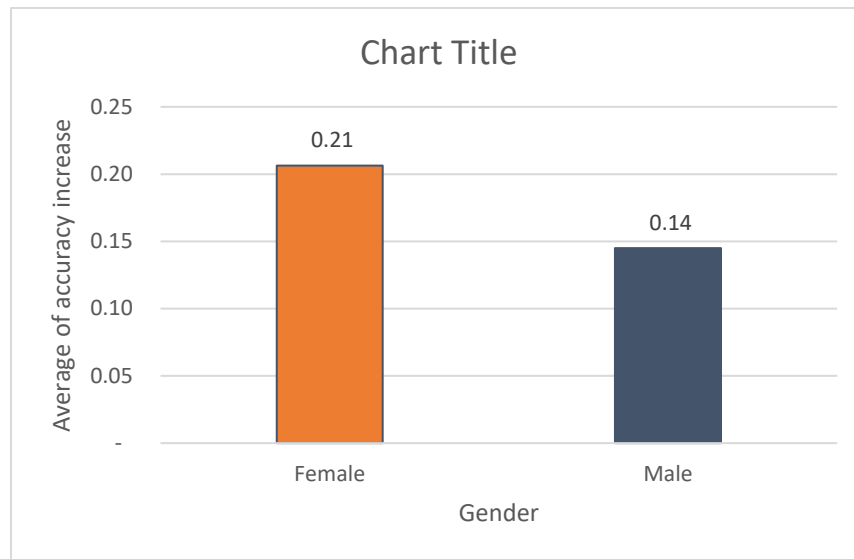


Figure 29. Accuracy trend before and after training.

Besides learning experience, this study also calculated the correlation between the accuracy rate, accuracy increase and age, gender, and language background. As data in Figure 30 showed, there was no significant correlation between these factors. Only the average of accuracy increased between male and female was noticeable.



*Figure 30: Average of accuracy increase of male and female learners.*

Dr. Heof the WVU Confucius Institute claimed that students who have multilingual backgrounds tend to have better learning outcomes than other students. For example, in the WVU Confucius Institute Chinese Teacher Program, students who were teaching the other languages did better than non-language teachers such as coaches and mentors. Dr. He commented that one student who was a Russian American and a Spanish teacher had an advantage and her own method of learning a foreign language. However, the data did not support this assumption. In this study, 18 students had multi-lingual backgrounds such as Farsi (a Persian Language), French, Italian, and Spanish etc., and 10 students did not know a second language except for English and were learning Chinese. These two groups of students had similar tonal production accuracy rates: the multi-language group had 53 percent before training and the mono-lingual

group had 51 percent before training. After training, the multilingual group had 67 percent and the monolingual group had a 69 percent accuracy rate. This data revealed that the language background had no significant influence in learning Mandarin Chinese tones. This finding is consistent with some studies (e.g., Wang, 2006, 2013; Hao, 2012), which indicated that learners of different language backgrounds do not have significant influence on learning Chinese tones. However, since the participants in this study all had backgrounds in the European languages, which are all non-tonal languages, this study cannot draw a conclusion that L1 backgrounds do not have impact on learning Chinese tones, especially when comparing tonal and non-tonal L1 backgrounds.

Dr. He and Mr. Lan also suggested that students who had high motivation in learning Chinese tend to show more progress. From their perspectives, two kinds of people choose to learn Chinese, one was interested in Chinese culture; the other was from a multilingual background. These students use their knowledge and experience of other languages to learn Chinese effectively. Since the participants in this study voluntarily took the Chinese class and most students wrote the reasons for learning Chinese as “like Chinese language and culture, I will go to China” “Chinese is a future language,” and “learning Chinese is cool and challenging,” only three students mentioned the reasons for learning Chinese as “getting a credit,” “being forced” and “my mom made me learn,” so it was assumed that most of the participants had high motivation. Without control group data, the current study had not offered evidence to support their opinion.

The last influential factor of learning Chinese tones this study would like to investigate was if students’ musical background helped them in learning Chinese tones. Many neuropsychological studies (e.g., Schön, Magne, & Besson, 2004; Alexander, Wong, & Bradlow,

2005; Micheyl, et al., 2006; Lee & Hung, 2008; Nan and Friederici, 2013) claimed that musicians are more sensitive to subtle pitch variations than non-musicians, and musicians have significantly lower error rates than non-musicians in tonal production. They advocated that the abilities to process musical pitch and linguistic tone are closely linked and pitch-related expertise seems transferable across domains. In order to acquire some sense about the correlation between musical background and learning Chinese tones, the researcher sent another survey to the participants (see Appendix B) after the training. To the surprise of the researcher, the survey showed that over 80 percent of the participants have more or less musical backgrounds (play a musical instrument or in a choir, orchestra, or band) and can read the musical notes on the five-scale staff. Some participants also think that Chinese tones are similar or related to musical notes. For example, they both have high and low sounds, and the gap between the highest and lowest sounds is big. This was consistent with Yang (2015) which examined the beliefs of 42 Mandarin teachers and 443 beginner English learners of Mandarin in secondary schools in the UK. According to teachers, Chinese tones were unfamiliar for non-tonal English speakers, and thus only students with musical talents or trained with musical skills would find it easier than others to perceive pitches of Chinese tones (p. 283). If Yang's finding that the musical background benefit in learning Chinese tones is true, it is lucky to say that in America, music education was widely spread at schools and a best part of school children acquired some music training thus would be very beneficial to learning Chinese tones. Although the current study cannot provide valid data to support the claim that musical background has influence on students' tonal proficiency due to the unbalance in the sample size, it may suggest that the current teaching method, which is presented on the five scale musical staff and uses some musical concepts such as Middle C and opera pitch, is well accepted by the students. The current

method seems to have built upon the background schema of most learners and made Chinese tone learning more relevant for them.

To sum up, this research suggests a few factors for the success of the current teaching model henceforth for English speaking learners to grasp Chinese tones. These factors include raising the consciousness on the importance of Chinese tones; noticing the gap between native tonal production and the learners' production; breaking up learners' awkwardness in pronouncing Chinese tones is necessary; activating learners' schemata of Chinese tones; and encouraging output at an early stage of learning Chinese.

As side products, the researcher also found that learning experience has a positive influence on the tonal accuracy rate, but learners' age and gender have no correlation with the tonal accuracy. Without sufficient data, the research does not support the hypothesis of the influence of learners' musical background and language background on the tonal production accuracy rate.

### **Pedagogical Implications**

A few pedagogical implications can also be drawn from the research.

#### **Add Tone Training Session and This Teaching Model to Chinese Teaching**

The most important pedagogical implication of course is to use this teaching method in Chinese teaching. The researcher highly suggests CFL teachers to add this training session to the beginning of Chinese teaching, ideally to the Chinese Pinyin section. In the Chinese programs of WVU, Pinyin is taught at the beginning of the first year Chinese major. It usually takes one month to finish the Pinyin section. The researcher would suggest adding the tonal training sessions to the Pinyin teaching process. For the public schools, if they have similar curriculum,



tonal training sessions can be added to the Pinyin section. Otherwise, this training session should be added to the beginning of the program.

### **Chinese Tones should be a Long-term Focus in CFL Pedagogy**

Chinese tones are considered by both teachers and students as the most difficult part of learning Chinese (Yang, 2015). Therefore, teachers cannot anticipate that students would master the skills overnight. On the contrary, it may take a long-term effort with rebound and attrition. In the meantime, because of its high importance to communication, neither instructors nor students should quit or compromise. Belief should be held that with time and efforts, high tonal accuracy is achievable.

### **Practice is King to Learn and Enhance Chinese Tones**

Skill Acquisition Theory (SLT) argued that leaning a language is like learning any other skills. SLT believes that skilled behaviors can become routinized and even automatic under some conditions (Dekeyser, 2007b). This theory assigns roles for both explicit and implicit learning in SLA. And, as a general theory of learning, it claims that adults commence learning something through largely explicit processes, and with subsequent sufficient practice and exposure, move into implicit processes (Taie, 2014).

Multiple forms of practice are the key to the effective teaching in this study. In the research, both students and teachers commented that the most impressive part of the training was the practice. Therefore, the researcher modified the lesson plan to shorten the lecture time and to allot more time on the practice. In the first DBR cycle, only one round of written practice was implemented. In the subsequent trainings, one more round of perception exercise was added in terms of the students and teachers' feedback from the first cycle. Students gained versatile insights from the exercises. Some students found that they did better with input while the other

students found they memorized the tones better without listening to the teacher. All students valued both of the exercises and wanted to do more because they knew what weakness they had and how to improve through doing the practices. The Chinese teacher of the middle school and the high school, Mr. Lan, commented that the research could have been better if it would have provided more consistent practices for students to enhance the tonal production.

### **Allow Slow Production and Low Fluency at the Beginning**

There have long been debate on the function of conscious knowledge. Dr. Krashen (1982) advocated that conscious learning functions only when three very severe conditions are met: (1) when we know the rule, (2) when we have time, and (3) when we are thinking about correctness or focusing on form. Dr. Krashen believed that these conditions are almost impossible to meet together.

The researcher admits that conscious learning on tones may cause slow production and low fluency at the beginning. However, slow production allows time for processing the rules and focusing on the forms. It gives students chance to “feel” for correctness. Consider how children start to speak or write, they never start with great fluency or high speed. They normally start at a slow pace and a low fluency. In the researcher’s opinion, tolerance on slow production and low fluency is required for any beginning learners. Teachers may observe hesitations in speaking, thinking for a long time, and self-correctness (Burt & Dulay, 1978). With more time being exposed to the target language and more output, these phenomena would mitigate until natural production is observed.

Allowing slow production and low fluency also indicates minimum direct correction in the communication. Teachers are suggested to make tonal corrections when teaching new words, or during activities such as reading aloud which tonal forms are supposed to emphasize. In free

speaking, we should notice the tonal accuracy globally. When we find tonal errors hamper the meaning, we should use meaning negotiation and indirect correction. For example, use hand gestures or “opera sound” to help students realize their errors and allow them time to self-modify.

### **Recommendations for Further Study**

Teaching Chinese in America has a history of about one hundred years. However, the theoretical and pedagogical development are still unsatisfactory. In reality, many Chinese researchers are no longer involved in language teaching and language acquisition, and do not interact with teachers. On the other hand, in-field teachers do not do research. When the researcher tried to find a Chinese faculty job and she found out that most of the universities including the top-rated colleges only hired Chinese teaching faculty and rarely research faculty. There is also far too little interaction between theoretical and applied research; those who search for the best method are often too little concerned with the underlying theory. What is perhaps most evident is that teachers and materials developers pay little attention to research and theorizing of any sort.

This status put Chinese teaching theory and pedagogy in an embarrassing situation. Furthermore, this makes Chinese teaching in America stagnant and inconsistent. The researcher heard some scholars complain that the presentations on Chinese pedagogy at a national level conference for language teachers had stagnated for the past twenty years. The presentations repeated or contradicted each other year by year but yielded nothing new. In this circumstance, the researcher would suggest the following:

1. Spread this research to more Chinese teachers and learners. Develop relevant training modules to benefit more Chinese teacher expertise. Set up more workshops, online

meetings, YouTube video etc. to help facilitate teachers and Chinese learners to learn methods of teaching Chinese tones.

2. Remodel the current teaching method to be applicable to computer-based instruction. For example, the researcher could design a computer program or a mobile application that integrates the elements of the teaching method to virtual instruction. In this way, this method may contribute to the development of underused computer assisted Chinese language learning.
3. The current teaching method is fundamentally an explicit method. However, it could be beneficial to implicit learning as well by adding free-speaking and spontaneous conversation into the research, investigating long-term retention of students' tonal production proficiency, and by redesigning the teaching method in an implicit way.
4. In field teachers should conduct research in their daily teaching. DBR may be a good research method for teachers to design, implement, and to adjust their real-life "experiment" anytime and anywhere.
5. Researchers and teachers should work together and publish more collaboratively.
6. Researchers and teachers should update their knowledge of the second language teaching, Chinese teaching, and Chinese linguistics.
7. The Chinese scholars in America should enhance the cooperation with research labs in China such as Hanyu Yuyin lab at Nankai University, and Beijing CFL teaching lab.

With regard to the topics suggested for further study, the researcher would suggest teachers and researchers put more time and strength on tonal teaching research. Needless to say, Chinese tones and characters are the two most difficult parts of Mandarin learning. However,

comparing against Chinese characters, Chinese tones are still under researched. The researcher would like to propose several detailed topics for further research.

1. Should pinyin text reflect the factual tones instead of the unified tones for the characters? For example, some texts change the tones for “一 yi” in terms of the tonal context, but some texts use the first tone in every incidence. Which practice is more beneficial for tonal learning?
2. Can tones be acquired instead of learned as a second language in America? How can CFL programs provide sufficient input for tonal acquisition? Dr. Krashen is interested to know that learning experience has impact on the tonal proficiency but how does it work. For example, the beginning learner’s tonal accuracy rate was reported to be about 40 percent, while the intermediate learners’ accuracy level is about 70 percent. Future research might explore how the improvement occurs.
3. Is teaching Chinese songs to the beginning learners helpful or harmful to learning Chinese tones? Is implicit teaching applicable to Chinese tonal teaching?

### **Limitations of the Study**

Despite the careful preparation and implementation, the limitations and shortcomings are unavoidable. They are principally as follows:

First of all, the research was conducted in the five DBR cycles which have lasted for three months. Three months is not enough for the researcher and for the classroom teachers to observe all of the students’ speaking performances. In addition, only one recording right after the training was collected. Without long-term follow up and recording analysis, the study cannot determine what the effect is with longer time after the training.

Second, the sample size of the experimental group is small, only thirty-two participants, and might not represent the majority of the CFL learners. In addition, the age distribution was not balanced. There were no college students involved in the research.

Third, since the recording was only a reading on a certain text, and there was no free speaking involved, it seems not to provide enough evidence of the students' actual tonal production quality in their communicative speaking performance.

Fourth, since each class studied had its own Chinese instructor, instructional techniques and learning strategies might have influenced the research result. This research was not in an experiment setting so it cannot rule out the possibility that the classroom instruction would have interfered with the results. Because the *r* for second rating is low, simply refer to it in limitation section and suggest that future studies may need to use training for rating, which will increase the inter-rater reliability.

### **Summary of This Study**

This dissertation examined the effectiveness of a method of teaching Mandarin Chinese tones to English speakers, which is created by the researcher.

Chapter One introduced the status of Chinese language education in America, especially in West Virginia. It also introduced the design and the teaching method and the research questions as follows:

Q1. Is the designed method effective to improve the tonal accuracy of English speaking K-12 children?

Q2: Does the designed method meet the satisfaction of English speaking K-12 children?

Q3: Does the designed method meet the satisfaction of K-12 Chinese teachers?

Chapter Two focused on the literature studies with regard to the linguistic features of

Mandarin Chinese tones, contrastive analysis and error analysis in learning Chinese tones, and pedagogy of Chinese tones. Gaps in literature and the contributions of the present study were pointed out.

Chapter Three illustrated the epistemological considerations of social constructionism, and the research methodology of mixed method and DBR. It also elaborated the research model and design, including participants and the research procedure and instruments.

Chapter Four revealed the results of the research. The designed teaching method was effective to improve the tonal production accuracy of English speaking K-12 children and adult learners. Furthermore, both K-12 and adult learners and teachers were satisfied with the teaching method and hold positive attitudes toward it.

Chapter Five discussed the theoretical and pedagogical implications of this research. The most important implication was to use this teaching model to teach Mandarin Chinese tones to learners of English speakers and it suggests adding it to the process of teaching the Chinese pronunciation system.

Last but not least, this research was conducted in West Virginia at a time that the Chinese language is booming. In 2017, only 14 schools in WV offered Chinese programs. In 2018, 23 schools out of 725 schools in WV would offer Chinese programs and 2500 out of 25000 students are learning Chinese. Mandarin Chinese has become the third most popular second language after Spanish and French (Nicholson, D., personal communication, December 21, 2017). In 2017, six guest teachers were sent to West Virginia by the Chinese government to teach Chinese in public schools. The Chinese programs and teachers are widely accepted and appreciated. In order to continuously improve the quality of Chinese teaching in WV, Debora Nicolson, the coordinator of the department of Education commented:

*The current Chinese teaching quality is good and the teachers are all qualified. The next step should be unifying the curriculum. For example, teachers should teach pronunciation and tones at the beginning of the program. Some teachers have not paid enough attention on teaching tones. We should give this training to all the teachers together before they begin to teach ((Nicholson, D., personal communication, December 21, 2017).*

The researcher hoped this dissertation would contribute to the current Chinese tonal teaching repertoire and Chinese teachers would try out this method and feedback to the researcher. If we need an easy memorable name for this teaching method, the researcher would like to name it Musical Method of Mandarin Tones—3MT.



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## Appendix A

### Interview/Survey Outline

Name:                      age:                      Gender:                      Native Chinese? Y / N                      Date:

Level of Teaching/Study (circle): Elementary, Middle, and/or High  
Chinese teaching experience (    ) years or (    ) months

#### 1. Background information

- How long have you been learning Chinese?
- What language(s) do you speak:

#### 2. Learner's self-assessment

- Did you think tone is important for learning Chinese? If not, do you think Chinese tones are important now? Have you emphasized tones in your teaching?
- How do you think your Chinese tones quality before and after training? (0-10, 0 is knowing nothing about Chinese tones, 10 is extremely good)

#### 3. Learning method and strategy

If there are 3 reasons accounting for tonal errors, which reason(s) do you think account for your students' tonal errors? (Circle the answers)

- 1) Lacking awareness of the importance of tones;
- 2) Lacking noticing of the tone of a word;
- 3) Lacking knowledge of how to produce Chinese tones correctly

4. Do you think our tonal training is useful for you and your students? If you rate from 0-10, 0 is nothing, 10 is extremely useful, what's your rank for the training session?

5. In what way, do you think the training would help you or your students in the tones?

- 1) Raising awareness of the importance of tones
- 2) The technique of producing Chinese tones correctly such as widening the pitch range and tone variation rules
- 3) Noticing the tone when learning a new word

Other: \_\_\_\_\_

6. Any suggestions on the training?

## Appendix B

### Survey on Musical Background and Chinese Tones

Your name:                      Chinese Name:                      Age:                      Grade:                      School:

1.        Do you or have you learned any musical instrument? If yes, how long? What is the instrument?

2.        Do you or have you been participated in any musical activity or training? such as choir, band, and etc. If yes, what is it and how long?

3.        Do you know how to read musical notes on the five scale musical staff?

4.        What do you think about the relationship between music and Chinese tones?



## Appendix C

### Recording Script for Morgantown Chinese School before Training

Nǐhǎo, wǒ jiào ...jīn tiān shì shí yī yuè wǔ hào xīng qī tiān shàng zhōu èr shì  
你好 我叫... 今天 是 十一 月 五 号 星 期 天。上 周 二 是

Wàn shèng jié wàn shèng jié shì wǒ zuì xǐ huān de jié rì yīn wèi wǒ kě yǐ chuān hǎo  
万 圣 节。万 圣 节 是 我 最 喜 欢 的 节 日, 因 为 我 可 以 穿 好

wán de yīfu hái kě yǐ hé péng yǒu yì qǐ chū qù yào táng qù nián wǒ yào dào le hěn duō  
玩 的 衣 服, 还 可 以 和 朋 友 一 起 出 去 要 糖。 去 年 我 要 到 了 很 多

táng kě shì māma bú ràng wǒ chī pà wǒ de yá chǐ huì huài diào qí shí wǒ měi tiān cái  
糖, 可 是 妈 妈 不 让 我 吃, 怕 我 的 牙 齿 会 坏 掉。 其 实 我 每 天 才

chī yì liǎng kē táng duì yá chǐ yīng gāi méi yǒu huài chù suǒ yǐ jīn nián wǒ dǎ suàn  
吃 一 两 颗 糖, 对 牙 齿 应 该 没 有 坏 处。 所 以 今 年 我 打 算

cáng qǐ lái yì bàn táng bú ràng wǒ māma kàn jiàn.  
藏 起 来 一 半 糖 不 让 我 妈 妈 看 见。

## Appendix D

### Recording Script for Morgantown Chinese School after Training

Nǐhǎo, wǒ jiào ... wǒ jiā zài měi guó, wǒ bàba shì měi guó rén, dàn shì wǒ māma bú shì  
你好, 我叫 ... 我家在美国, 我爸爸是美国人, 但是我妈妈不是

Měi guó rén, tā shì yì dà lì rén. Wǒ sān suì de shí hòu lái dào le měi guó.  
美国人, 她是意大利人。我三岁的时候来到了美国。

Wǒ de yéye nǎinai hái zài yì dà lì. Wǒ yǒu yí gè dìdì hé yí gè mèi mei,  
我的爷爷奶奶还在意大利。我有一个弟弟和一个妹妹。

wǒ yě yǒu yì zhī gǒu hé liǎng zhī māo. Xiǎo māo xǐ huān chī yú, yě xǐ huān hē niú nǎi.  
我也有一只狗和两只猫。小猫喜欢吃鱼, 也喜欢喝牛奶,

xiǎo gǒu xǐ huān chī ròu, yě xǐ huān hē guǒ zhī.  
小狗喜欢吃肉, 也喜欢喝果汁。

小 狗 喜 欢 吃 肉 也 喜 欢 喝 果 汁

Wǒ jiā bú dà, zhǐ yǒu wǔ ge fáng jiān. Wǒ hé wǒ de dìdì zhù zài yí gè fáng jiān lǐ.  
我家不大, 只有5个房间。我和我的弟弟住在一个房间里。

Měi gè xīng qī liù wǒ men dōu huì dài gǒu dào gōng yuán lǐ qù wán.  
每个星期六我们都会带狗到公园里去玩。

## Appendix E

### Recording Script for Middle and High School before Training

Nǐhǎo, wǒ jiào ... wǒ shì xué shēng, hěn gāo xìng rènshi nǐ. Wǒ hěn xǐ huān xué zhōng wén.

你好，我叫XXX我是学生，很高兴认识你。我很喜欢学中文。

xué zhōng wén hěn nán, dàn shì wǒ huí jiā yì yǒu shí jiān jiù fù xí.

学中文很难，但是我回家一有时间就复习。

Wǒ yí kàn jiàn zhōng guó rén jiù dǎ zhāohu.

我一看见中国人就打招呼。

Kāi xué dì yī tiān, wǒ gēn yí ge zhōng guó xué shēng shuō nǐ hǎo, tā bù lǐ wǒ.

开学第一天，我跟一个中国学生说你好，她不理我。

Hòu lái wǒ cái zhī dao tā bú shì zhōng guó rén, tā shì rì běn rén.

后来我才知道她不是中国人，她是日本人。

Wǒ xiǎng yíhuìr qù mǎi xiē píng guǒ hé cǎo méi. Kě shì, wàimian hěn lěng,

我想一会儿去买些苹果和草莓。可是，外面很冷，

wǒ hái shì zài jiā kàn diànshì suàn le.

我还是在家看电视算了。

## Appendix F

### Recording Script for Middle and High School after Training

Nǐhǎo, wǒ jiào ... jīn tiān shì shí yuè èr shí jiǔ hào xīng qī tiān zài guò liǎng tiān jiù shì  
你好 我叫... 今天 是十月二十九号 星期 天。再 过两 天 就是  
Wàn shèng jié le wàn shèng jié shì wǒ zuì xǐ huān de jié rì yīn wèi wǒ kě yǐ chuān hǎo  
万 圣 节了。万 圣 节 是 我 最 喜 欢 的 节 日，因 为 我 可 以 穿 好  
wán de yī fu hái kě yǐ hé péng yǒu yì qǐ chū qù yào táng qù nián wǒ yào dào le hěn duō  
玩 的 衣 服，还 可 以 和 朋 友 一 起 出 去 要 糖。去 年 我 要 到 了 很 多  
táng kě shì māma bú ràng wǒ chī pà wǒ de yá chǐ huì huài diào qí shí wǒ měi tiān cái  
糖，可 是 妈 妈 不 让 我 吃，怕 我 的 牙 齿 会 坏 掉。其 实 我 每 天 才  
chī yì liǎng kē táng duì yá chǐ yīng gāi méi yǒu huài chù suǒ yǐ jīn nián wǒ dǎ suàn  
吃 一 两 颗 糖，对 牙 齿 应 该 没 有 坏 处。所 以 今 年 我 打 算  
cáng qǐ lái yí bàn táng bú ràng wǒ māma kàn jiàn.  
藏 起 来 一 半 糖 不 让 我 妈 妈 看 见。

## Appendix G

### Recording Script for Confucius Teacher's Program Level 1 before Training

Nǐhǎo, wǒ jiào wǒ shì lǎo shī , hěn gāo xìng rènshi nǐ. Wǒ hěn xǐ huān xué zhōng wén.

你好，我叫-----，我是老师，很高兴认识你。我很喜欢学中文。

xué zhōng wén hěn nán, dàn shì wǒ huí jiā yì yǒu shí jiān jiù fù xí.

学中文很难，但是我回家一有时间就复习。

Wǒ yí kàn jiàn zhōng guó rén jiù dǎ zhāohu.

我一看见中国人就打招呼。

Kāi xué dì yī tiān, wǒ gēn yí ge zhōng guó xué shēng shuō nǐ hǎo, tā bù lǐ wǒ.

开学第一天，我跟一个中国学生说你好，她不理我。

Hòu lái wǒ cái zhī dao tā bú shì zhōng guó rén, tā shì rì běn rén.

后来我才知道她不是中国人，她是日本人。

Wǒ xiǎng yíhuìr qù mǎi xiē píng guǒ hé cǎo méi. Kě shì, wàimian hěn lěng,

我想一会儿去买些苹果和草莓。可是，外面很冷，

wǒ hái shì zài jiā kàn diànshì suàn le.

我还是在家看电视算了。

## Appendix H

### Recording Script for Confucius Teacher's Program Level 1 after Training

Xiǎo lì, jīn tiān huí jiā chī fàn ma ?

A: 小丽, 今天回家吃饭吗?

Bù huí jiā le, wǒ xià wǔ qù běijīng kāi huì

B: 不回家了, 我下午去北京开会。

Hǎo de xiǎo míng yě bú zài jiā nà wǒ bú zuò cài le nǐ shénme shíhòu huílái

A: 好的, 小明也不在家, 那我不做菜了。你什么时候回来?

Xīngqīyī ba wǒ yì kāi wán huì jiù huílái

B: 星期一吧, 我一开完会就回来。

Nǐ néng bang wǒ mǎi diǎnr dōngxi huí lái ma

A: 你能帮我买点东西回来吗?

Kěyǐ a nǐ xiǎng yào shénme

B: 可以啊, 你想要什么?

Bang wǒ mǎi diǎnr běijīng guǒfǔ ba zài mǎi yí kuài guǒ rén gāo

A: 帮我买点北京果脯吧。再买一块果仁糕。

Méi wèn tí zhōu yī jiàn

B: 没问题, 周一见。

Běijīng bú rè yào duō dài diǎnr yīfu

A: 北京不热, 要多带点衣服。

Huì de xièxie

B: 会的, 谢谢。

## Appendix I

### Recording Script for Confucius Teacher's Program Level 3 before Training

Fúwùyuán, wǒ men zhè shǎo le yì shuāng kuàizi hé yíge wǎn, hái yǒu, bǎ cài dān yě ná guò lái

A: 服务员,我们这少了一双筷子和一个碗,还有,把菜单也拿过来,

Wǒ men yào zài diǎn liǎng ge cài.

我们要再点两个菜。

Bié diǎn le, lái bù jí le. Bǐ sài hái yǒu yíhuìr jiù kāishǐ le. Zài shuō, cài yǐ jīng gòu le

B: 别点了,来不及了。比赛还有一会儿就开始了。再说,菜已经够了。

Wǒ tīng shuō zhèr de hóng shāo ròu hěn hǎo chī, nǐ bú shì zuì ài chī le ma?

A: 我听说这儿的红烧肉很好吃,你不是最爱吃了吗?

Kě wǒ yǐ jīng chī bǎo le, hái shì bié chí dào le

B: 可我已经吃饱了,还是别迟到了。

Bǐ sài shuō shì bā diǎn kāi shǐ, kě měi cì dōu yào kàn hěn cháng shí jiān de guǎng gào

A: 比赛说是8点开始,可每次都要看很长时间的广告,

Gū jì bā diǎn bàn cái néng zhēn zhèng kāi shǐ

估计8点半才能真正开始。

hǎo ba, bú guò wǒ bù xiǎng chī hóng shāo ròu, tài nì le

B: 好吧,不过我不想吃红烧肉,太腻了。

Má pódòufu yě bú cuò

A: 麻婆豆腐也不错。

en nà jiù má pó dòufu ba kuài diǎnr chī, zuì hǎo bú yào chí dào

B: 嗯,那就麻婆豆腐吧。快点儿吃,最好不要迟到。

Méi wèn tí de, nǐ bié dān xīn le

A: 没问题的,你别担心了。

## Appendix J

### Recording Script for Confucius Teacher's Program Level 3 after Training

wǒ yǒu yì zhī gǒu hé yì zhī māo māo yǐ jīng sān suì le, gǒu hái zhǐ yǒu liǎng suì  
我有一只狗和一只猫。猫已经三岁了，狗还只有两岁。

Māo bǐ gǒu dà yì suì māo yì suì de shí hòu wǒ yǎng le zhè zhī gǒu  
猫比狗大一岁。猫一岁的时候我养了这只狗。

Nà shí shòu gǒu hái hěn xiǎo māo yì diǎn yě bú pà gǒu dàn shì gǒu bǐ māo zhǎng dé kuàidéduō  
那时候，狗还很小。猫一点也不怕狗，但是，狗比猫长得快得多。

Xiàn zài gǒu shì māo de sān bèi dà māo kàn jiàn gǒu jiù jué dé hài pà  
现在，狗是猫的三倍大。猫看见狗就觉得害怕。

Yǒu yì tiān wǒ chū mén le māo hé gǒu dān dú zài jiā wǒ huí jiā de shí hòu yǐ jīng shì wǎn shàng le  
有一天，我出门了，猫和狗单独在家。我回家的时候已经是晚上了。

Wǒ zěn me yě zhǎo bú dào māo wǒ dào chù zhǎo zhōng yú zài mén wài de shù shàng  
我怎么也找不到猫，我到处找，终于在门外的树上  
zhǎo dào le māo Kě shì tā zì jǐ xià bù lái shí yī yuè de běi jīng hěn lěng wǒ pà māo zhāo liáng  
找到了猫。可是他自己下不来。十一月的北京很冷，我怕猫着凉。

zhǐ hǎo zhǎo xiāo fáng yuán bǎ tā cóng shù shàng jiù xià lái  
只好找消防员把他从树上救下来。

Wǒ xiàn zài zhēn de bù zhī dào zěn me cái néng ràng tā men yǒu hǎo xiāng chǔ  
我现在真的不知道怎么才能让他们友好相处。

Nǐ yǒu shén me zhǔ yì ma?  
你有什么主意吗?

你有什么主意吗?





## What are the most popular languages in the world?



## What is TONE in a language?

- Tone is pitch, all languages use pitch for various linguistic purposes such as intonation
- Depending on if pitch is used to distinguish a word's meaning, languages can be categorized as tonal and non-tonal languages.
- Chinese is a tonal language, while English is a non-tonal language.



# Importance of Mandarin Chinese Tones

[https://www.youtube.com/watch?v=fexT1A3BQ\\_w](https://www.youtube.com/watch?v=fexT1A3BQ_w)

- dà mǎ (大马, big horse) vs. dà má (大麻, marijuana)
- The overall average production accuracy is 60-70 percent for intermediate learners



## Four Lexical Chinese Tones

Tone	Description	Tone depicted in Pinyin	Pinyin example	Meaning
1 <sup>st</sup>	high and level	—	mā	mother
2 <sup>nd</sup>	rising	/	má	hemp
3 <sup>rd</sup>	falling and rising	∨	mǎ	horse
4 <sup>th</sup>	falling and stressing	\	mà	admonish



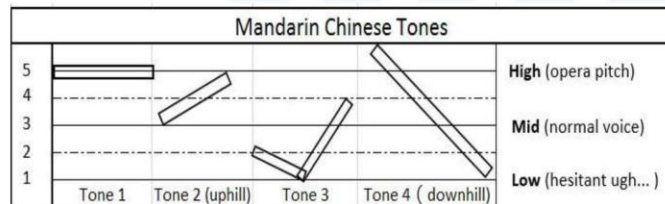
## Find Your Own Pitch Range

- Opera sound
- Hesitant Ugh sound



West Virginia University

### Teaching Model



West Virginia University

### Tone Sandhi Rules and Strategy (T3)

- Two 3<sup>rd</sup> tones in a row, the first one becomes 2<sup>nd</sup> tone. e.g.  
你好 (*nǐ + hǎo = ní hǎo*)
- T3 is a low-dipping tone when followed by any other tones than another T3.



### Tone Sandhi Rules and Strategy (一 and 不)

- <http://politics.people.com.cn/n1/2017/1013/c1001-29584490.html>
- 不 (*bù*) is 4<sup>th</sup> tone except when followed by another 4<sup>th</sup> tone, when it becomes 2<sup>nd</sup> tone. e.g. 不对 (*bù+duì = bú duì*)
- 一 (*yī*) is
  - \* 1<sup>st</sup> tone when it represents the ordinal "first". e.g. 第一个 (*dìyīgè*).
  - \* 2<sup>nd</sup> tone when followed by a 4<sup>th</sup> tone, e.g. 一个 (*yī + gè = yí gè*), 一次 (*yī + cì = yí cì*), 一半 (*yī + bàn = yí bàn*), 一会儿 (*yī + huìr = yí huìr*).
  - \* 4<sup>th</sup> tone when followed by any other tones (T1, 2, 3). e.g. 一般 (*yī + bān = yì bān*), 一毛 (*yī + máo = yì máo*). Yí qí





## Practice

Nǐhǎo, wǒ jiào wǒ shì lǎo shī, hěn gāo xìng rènshi nǐ Wǒ hěn xǐ huān xué zhōng wén

你好, 我叫-----我是老师, 很高兴认识你。我很喜欢学中文。

xué zhōng wén hěn nán, dàn shì wǒ huí jiā yì yǒu shí jiān jiù fù xí

学中文很难, 但是我回家一有时间就复习。



## Practice

Wǒ yí kàn jiàn zhōng guó rén jiù dǎ zhāohu

我一看见中国人就打招呼。

Kāi xué dì yī tiān, wǒ gēn yí ge zhōng guó xué shēng shuō nǐ hǎo, tā bù lǐ wǒ.

开学第一天, 我跟一个中国学生说你好, 她不理我。

Hòu lái wǒ cái zhī dao tā bú shì zhōng guó rén, tā shì rì běn rén

后来我才知道她不是中国人, 她是日本人。



## Practice

Wǒ xiǎng yíhuìr qù mǎi xiē píng guǒ hé cǎo méi Kě shì, wàimian hěn lěng

我 想 一 会 儿 去 买 些 苹 果 和 草 莓。可 是，外 面 很 冷，

wǒ hái shì zài jiā kàn diànshì suàn le

我 还 是 在 家 看 电 视 算 了。



míng tiān xīng qī liù nǐ qù xué xiào ma

A: 明 天 星 期 六，你 去 学 校 吗？

wǒ qù xué xiào

B: 我 去 学 校。

Nǐ qù xué xiào zuò shénme

A: 你 去 学 校 做 什 么？

Wǒ qù xué xiào kàn shū

B: 我 去 学 校 看 书。



míng tiān xīng qī liù      nǐ qù xué xiào ma  
A: 明 天 星 期 六, 你 去 学 校 吗?

wǒ qù xué xiào  
B: 我 去 学 校。

nǐ qù xué xiào zuò shénme  
A: 你 去 学 校 做 什 么?

wǒ qù xué xiào kàn shū  
B: 我 去 学 校 看 书。



### Lesson Plan for a Chinese Tone Training Session (30M)

Minutes	Procedures	Tools	Considerations
2	Introduction to Chinese tones	PPT, Video	Raise consciousness to tones
8	Intro of tonal shape and pitch	Tonal map, gestures	Concept about 4 tones
5	Find pitch range	Tonal map, demo	Locate highest, mid, and lowest
5	Practice each tone	PPT, tonal map	Focus on pitch register/shape
5	Tone sandhi rules (yi/bu/T3)	PPT, demo	Treat T3 as low, yi/bu variation
5	Written/coloring practice	PPT, color markers	Learning by doing





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## Questions/Discussion

Thank you!