



Analysis of Third Tone Pronunciation Errors in Chinese Language Education Students

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ABSTRACT

Mandarin Chinese phonetics consists of initials, finals, and tones. Among these components, tones are considered the most difficult for learners because they distinguish meaning through pitch variations. Of the four Mandarin tones, the third tone is often regarded as the most challenging due to its complex pronunciation and tone sandhi rules. This study analyzes third-tone pronunciation errors among Chinese Language Education students in the 2022 cohort at Tanjungpura University. The research employed a quantitative approach using tests and questionnaires. Test data were analyzed using Praat software to assess pronunciation accuracy, while questionnaires identified factors influencing pronunciation errors. The results show that, out of seven tone combinations, five had error rates above 50%, namely (third tone + third tone) + third tone, third tone + (third tone + third tone), (third tone + third tone), (third tone + second tone), and (third tone + neutral tone). These findings indicate that students have not yet mastered third-tone pronunciation. Furthermore, questionnaire results reveal that the main cause of errors is an insufficient understanding of third-tone sandhi rules. The similarity between the second and third tones also contributes to students' confusion. These linguistic difficulties are further influenced by first-language interference and a lack of consistent practice in spoken Mandarin. Overall, the findings suggest that students' difficulties in producing the third tone are related not only to theoretical understanding but also to practical application in communication. Therefore, Mandarin teaching should place greater emphasis on systematic practice of third-tone sandhi rules in communicative contexts. Increasing students' exposure to spoken Mandarin and providing more pronunciation practice may help improve pronunciation accuracy and overall fluency in Mandarin phonetics.

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■ INTRODUCTION

Language is the primary means of human communication, enabling individuals to express ideas, thoughts, and emotions while interacting with others. In second language learning, successful communication depends not only on learners' grammatical and lexical knowledge but also on accurate pronunciation. Differences between the phonological systems of the first language and the target language often create challenges in speech perception and production, making pronunciation one of the most difficult aspects of second language acquisition (Hao & de Jong, 2016; Pelzl, 2019).

In spoken communication, pronunciation plays a crucial role in conveying meaning accurately. Unlike many non-tonal languages, Mandarin Chinese is a tonal language in which

lexical meaning is determined by pitch variations. Consequently, inaccurate tone production may alter word meanings and hinder communication. Previous studies have shown that Mandarin lexical tones remain one of the greatest challenges for second-language learners, particularly because learners often have difficulty perceiving and producing tonal contrasts accurately (Pelzl, 2019).

Mandarin Chinese has a distinctive phonological system in which each syllable consists of three fundamental components: an initial consonant (*shēngmǔ*), a final (*yùnmǔ*), and a lexical tone (*shēngdiào*). Unlike segmental sounds, lexical tones are suprasegmental features that function to distinguish the meanings of words sharing the same initials and finals but differing in pitch

contours. Therefore, accurate production of lexical tones is essential to Mandarin pronunciation because incorrect tone realization may change lexical meaning and reduce communicative effectiveness (Gao et al., 2019; Chen et al., 2022).

In learning a language, the first important step is mastering phonetics. Phonetics refers to the sounds produced by human speech organs that convey meaning (Ding & Rong, 2012). However, not all human-produced sounds are phonetic; for example, coughing or groaning does not carry linguistic meaning. In Mandarin, learners are introduced to 声母 (*shēngmǔ*) and 韵母 (*yùnmǔ*) early to help distinguish consonants and vowels (Setiawati & Amri, 2020). In addition, effective pronunciation learning requires learners to accurately perceive, imitate, and produce speech sounds, as these processes are closely related to successful second-language speech acquisition (Hao & de Jong, 2016). For Mandarin learners, phonetic competence also includes the ability to perceive and produce lexical tones accurately, since tone perception and production are fundamental to intelligible spoken communication (Pelzl, 2019).

Among the three phonetic components of Mandarin Chinese, lexical tones are considered the most distinctive feature because they determine lexical meaning. Mandarin has four lexical tones: the first tone (*yīnpíng*), second tone (*yángpíng*), third tone (*shǎngshēng*), and fourth tone (*qùshēng*). A single syllable may have different meanings depending on its tone (Kusumawardhani et al., 2015). Therefore, accurate tone production is essential for effective communication, as incorrect tone usage may lead to misunderstanding (Henry & Eryc, 2024). Many learners struggle to master Mandarin tones, especially the third tone, because of its complex pronunciation and the application of tone sandhi rules (Lan & Xing, 2013).

Among the four Mandarin lexical tones, the third tone (*shǎngshēng*) is widely recognized as the most challenging for second language learners because its pronunciation changes depending on the phonological context through tone sandhi. Recent experimental and cognitive studies have further confirmed the complexity of Mandarin tone sandhi acquisition. Tang et al. (2019) investigated Mandarin tone sandhi acquisition among 108 children aged 3–5 years and 33 adults. The findings showed that even young learners could acquire and apply tone sandhi rules in disyllabic contexts; however, difficulties remained in more complex trisyllabic structures, indicating that tone sandhi

acquisition develops gradually as prosodic complexity increases.

Chen et al. (2022) conducted an EEG study on Mandarin third tone sandhi production. The study found that different cognitive stages are involved in tone sandhi processing. The abstract tonal category is activated during early phonological encoding, while the surface tonal form emerges during later phonetic or motor planning stages. These findings indicate that third tone sandhi is not only a phonetic phenomenon but also involves complex cognitive processing in speech production.

Studies on second language learners have further demonstrated that acquiring Mandarin lexical tones remains challenging despite increased language proficiency. Xi et al. (2021) investigated the categorical perception of Mandarin lexical tones among highly proficient second-language learners and found that, although learners showed improved perception accuracy, they still had difficulty distinguishing tonal contrasts compared with native speakers.

Similarly, Han & Tsukada (2020) examined the lexical representation of Mandarin tones among advanced second-language learners and reported that learners could encode tonal contrasts in their mental lexicon; however, they still differed from native speakers in using tonal information during spoken word recognition. These findings indicate that mastering Mandarin lexical tones requires not only accurate pronunciation but also efficient perceptual and cognitive processing, highlighting the persistent challenges second-language learners face.

Wiener et al. (2020) investigated Mandarin tone perception among second-language learners and found that learners relied on both acoustic input and phonological knowledge when processing tonal contrasts. The findings suggest that tone acquisition involves not only auditory perception but also cognitive processing, which may contribute to pronunciation difficulties. Similarly, Pelzl et al. (2019) examined Mandarin tone perception among advanced second-language learners and found that tonal contrasts, particularly those involving similar pitch contours, remained difficult even at higher proficiency levels. This indicates that mastering Mandarin tones requires extensive exposure and practice beyond general language proficiency. Chen et al. (2019) examined the mechanisms of Mandarin tone sandhi application among tonal and non-tonal second-language learners. The study showed that first-language background influences learners' ability to apply tone sandhi rules, although learners from different

linguistic backgrounds demonstrated similar patterns in acquiring third-tone alternation. These findings reinforce the argument that pronunciation errors in Mandarin tones are affected not only by phonetic complexity but also by language transfer and cognitive processing factors.

Wang et al. (2020) investigated Mandarin tone perception among learners with different levels of Mandarin experience. Their findings demonstrated that learners' sensitivity to tonal contrasts improved with increased exposure and learning experience. Nevertheless, Mandarin tones remained challenging for second-language learners, indicating that tone acquisition requires extensive perceptual and productive practice. Similarly, Tsukada and Idemaru (2022) examined Mandarin tone perception among learners from English- and Japanese-speaking backgrounds. The results showed that both first-language background and learning experience significantly influenced learners' ability to perceive Mandarin tones. In particular, distinctions involving the second and third tones remained difficult for many learners, highlighting the influence of linguistic experience on tone acquisition.

Despite these international findings, pronunciation difficulties related to the Mandarin third tone continue to appear among learners in different educational contexts, including in Indonesia. Previous studies show that learners often struggle to master Mandarin tones, particularly the pronunciation and tonal changes of the third tone (Xiao, 2020; Li, 2023). One of the main challenges is pronouncing the third tone and its tone sandhi. The third tone is considered difficult because it is perceptually similar to the second tone, which often confuses learners. In addition, the third tone undergoes tone sandhi. When two third tones occur consecutively, the first third tone changes into a rising tone similar to the second tone. For example, in 鼓掌 (*gǔzhǎng*, "to applaud"), the first syllable 鼓 is pronounced with a rising tone, equivalent to the second tone, in actual speech. This tonal change frequently becomes a major source of difficulty in learning Mandarin pronunciation.

Several previous studies have shown that third tone pronunciation remains a persistent difficulty for learners. Xiao Ling (2020), in a study of Thai learners, found that third-tone sandhi errors were influenced by negative transfer from the mother tongue, insufficient understanding of tonal rules, cultural communication factors, and limited emphasis on tone instruction. Similarly, Li Fan (2023) reported that Indonesian intermediate learners

frequently confused the third tone with the second tone and experienced difficulties applying tone sandhi in both disyllabic and trisyllabic structures. In contrast, advanced learners demonstrated better but still incomplete mastery.

Other studies conducted in Indonesia also confirm that university students still experience significant difficulties in pronouncing Mandarin tones, especially the third tone, due to insufficient understanding, language interference, and limited learning duration (Anggraeni & Wibisono, 2020; Kadarwati, 2017). These findings indicate that third-tone acquisition remains challenging across different learner groups. Based on these findings, third-tone pronunciation remains a persistent problem among Mandarin learners, particularly at the university level. Therefore, the researcher selected students of the Chinese Language Education Study Program, cohort of 2022, at Universitas Tanjungpura as the subjects of this study.

Although previous studies have investigated Mandarin third-tone acquisition among learners from different countries and educational levels, they have primarily relied on descriptive analysis to examine pronunciation errors. In contrast, the present study uses Praat software to conduct acoustic analysis of pitch contours generated from students' speech recordings, providing more objective, measurable evidence of the accuracy of Mandarin third-tone pronunciation. In particular, research focusing on students of the Chinese Language Education Study Program at Universitas Tanjungpura remains limited. Therefore, this study contributes by examining third-tone pronunciation errors among Indonesian university students through acoustic analysis using Praat software, enabling objective measurement of pronunciation patterns and providing empirical evidence on the factors influencing third-tone pronunciation difficulties.

The present study is guided by the following research questions:

1. What are the patterns of third tone pronunciation errors among students of the Chinese Language Education Study Program, cohort of 2022?
2. What factors influence third tone pronunciation errors among students of the Chinese Language Education Study Program, cohort of 2022?

■ METHOD

Research Design

This study used a quantitative descriptive research design to analyze third-tone

pronunciation errors among university students. The study focused on identifying error patterns and determining factors influencing pronunciation accuracy in Mandarin tone production. Quantitative research involves systematic data collection and statistical analysis to describe phenomena and test research objectives (Sugiyono, 2018). It is also grounded in deductive reasoning and utilizes descriptive statistical techniques to interpret data (Khalid et al., 2012). This design was selected because it allows the researcher to obtain objective, measurable data on students' pronunciation performance.

Participants

The subjects of this study were 27 students from the Chinese Language Education Study Program, class of 2022, at Universitas Tanjungpura, consisting of 13 students from Class A and 14 students from Class B, including 5 male students and 22 female students.

Before data collection, the researcher obtained permission from the Chinese Language Education Study Program and an official research permit from Universitas Tanjungpura. Students were then contacted individually and informed about the objectives and procedures of the study, including the voice-recording process. Participation was voluntary, and all participants agreed to take part in the pronunciation test and voice-recording session before data collection began. The recorded data were used solely for research purposes and were kept confidential throughout the study.

Table 1 presents the demographic characteristics of the participants. All participants belonged to the same academic cohort and were enrolled in the same semester at the time of data collection. However, their ethnic backgrounds and Mandarin learning

Table 1. Demographic characteristics of the participants

Variable	Category	Number of students
Gender	Male	5
	Female	22
Age	20–21 years	27
Semester	5	27
Mother Tongue (L1)	Chinese local languages (Hakka and Teochew)	16
	Indonesian	11
Mandarin Learning	< 3 years	14
Duration	≥ 3 years	13

experience varied. As shown in Table 1, the participants shared relatively similar demographic and academic characteristics, as they were within a similar age range and belonged to the same cohort and semester level. However, differences were observed in their first-language (L1) backgrounds and duration of learning Mandarin. These differences may contribute to individual variation in Mandarin third-tone pronunciation performance.

Instruments

Two instruments were used in this study: a pronunciation test and a questionnaire. The pronunciation test consisted of 21 items representing seven third-tone combinations, namely (third tone + first tone), (third tone + second tone), (third tone + third tone), (third tone + fourth tone), (third tone + neutral tone), (third tone + third tone) + third tone, and third tone + (third tone + third tone). Each tone combination was represented by three test items. The test items were selected from Mandarin learning materials that participants had previously studied in their coursework. Before data collection, a lecturer in the Chinese Language Education Study Program reviewed the test instrument to ensure the vocabulary and tone combinations were appropriate for the study.

The second instrument was a questionnaire consisting of 15 items developed by the researcher to identify the factors influencing students' errors in pronouncing the Mandarin third tone. The questionnaire was constructed based on Zhou's (2014) error analysis theory, which categorizes language errors into interlingual errors, intralingual errors, and training errors. Accordingly, the questionnaire items were developed to address three main aspects: first-language interference, learners' understanding of the third-tone and tone sandhi rules, and learning- and teaching-related factors. Before data collection, a lecturer in the Chinese Language Education Study Program reviewed the questionnaire to assess each item's relevance to the research objectives, the clarity of the wording, and the appropriateness of the content. Revisions were made based on the feedback before the questionnaire was administered to the participants.

Data Analysis

The pronunciation test was conducted individually. During data collection, the researcher recorded each participant's pronunciation using Praat software installed on the researcher's laptop and connected to a headset microphone. Participants were invited

one by one to complete the pronunciation test while their voices were being recorded. The recordings were saved in WAV format at a sampling rate of 44.1 kHz, with a 16-bit sample size and a mono channel configuration. To minimize background noise and prevent interference from external sounds, all recording sessions were conducted in a quiet room. The recorded audio files were subsequently analyzed using Praat software to observe the pitch contours produced by the participants and identify pronunciation errors in third-tone combinations.

The test data were then analyzed quantitatively to determine the percentage of errors in each tone combination, while the questionnaire results were analyzed using simple percentage calculations. All research findings were presented in tables, figures, and descriptions to explain patterns in students' pronunciation errors. In the final stage, all data were analyzed descriptively in order to draw conclusions that address the research questions.

■ RESULTS AND DISCUSSION

The Results and Discussion section is organized according to the research questions and the sequence of data analysis. The first part presents the patterns of third-tone pronunciation errors identified through pronunciation tests and acoustic analysis using Praat software. This section focuses on the error rates across different tone combinations and the distribution of pronunciation difficulties. The second part discusses the factors contributing to students' third-tone pronunciation errors based on questionnaire responses. By integrating the findings from both the pronunciation tests and questionnaires, this section provides a comprehensive

understanding of the challenges students encounter in accurately producing Mandarin third tones.

Third-Tone Pronunciation Error Patterns

Figure 1 shows that students experienced varying levels of difficulty across the seven third-tone combinations. In general, combinations containing consecutive third tones tended to produce the highest error rates, indicating that tone sandhi involving multiple third tones remains a major challenge for learners. The greatest difficulties were observed in combinations that required pronouncing three consecutive third tones or the interaction between a third tone and an embedded third-tone sequence. In contrast, combinations involving the first and fourth tones were associated with substantially lower error rates, suggesting that students were better able to distinguish and produce these tonal patterns. Overall, the findings indicate that students' third-tone pronunciation difficulties are concentrated in complex tonal environments rather than being evenly distributed across all tone combinations.

While Figure 1 illustrates the overall distribution of error rates across the seven third-tone combinations, a more detailed analysis is needed to understand how students produced these tonal patterns. Therefore, an acoustic analysis was conducted using Praat software to examine the pitch contour patterns underlying the students' pronunciation errors.

To further investigate the characteristics of these pronunciation errors, the seven third-tone combinations were analyzed using measurements obtained from Praat. Praat is widely used in phonetic research to analyze various aspects of speech, including vowels,

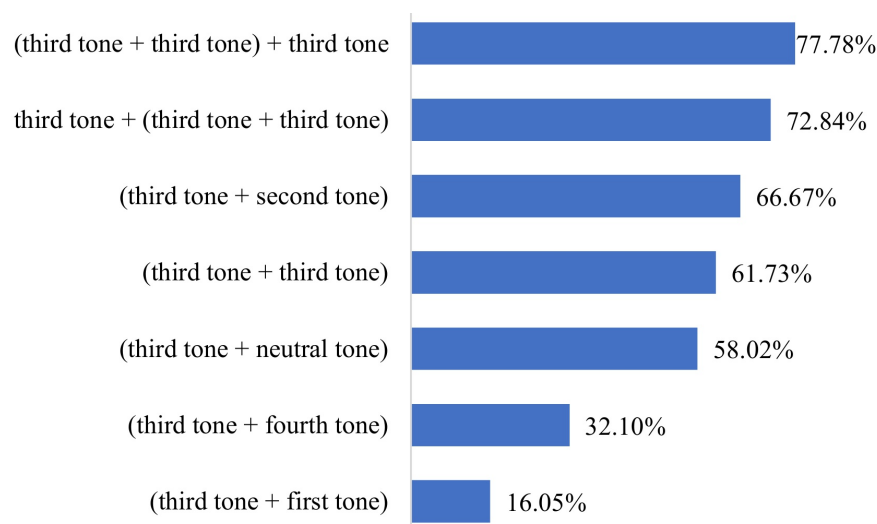


Figure 1. Error rates of third tone pronunciation in different tone combinations

consonants, intonation, tone, and duration (Hassan, 2015). In this study, the students' speech recordings were processed using Praat to generate pitch contour patterns. These contour patterns represent the rise and fall of tones in Mandarin Chinese and enabled the researcher to evaluate the extent to which the students' pronunciations corresponded to the standard tonal patterns. Since variations in pitch and frequency can be measured acoustically, Praat provides an objective basis for identifying and analyzing pronunciation errors (Heryono, 2019).

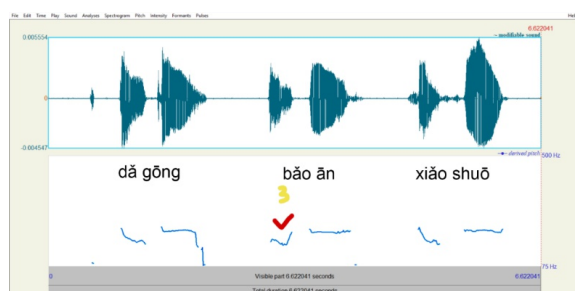


Figure 2. Pitch contour patterns of the third tone + first tone combination produced by students.

Based on Figure 2, when the third tone is combined with the first tone in the pattern (third tone + first tone), the third tone should not be pronounced in its full citation form but rather as a half-third tone, as illustrated by the pitch contour patterns of the words *dǎ gōng* and *xiǎo shuō*. However, the most common error students made was pronouncing the third tone in its full citation form, as shown in the pitch contour pattern of the word *bǎo ān*. The comparison between these contour patterns indicates that accurate pronunciation is characterized by realizing the third tone as a half-third tone. In contrast, inaccurate pronunciation tends to retain the complete falling-rising contour of the citation form.

This error may be attributed not only to the students' limited understanding of the phonological rules governing the Mandarin third tone but also to the phonetic complexity

of third-tone production. Unlike the other Mandarin tones, the third tone involves a falling-rising pitch contour in its citation form, requiring precise control of pitch movement and coordination during articulation. In connected speech, however, the third tone preceding a first tone is typically realized as a half-third tone, in which the rising portion of the contour is omitted. Many students appeared to rely on the citation form learned in isolation and consequently maintained the complete falling-rising pitch contour instead of reducing it before transitioning to the following first tone. This tendency suggests that the students experienced difficulty adapting the phonetic realization of the third tone to its contextual pronunciation, resulting in the retention of the full citation contour in environments where a reduced form was required.

Based on Figure 3, when the third tone is combined with the second tone in the pattern (third tone + second tone), the third tone should be realized as a half-third tone, while the second tone remains unchanged. Figure 3 compares the pitch contour patterns produced by students with accurate and inaccurate pronunciation. The comparison shows that the accurate pronunciation follows the expected tonal contour. In contrast, the inaccurate pronunciation retains the third tone in its full citation form and deviates from the expected third tone + second tone pattern. An additional deviation was also observed in the pronunciation of *guǒ rán*, where the resulting contour did not conform to the expected tonal realization.

This error may relate to students' limited understanding of the phonological realization of the Mandarin third tone in connected speech, as well as the phonetic complexity of adjusting pitch movement across consecutive tones. Many students appeared to rely on the citation form of the third tone learned in isolation and consequently retained the complete falling-rising contour instead of reducing it to the expected half-third tone before transitioning to the following second tone. As a result, the tonal

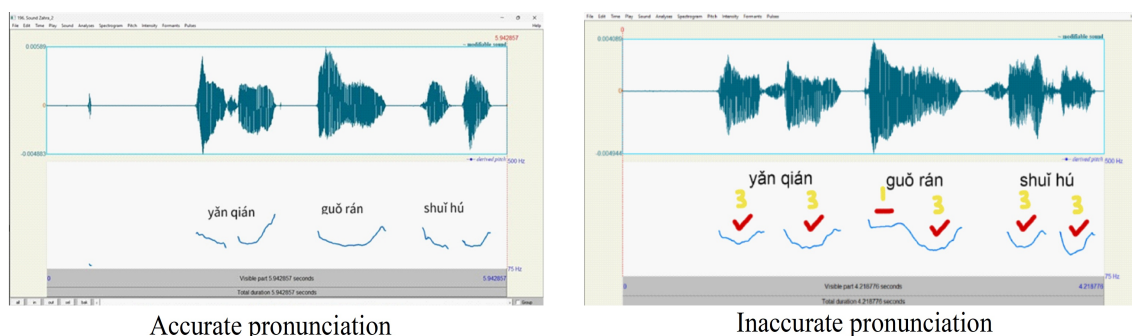


Figure 3. Comparison of pitch contours in the third tone + second tone combination

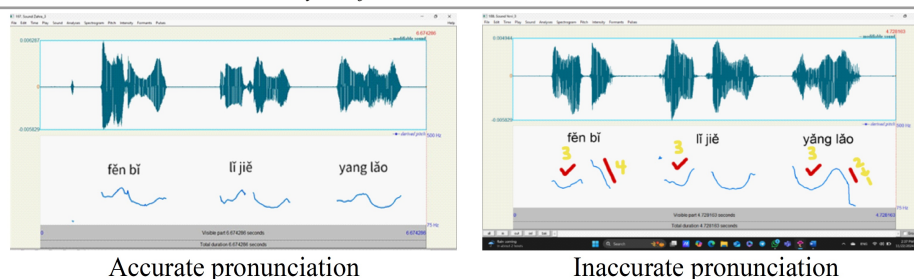


Figure 4. Comparison of pitch contours in the third tone + third tone combination

transition between the third and second tones was not appropriately realized, indicating difficulty in adapting the phonetic realization of the third tone to its contextual pronunciation. These findings suggest that the students had not yet fully mastered the contextual variation of the Mandarin third tone and the application of tone sandhi rules in continuous speech.

Based on Figure 4, when the third tone is combined with another third tone in the pattern (third tone + third tone), the first third tone should undergo third-tone sandhi and be realized as a second tone, while the second third tone remains unchanged. Figure 4 compares the pitch contour patterns produced by students with accurate and inaccurate pronunciation. The comparison shows that the accurate pronunciation follows the expected third-tone sandhi pattern, whereas the inaccurate pronunciation retains the original full third-tone contour in the first syllable. As a result, the produced contour deviates from the expected tonal realization.

This error may be related not only to the students' limited understanding of the phonological realization of the Mandarin third tone in connected speech but also to the difficulty of modifying the pitch contour required by the third-tone sandhi rule. Many students appeared to rely on the citation form of the third tone learned in isolation and consequently maintained the complete falling-rising contour instead of changing the first third tone into a rising contour similar to the second tone. As a result, the tonal transition between the two consecutive third tones did not conform

to the expected sandhi pattern. Although this tonal combination is frequently encountered in everyday Mandarin communication, many students still failed to adapt the phonetic realization of the first third tone to its contextual form. These findings indicate that the students had not yet fully mastered applying the third-tone sandhi rule in continuous speech.

Based on Figure 5, when the third tone is combined with the fourth tone in the pattern (third tone + fourth tone), the third tone should not be pronounced in its full citation form but should instead be realized as a half-third tone, as shown in the pitch contour pattern of the word *jǔ bàn*. However, many students pronounced the third tone in its full citation form, as observed in the pitch contour patterns of the words *kǎo lǔ* and *guǎng gào*. The comparison between these pitch contour patterns indicates that accurate pronunciation is characterized by realizing the third tone as a half-third tone before the fourth tone. In contrast, inaccurate pronunciation tends to retain the complete falling-rising contour of the citation form.

This error may relate not only to students' limited understanding of the phonological realization of the Mandarin third tone in connected speech but also to the phonetic complexity of adjusting the pitch contour before a following fourth tone. Many students appeared to rely on the citation form of the third tone learned in isolation and consequently maintained the complete falling-rising contour instead of reducing it to the expected half-third tone. As a result, the transition from the third tone to the following fourth tone did not conform to the expected contextual pronunciation. These findings suggest that the students had not yet fully mastered the contextual realization of the Mandarin third tone in continuous speech.

Based on Figure 6, when the third tone is combined with a neutral tone in the pattern (third tone + neutral tone), the third tone should be realized as a half-third tone rather than its full citation form. Figure 6 compares the pitch contour patterns produced by students with

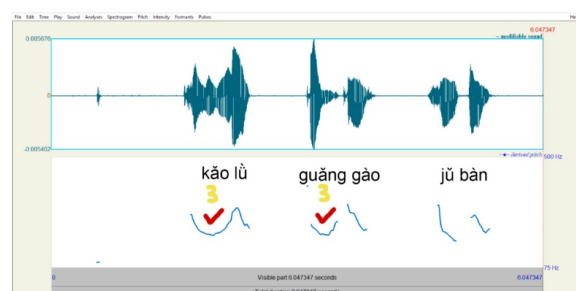


Figure 5. Pitch contour patterns of the third tone + fourth tone combination produced by students

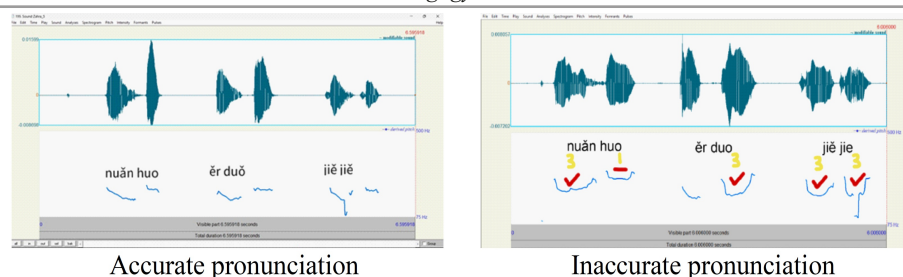


Figure 6. Comparison of pitch contours in the “third tone + neutral tone” combination

accurate and inaccurate pronunciation. The comparison shows that the accurate pronunciation follows the expected tonal contour by realizing the third tone as a half-third tone before the neutral tone. In contrast, the inaccurate pronunciation retains the original full third-tone contour, as observed in the words *nuǎn huo* and *jiě jie*. These contour differences indicate that many students experienced difficulty in applying the contextual realization of the Mandarin third tone before a neutral tone.

This error may be related not only to the students' limited understanding of the phonological realization of the Mandarin third tone in connected speech but also to the phonetic difficulty of adjusting the pitch contour before a following neutral tone. Many students appeared to rely on the citation form of the third tone learned in isolation and consequently maintained the complete falling-rising contour instead of reducing it to the expected half-third tone. As a result, the transition from the third tone to the neutral tone did not conform to the expected contextual pronunciation. These findings suggest that the students had not yet fully mastered the contextual variation of the Mandarin third tone in continuous speech.

Based on Figure 7, when three consecutive third tones occur in the pattern “(third tone + third tone) + third tone,” the first two syllables carrying the third tone should change into second tones because these two syllables are closely connected. In contrast, the final syllable remains pronounced as a third tone. Figure 7 compares the pitch contour patterns of accurate and inaccurate

pronunciation. The comparison shows that the accurate pronunciation follows the expected third-tone sandhi pattern, whereas the inaccurate pronunciation deviates from the expected tonal realization. In the inaccurate pronunciation, the first syllable was produced with a contour resembling the first tone instead of the expected second tone, resulting in a contour pattern that differed from the standard realization.

This combination showed the highest percentage of pronunciation errors among all tone combinations analyzed. The errors may be attributed not only to the students' limited understanding of the phonological realization of consecutive third tones in connected speech but also to the increased phonetic complexity of producing multiple pitch adjustments within a single tonal sequence. Unlike combinations involving only two tones, this pattern requires the speaker to apply successive third-tone sandhi while maintaining smooth pitch transitions across three consecutive syllables. Many students appeared to rely on the citation form of the third tone learned in isolation rather than modifying the pitch contour according to the contextual pronunciation rules. As a result, the expected sequential tonal changes were not appropriately realized, indicating that the students had not yet fully mastered the application of third-tone sandhi in longer tonal sequences.

Based on Figure 8, when three consecutive third tones occur in the pattern “third tone + (third tone + third tone),” the first syllable carrying the third tone should be realized as a half-third tone, while in the final two closely connected syllables, the first third

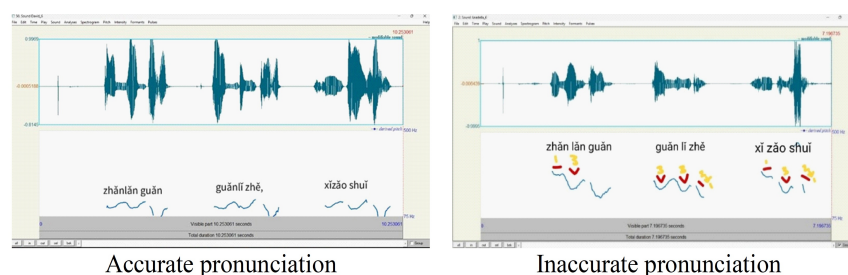


Figure 7. Comparison of pitch contours in the (third tone + third tone) + third tone combination

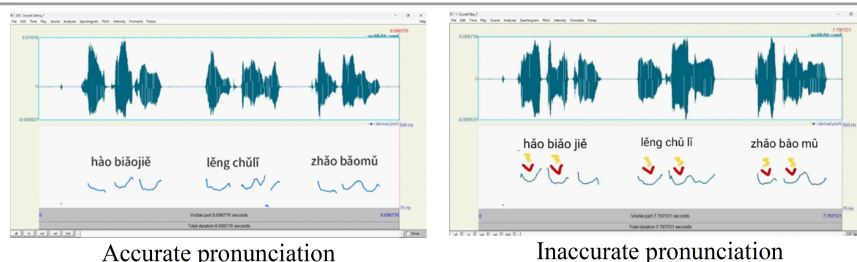


Figure 8. Comparison of pitch contours in the third tone + (third tone + third tone) combination

tone should undergo third-tone sandhi and be realized as a second tone, whereas the final syllable remains pronounced as a third tone. Figure 8 compares the pitch contour patterns of accurate and inaccurate pronunciation. The comparison shows that the accurate pronunciation follows the expected tonal realization of this combination. In contrast, the inaccurate pronunciation retains the original full third-tone contour in the first two syllables, resulting in a pitch contour pattern that deviates from the expected tonal realization.

This combination showed the second-highest percentage of pronunciation errors among all tone combinations analyzed. The errors may be attributed not only to the students' limited understanding of the phonological realization of consecutive third tones in connected speech but also to the increased phonetic complexity of coordinating two different contextual tonal changes within a single tonal sequence. Unlike two-syllable combinations, this pattern requires the speaker to reduce the first third tone to a half-third tone while simultaneously applying third-tone sandhi to the following syllable. Many students appeared to rely on the citation form of the

third tone learned in isolation rather than modifying the pitch contour according to the contextual pronunciation rules. Consequently, the first third tone was not reduced to a half-third tone, and the following third tone did not undergo the required sandhi process. These findings indicate that the students had not yet fully mastered the contextual realization of multiple consecutive third tones in continuous speech.

Factors Contributing to Third-Tone Pronunciation Errors.

Based on the pronunciation analysis presented in the previous section, students still had difficulty producing the Mandarin third tone accurately, and many exhibited similar pronunciation errors. To further investigate the factors contributing to these errors, a questionnaire was administered. The questionnaire responses were categorized into three dimensions: interlingual errors, intralingual errors, and training-related errors. The following sections discuss each category by examining the distribution of participants' responses for each questionnaire item.

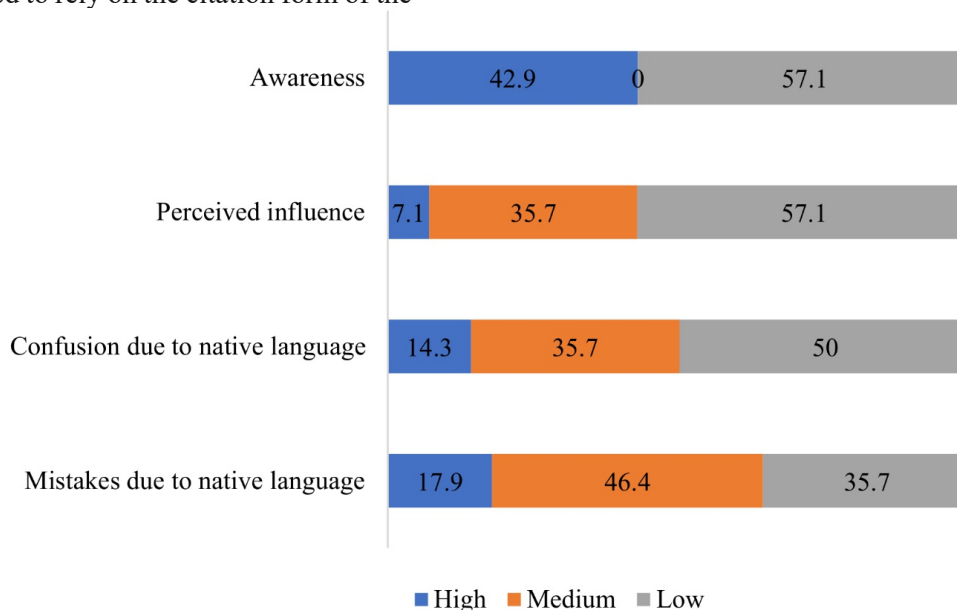


Figure 9. Students' responses on interlingual factors affecting mandarin third-tone pronunciation

Interlingual errors

Figure 9 shows the distribution of participants' responses concerning the influence of their native language on Mandarin third-tone pronunciation. The results provide insights into the extent to which mother-tongue interference affects students' pronunciation accuracy and contributes to interlingual errors.

As shown in Figure 9, the questionnaire results indicate that the influence of the mother tongue on Mandarin third-tone pronunciation is generally limited among the participants. Regarding pronunciation mistakes, 17.9% of the students reported a high level of influence, 46.4% reported a moderate level, and 35.7% reported a low level. Similarly, only 14.3% experienced a high level of confusion due to their native language, whereas half of the participants (50.0%) reported a low level of confusion. In terms of perceived influence, 57.1% considered the influence of their native language to be low, while only 7.1% perceived it as high. Concerning awareness, 57.1% of the participants showed a low level of awareness of mother-tongue influence, whereas 42.9% demonstrated a high level of awareness. Overall, these findings suggest that mother-tongue interference is not the dominant factor affecting participants' pronunciation of the Mandarin third tone.

These findings may be interpreted from the perspective of second-language speech learning. Learners' previous linguistic

experience plays an important role in acquiring the phonological features of a target language. In Mandarin learning, the third tone presents particular challenges because it involves not only lexical pitch distinctions but also tone sandhi processes that may be unfamiliar to learners whose first language is non-tonal. Consequently, learners with limited experience in tonal languages may have difficulty perceiving and producing third-tone patterns accurately.

However, the present study did not collect detailed information regarding the participants' specific mother tongues or home-language practices. Therefore, the discussion of mother-tongue influence is primarily based on learners' self-reported perceptions and should be interpreted with caution. Although interlingual influence may contribute to certain pronunciation difficulties, the questionnaire findings suggest that it is not the primary factor affecting third-tone pronunciation among the participants. Future studies should collect more comprehensive linguistic background data to examine potential cross-linguistic influences more systematically.

Intralingual errors

Figure 10 shows the distribution of participants' responses concerning their understanding and application of Mandarin third-tone pronunciation rules. The results provide insights into the extent to which

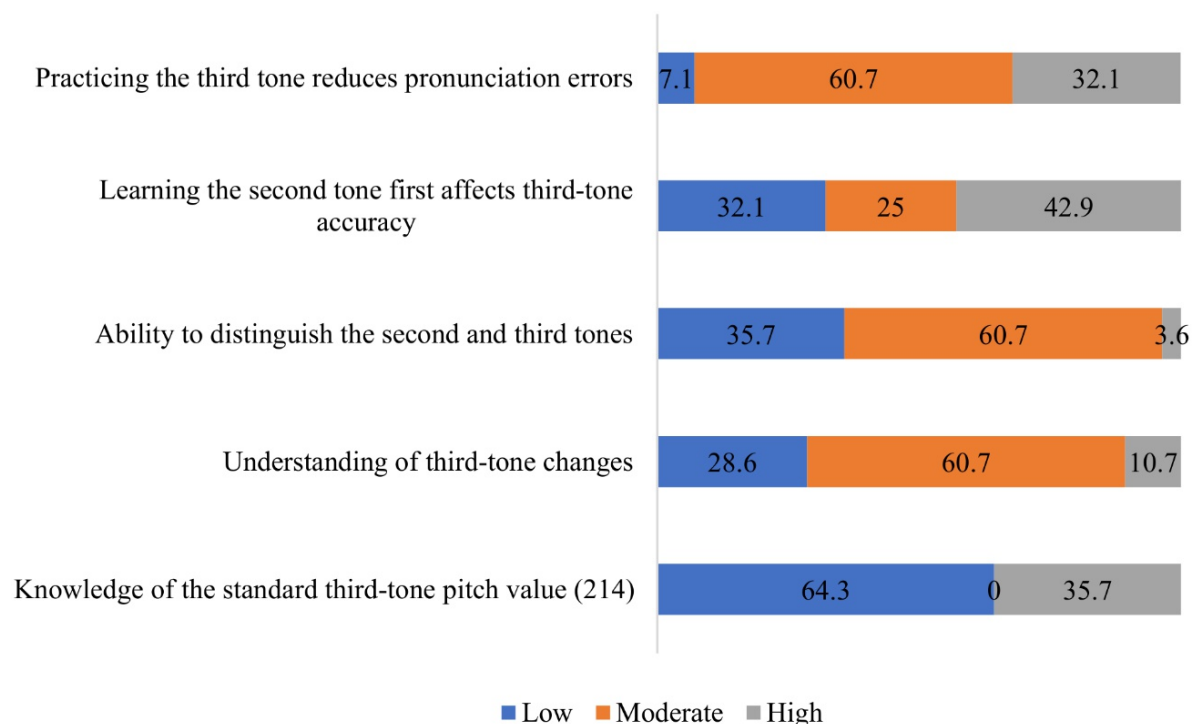


Figure 10. Students' responses on intralingual factors affecting mandarin third-tone pronunciation

learners' incomplete knowledge of third-tone phonological rules contributes to pronunciation difficulties and intralingual errors.

As shown in Figure 10, the questionnaire results indicate that intralingual factors constitute an important source of students' difficulties in mastering Mandarin third-tone pronunciation. Overall, the findings reveal that although many students reported a moderate level of understanding of the third-tone rules, gaps remained in their knowledge of the standard pitch value, tone changes, and the application of these phonological principles.

Regarding knowledge of the standard pitch value, 64.3% of the participants demonstrated a low level of knowledge, as they did not know that the standard pitch value of the Mandarin third tone is 214. In comparison, only 35.7% demonstrated a high level of knowledge. Regarding understanding of third-tone changes, 60.7% of participants reported a moderate level of understanding, 28.6% demonstrated a low level, and only 10.7% reported a high level. Although 71.4% of the participants reported that they understood or very well understood the changes in the third tone, the pronunciation analysis presented in the previous section revealed that students continued to produce a considerable number of pronunciation errors. This discrepancy suggests that students' perceived understanding of the rules had not yet been fully translated into accurate pronunciation performance.

Furthermore, 96.4% of participants reported difficulty distinguishing between the

third and second tones, with 35.7% reporting that they had experienced such difficulty and 60.7% experiencing it sometimes. Only 3.6% reported never experiencing this difficulty. This finding is consistent with the pronunciation test results, which showed that the combination of the third tone followed by the second tone was perceived as the most difficult pattern (67.9%), followed by sequences of three consecutive third tones (50.0%). These results suggest that students encounter difficulties not only in producing the third tone itself but also in distinguishing and applying tonal patterns in connected speech.

Regarding the learning sequence, 42.9% of the participants believed that learning the second tone before the third tone could affect the accuracy of third-tone pronunciation, while 32.1% believed that it could not and 25.0% were unsure. This variation suggests that the perceived effect of learning sequence may differ according to individual learning experiences. In addition, 92.8% of the participants believed that increased practice of third-tone pronunciation could help reduce pronunciation errors, with 32.1% considering such practice very helpful and 60.7% considering it helpful. This finding highlights the perceived importance of repeated practice in developing more accurate tonal production.

Overall, the findings suggest that intralingual factors are associated with gaps in students' mastery of the phonological features governing Mandarin third-tone pronunciation. Their difficulties relate not only to limited

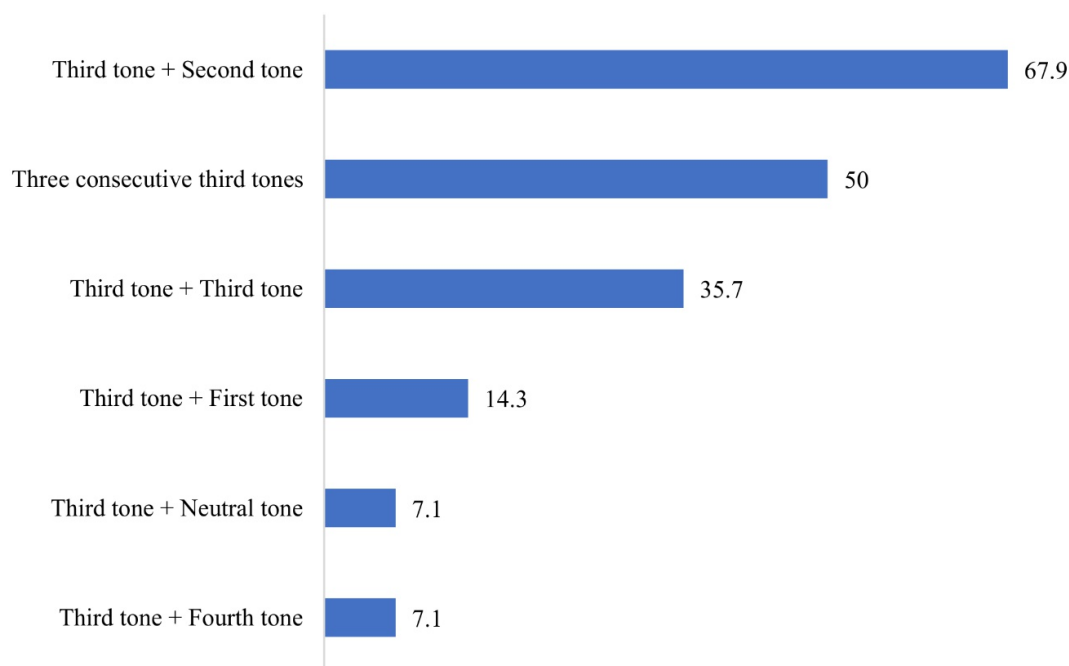


Figure 11. Students' perceived difficulty of mandarin third-tone combinations

knowledge of standard pitch values and third-tone changes but also to challenges in distinguishing the third tone from the second tone and applying tonal patterns consistently in actual pronunciation.

As shown in Figure 11, students perceived certain third-tone combinations as considerably more difficult than others. The combination of a third tone followed by a second tone was the most challenging pattern, accounting for 67.9% of responses. This was followed by sequences of three consecutive third tones (50.0%) and the combination of two consecutive third tones (35.7%). In contrast, relatively few participants selected combinations involving the first tone, fourth tone, or neutral tone, indicating that these patterns posed fewer pronunciation difficulties.

These findings are consistent with the pronunciation analysis presented in the previous section, which also showed that the highest pronunciation error rates occurred in the third tone + second tone pattern and in sequences of three consecutive third tones. The consistency between students' perceptions and their actual pronunciation performance suggests that these combinations represent the most problematic aspects of Mandarin third-tone production.

From a phonological perspective, these patterns require learners to apply tone sandhi rules rather than simply produce the citation form of the third tone. In particular, learners must modify the surface realization of the third tone according to its phonological environment while simultaneously maintaining the correct pitch contour of the following syllables. Such rule application increases the cognitive

demands of pronunciation and may explain why these combinations were perceived as more difficult than other tone patterns. These findings further support the conclusion that students' pronunciation difficulties are primarily associated with incomplete mastery and application of Mandarin third-tone sandhi rules rather than with producing the third tone in isolation.

Training errors

Figure 12 shows the distribution of participants' responses concerning training-related factors affecting Mandarin third-tone pronunciation. These findings provide insights into how instructional materials, teacher guidance, and learning resources may influence students' acquisition of third-tone pronunciation and their ability to apply tone sandhi rules accurately.

As shown in Figure 12, the questionnaire results indicate that training-related factors also play a role in students' mastery of Mandarin third-tone pronunciation. Overall, the participants expressed generally positive perceptions of the instructional support provided through teaching materials and teacher explanations. Regarding the accuracy of the teaching materials, 57.1% of the participants considered the information sufficiently accurate, while 28.6% were uncertain and 14.3% did not consider it sufficiently accurate. Similarly, 64.3% of the participants considered the teacher's explanation of the third tone clear, while 35.7% considered it very clear.

However, despite these generally positive perceptions, 53.6% of participants reported

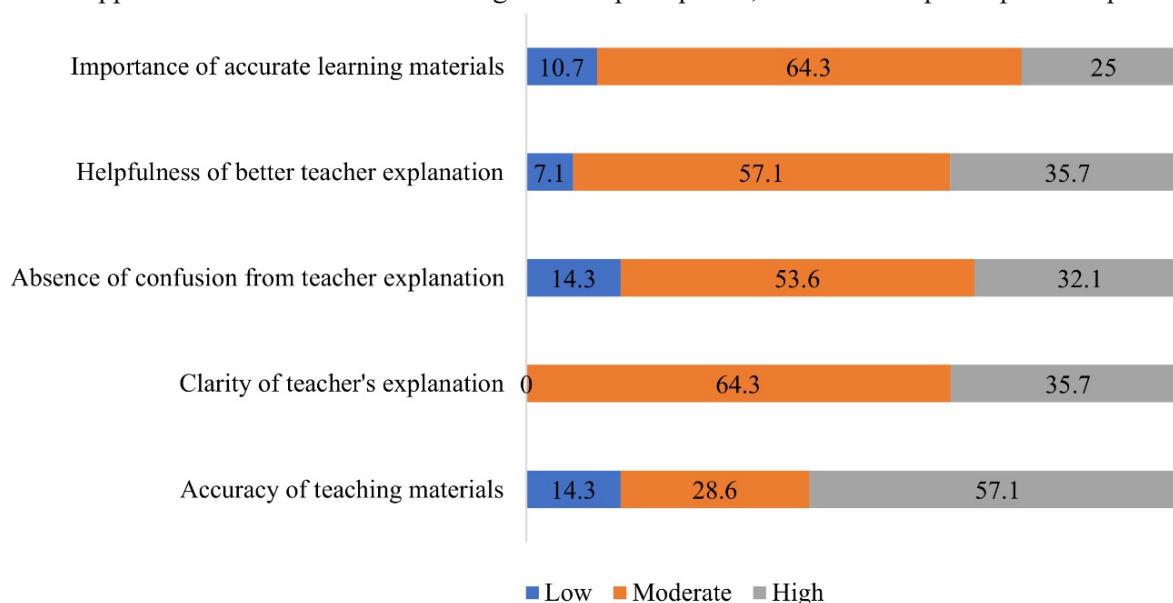


Figure 12. The distribution of participants' responses

sometimes experiencing confusion or misunderstanding due to insufficient teacher explanation, while 14.3% experienced such difficulties frequently. Meanwhile, 32.1% reported never experiencing such difficulties. These findings suggest that although instructional materials and teacher explanations were generally perceived positively, they did not necessarily guarantee accurate pronunciation performance.

Furthermore, 57.1% of participants considered improved teacher explanations helpful in correcting their pronunciation errors, 35.7% considered them very helpful, and only 7.1% considered them not very helpful. Regarding learning resources, 64.3% of the participants considered accurate and clear materials on third-tone pronunciation from textbooks or dictionaries important. In comparison, 25.0% considered them very important and 10.7% considered them not very important. These findings indicate that students recognize the value of explicit instruction and reliable learning resources in improving their pronunciation accuracy.

Taken together, the results suggest that although the existing instructional support was generally perceived as adequate, students still encountered difficulties in applying third-tone pronunciation rules accurately in practice. This finding implies that instruction should not only provide theoretical explanations of tone sandhi but also incorporate systematic pronunciation training and targeted practice activities focusing on the tone combinations identified as the most problematic in this study.

■ CONCLUSION

Based on the pronunciation test results, it was found that five of the seven Mandarin third-tone combinations exhibited pronunciation error rates above 50%, namely “(third tone + third tone) + third tone,” “third tone + (third tone + third tone),” “third tone + second tone,” “third tone + third tone,” and “third tone + neutral tone.” In contrast, the combinations “third tone + fourth tone” and “third tone + first tone” showed error rates below 50%. These findings indicate that students continue to experience considerable difficulty mastering Mandarin third-tone pronunciation, particularly when producing more complex tone combinations that require applying tone sandhi rules.

The questionnaire results further revealed three major factors contributing to students' pronunciation errors: interlingual factors (mother-tongue influence), intralingual factors (insufficient understanding of third-tone sandhi rules), and training-related factors. Among

these, intralingual factors emerged as the most influential source of pronunciation difficulties. Although students generally perceived that they understood the third-tone rules, the findings suggest that they still encountered difficulties distinguishing the third tone from the second tone and applying tone sandhi rules accurately in actual pronunciation.

Overall, the findings indicate that the students have not yet achieved satisfactory mastery of Mandarin third-tone pronunciation. Therefore, Mandarin language instructors are encouraged to adopt more targeted instructional strategies that emphasize both conceptual understanding and practical application of third-tone sandhi rules. In particular, pronunciation instruction should focus on the tone combinations identified as the most problematic in this study, especially the third tone + second tone pattern and sequences of three consecutive third tones. These objectives may be achieved through explicit explanations of tone sandhi rules, structured pronunciation drills, minimal-pair discrimination activities, contextual sentence practice, and repeated communicative speaking exercises. Such pedagogical strategies are expected to strengthen students' ability to apply third-tone pronunciation accurately and ultimately reduce pronunciation errors.

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