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The Negative Transfer of Shanghai Dialect on English Vowel Phonology Acquisition of Shanghai High School Students

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Abstract: With the accerleration of globalisation, the importance of English as an international common language has become more and more prominent. This study investigated the negative transfer effect of Shanghai dialect on English vowel acquisition in Shanghai high school students. Through the analysis of formant data of English vowel pronunciation in 49 Shanghai high school students, it is found that there is no significant change in tongue position when students pronounce some long and short vowels, the overall tongue position is low, and the distinction between long and short vowels is not obvious. The results show that the specific vowel phonemes in Shanghai dialect have a negative transfer effect on English pronunciation, which affects the accuracy of students' English pronunciation. Based on this, this study puts forward a variety of methods to improve English pronunciation teaching, including strengthening tongue position and oral shape training, using multimedia technology to assist teaching and providing personalized tutoring to help students overcome pronunciation barriers caused by dialects.

Keywords: English vowels, phonological acquisition, negative transfer, English pronunciation teaching

1. Introduction

In the context of increasing globalization, English has become a crucial tool for international communication, holding significant importance in China's education system. For high school students in Shanghai, proficiency in English affects both academic performance and future career opportunities. However, the local dialect, the Shanghai dialect, may negatively influence students' pronunciation of English vowels, thereby impacting their phonetic accuracy and fluency.

Studies indicate that the interplay between different languages' phonetic systems can lead to language transfer, with vowels being a key component. The English phonetic system includes segmental phonemes and suprasegmental features, with vowels serving as the core and nucleus of syllables and carriers of prosodic features. These functions not only distinguish lexical items but also aid in listener recognition and emotional expression.

Significant differences between the vowel systems of the Shanghai dialect and English warrant scholarly attention. For instance, the absence of certain vowel length contrasts in the Shanghai dialect may cause students to confuse similar sounds in English. This study aims to investigate how the Shanghai dialect affects local high school students' acquisition of English vowels, focusing on the negative transfer effects of the dialect. The research involves phonetic tests with 49 students,

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analyzing their pronunciation using Praat software. The findings will inform teaching strategies to help students overcome pronunciation barriers posed by their dialect.

2. Literature Review

2.1. Language Transfer Theory

The psychological term "transfer" was originally coined by behaviourists to describe how one learning activity affects another, and in the mid-twentieth century, applied linguists Charles Fries and Robert Lado applied the concept to linguistics, defining it as "the influence of one language in the learning of another" (also known as LANGUAGE TRANSFER or NATIVE LANGUAGE TRANSFER) [1,2]. Since then, the theory of contrastive analysis hypothesis has been gradually established. However, in the 1970s, due to Chomsky's theory of transformational generative grammar and universal grammar, academics began to question the contrastive analysis assumptions, and Selinker proposed the theory of mediated language in 1972 [3,4]. Since the 1990s, migration studies have begun to focus on its cognitive dimension, going beyond the realm of mere linguistic knowledge. In particular, from the perspective of conceptual transfer, Pavlenko of Temple University, Pennsylvania, first used the term "conceptual transfer" in his paper in 1998, and Jarvis and Pavlenko co-authored a book on the topic in 2008 [5,6]. Pavlenko co-authored the book "Crosslinguistic influence in language and cognition" which comprehensively summarises new developments in the study of conceptual transfer [6]. They proposed that the phenomenon of migration can be understood from several dimensions, including the domain of language use, directionality, cognitive hierarchy, kinds of knowledge, intentionality, mode, channel, form, performance and outcome. From the cognitive level, migration can be subdivided into language use migration, meaning migration and conceptual migration, in which conceptual migration belongs to the change of thinking level. At present, the study of conceptual transfer has attracted widespread attention, and scholars at home and abroad are trying to analyse the influence of mother tongue on second language acquisition from a conceptual perspective.

2.2. Chinese-English Comparative Analysis

Historical and ongoing research in the field of Chinese-English comparative analysis has greatly enriched scholars' understanding of these challenges. This part of the research details the systematic differences and similarities between the two languages and provides a theoretical basis for predicting the areas of difficulty or strength that Chinese learners may encounter in learning English.

Since Zhao Yuanren published “A preliminary study of English tone (including American) and Chinese tone” in 1932, the comparative study of Chinese-English phonology has gradually unfolded and moved towards the investigation of articulatory phonology, phonemic phonology, pitch system, and speech flow sound change [7]. Gui Can-kun's 1978 publication "A Comparison of the Main Characteristics of the Two Phonetic Systems of Chinese and English" provides a comparative analysis of Chinese and English phonology in terms of phonemic, rhythmic, and phonological articulation modes, etc. [8]. 1988's publication by Liu Naihua, "A Comparison of the Main Characteristics of the Two Phonetic Systems of Chinese and English," further deepens Professor Gui Chan-kun's research; meanwhile, He Shan-fen has carried out multifaceted comparative research on the English-Chinese phonology [9, 10]. These include analysing the discriminative function of English speech from the perspective of suprasegmental segments, comparing the syllable structure of English and Chinese and studying the phenomenon of native language transfer. Subsequently, scholars in China have begun to compare and contrast Chinese dialectal phonology and English phonology, and have applied their research results to teaching practice, making phonological research more relevant and practical. Yu

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Pingfang, Le Meiyun, and Ling Dexiang studied the negative effects of English phonological acquisition on students from different regions [11, 12].

Wang Hongjun's article "An Analysis of the Variables of the Negative Transfer Influence of Wu Dialect on English Phonetics" published in 2007 discussed in depth the potential influence of Wu Dialect on English phonological learning by comparing and analysing the phonological features of Wu Dialect and Mandarin [13]. Meanwhile, some scholars have also meticulously analysed the vowel pronunciation characteristics of secondary school students in Wu-speaking regions by means of field recordings, providing valuable empirical data for regional studies [14,15].

However, in view of China's vast territory and numerous dialects, many scholars tend to use the seven or ten major dialect regions as a framework to comprehensively analyse English phonological features in each region. However, considering the phonological differences within dialect areas, the influence of Wu dialect on English phonological acquisition needs to be studied in a more refined geographical way in order to draw more accurate and specific conclusions. Among them, the influence of Shanghai dialect on English speech acquisition is multifaceted, including both differences in consonant pronunciation, simplification of vowel pronunciation and difficulties in the acquisition of stress. In order to improve the accuracy of English pronunciation of learners from Shanghai dialect area, this study explores the characteristics of vowel pronunciation of Shanghai high school students and further discusses effective teaching methods and strategies to help learners overcome the negative transfer effects from their mother tongue. At the same time, research results and experiences from other dialect areas can also be drawn upon to provide more comprehensive and targeted guidance for learners in the Shanghai dialect area.

3. Research Questions

The purpose of this study is to investigate how the Shanghai dialect affects high school students' pronunciation performance during the acquisition of English vowel phonemes, with the following specific research questions:

Which specific vowel phoneme features in the Shanghai dialect are most likely to have a negative transfer effect on English pronunciation?

This question will be answered through systematic phonological analyses and experimental tests, with a view to gaining insights into the specific effects of the Shanghai dialect on English phonological acquisition and exploring effective teaching strategies to address these challenges.

4. Definition of the Concept of Shanghai Dialect

In the context of this study, the author focuses on the negative transfer effect from the Shanghai dialect to English phonological acquisition among high school students. Given the significant differences in vowels possessed between the Shanghai dialect and English, this may lead to systematic pronunciation errors.

Shanghai dialect is a Wu dialect, and the narrow definition of Shanghai dialect, according to Rujie You, refers to the new school of Shanghai Dialect that was formed in the present-day Shanghai city within 100 years [16]. On this basis, this paper defines the concept of Shanghai dialect as the new school of Shanghai Dialect spoken in the Shanghai urban area in a narrow sense.

There are 7 vowels, 4 vowel clusters, and 15 nasalised and glottalised vowels and vowel clusters unique to the Shanghai dialect [15]. These characteristic vowels, together with vowels that are pronounced similarly in Shanghai Dialect and Mandarin but do not have a similar pronunciation in English, are two types of sounds that cannot be found to be pronounced in the English vowel system in a manner or with acoustic features similar to theirs, and therefore the author considers their

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interference in the students' English phonological acquisition process to be minimal and will not be discussed here.

The Shanghai vowels discussed in this paper are i-/i/,e-/E/,a-/ɑ/,u-/ɯ/,o-/ɔ/ (All the following adopt the pinyin-International Phonetic Alphabet (IPA)-based phonetic notation of the Association of Wu Dialect).

In discussing the influence of vowels in the Shanghai dialect on English pronunciation, the author analyses the possible biases caused by the vowels in terms of their articulatory position, tongue position, mouth shape, and similarities or differences with English phonemes. The following is an analysis of the influence of the above vowels:

1) The i vowel: The i vowel in the Shanghai dialect is pronounced with a more spreading lip shape and with the tip of the tongue touching the back of the lower teeth, which is more tense and in a more forward position than the /i/ in English (e.g., in the word hill). This may cause Shanghai students to be too tight or positioned too far forward when trying to pronounce the English /i/ sound, thus affecting the naturalness of their English pronunciation.

2) The e vowel: This sound has a more open lip shape and lower tongue position than the English /e/ (as in the word bed). Such differences may make Shanghai students too open and not compact enough when pronouncing the /e/ sound in English, thus leading to inaccurate pronunciation.

3) The a vowel: the a vowel in the Shanghai dialect is significantly different from the English /a/ (e.g. in the word father) in terms of mouth shape and tongue position, especially in the mouth shape and tongue root position. This may cause students to pronounce the /a/ sound in English too closed when attempting to pronounce it, with a noticeable gap from the target speech.

4) The u vowel: In the Shanghai dialect, the u vowel has a more rounded and backward position of the lips, which may lead to insufficient lip rounding and forward placement of the sound quality when pronouncing it, compared to /u:/ in English (e.g., in the word boot).

5) The o vowel: although o is similar to the /ɒ/ sound in the International Phonetic Alphabet, it is more compact and rounded-lipped in the Shanghai dialect, which may lead to students rounding their lips too much or straining their lips when pronouncing the /ɒ/ sound in English (e.g., in the word dog).

5. Research Design

In this study, the purpose of the research was to investigate how the Shanghai dialect affects high school students' performance in English phonological acquisition. The author selected a sample of 55 high school students from different classes in Shanghai to minimise the teaching bias of any single English teacher. A background questionnaire was used to ensure the homogeneity of this population. They were all of similar age (15-17 years old), educated in Shanghai schools and from the same social background. The parents of these participants were all Shanghai Dialect. This was to reduce the risk of another dialect or another language influencing the participants' speech. After the questionnaires were retrieved, the results were culled by eliminating the questionnaires in which either or both parents were not from Shanghai, and retaining only the results in which both parents were from Shanghai, number: 49.

The methodology uses a two-part English phonological test. The test will be a combination of test questions used in previous related studies, including reading vowels and words aloud. The speech test will be conducted in a quiet space to ensure a controlled and soundproof environment. The interior of the space was equipped with the necessary recording equipment and computers to facilitate the recording and analysis by the Praat software. The first part was the reading aloud of vowels, which lasted about 1 minute. Students were required to read aloud all the basic phonemes of the English International Phonetic Alphabet (IPA) in order to directly assess the participants' accuracy in pronouncing a single phoneme. The second part consists of words read aloud and lasts approximately

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2 minutes, which not only examines the application of the test phonemes to actual vocabulary, but also checks the students' overall mastery of vocabulary.

Each student's responses will be recorded and analysed using Praat software, which allows for detailed phonological profiling. The main data examined when analysing the articulation of vowels using Praat is the resonance peaks. Vowel articulation is mainly affected by tongue height and tongue front/back, and the Praat software analyses multiple resonance peaks in a speech segment, where the value of the first resonance peak (F1) represents the height of the tongue, and the value of the second resonance peak (F2) represents the front/back of the tongue. Specifically, larger values of resonance peak F1 indicate lower tongue position; smaller values of resonance peak F1 indicate higher tongue position. A larger value of resonance peak F2 indicates a more forward tongue position; a smaller value of resonance peak F2 indicates a more backward tongue position. By analysing the data from the resonance peaks, the author will not only be able to identify the specific vowel that the pronouncer is pronouncing, but will also be able to compare the differences between different pronouncers in terms of tongue height and front to back. The collected data will be statistically analysed to assess the frequency and type of vowel mispronunciation, trying to exclude the influence produced by other languages or dialects, such as Mandarin, and relate it to the phonetic features of the Shanghai dialect. This approach aims to provide a comprehensive insight into the specific ways in which native dialects influence the phonological acquisition of English vowels.

6. Findings

The values of the subjects' vowel resonance peaks, F1 and F2, are the mean values of the resonance peaks for all subjects because when a group of people participates in a test, the mean values of F1 and F2 best represent the vowel articulation characteristics of the group [17].

The mean values of the F1 and F2 values of the subjects' articulatory vowel stabilisation intervals extracted by the Praat software in this study are shown in Table 1.

Table 1: Supplementary table headings.

Vowel	Subjects' F1	Subjects' F2
Front vowel [i:]	361.18	2269.21
Front vowel [i]	406.38	2185.64
Front vowel [e]	619.98	1681.18
Front vowel [æ]	740.83	1762.17
Middle vowel [ʌ]	717.57	1315.79
Middle vowel [ə:]	517.31	1382.22
Middle vowel [ə]	547.29	1385.00
Back vowels [ɒ]	538.30	1009.14
Back vowel [ɔ:]	521.96	982.22
Back vowel [u:]	402.01	987.87
Back vowel [u]	380.20	940.20
Back vowel [ɑ:]	718.14	1292.56

From Table 1, it can be seen that there are significant differences between the subjects in pronouncing different English vowel sounds.

Firstly, when the mean values of the subjects' first resonance peak F1 were analysed, the differences between the groups of long and short vowels were not significant. For example, the F1 value of [ə:] is 517.31 Hz, while the F1 value of [ə] is 547.29 Hz, and the F1 difference between the two is 29.98 Hz. In addition, none of the differences in the F1 values between [ɑ:] and [ʌ], and

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between [u] and [u:] are more than 22 Hz. This indicates that the subjects' anterior and posterior positions of the tongue position are very close to each other, or even basically the same, when pronouncing these long and short vowels. In particular, the long vowel [i:] had the smallest F1 value of 361.18 Hz, showing that the subjects had the highest tongue position when pronouncing [i:]. On the contrary, the short vowel [æ] had the largest F1 value of 740.83 Hz, indicating that the subjects had the lowest tongue position when pronouncing [æ].

Secondly, in terms of the mean value of the second resonance peak F2, the long vowel [i:] has the highest F2 value of 2269.21 Hz, which indicates that the subjects have the highest tongue position when pronouncing the [i:] sound. The short vowel [u], on the other hand, had the lowest F2 value of 940.20 Hz, indicating that the subjects had the lowest tongue position when pronouncing the [u] sound. In addition, the F2 values of the short and long vowels did not vary much, which shows that the subjects did not change their tongue position much when they pronounced these vowels. Meanwhile, as a whole, the subjects' F2 values were low, indicating that the subjects' overall tongue position was low when pronouncing [i:].

From the above analysis, it can be seen that the change in the mean values of the resonance peaks F1 and F2 was not significant when subjects pronounced different long and short vowels, i.e., the change in the tongue position of the subjects when pronouncing the above unitary sounds was not significant, and even no distinction was made between some of the unitary sounds. In addition, some subjects chose to read out the relative long and short vowels together in the test, which made the difference in the duration of the long and short vowels obvious, but the difference between the "long and short" vowels was also related to the degree of tension of the articulatory area and the difference in the shape of the oral cavity. From the data, it is clear that the subjects were not very conscious of these details of differentiation.

7. Discussion

Table 2 shows the values of resonance peaks F1 and F2 of vowel articulation for Received Pronunciation (RP) speakers in the control group of the above subjects:

Table 2: The values of the first and second resonance peaks of vowel articulation for RP speakers

Vowel	RP speakers' F1	RP speakers' F2
Front vowel [i:]	406.81	2514.88
Front vowel [i]	488.45	2190.22
Front vowel [e]	771.87	1820.45
Front vowel [æ]	1065,64	1603.49
Middle vowel [ʌ]	900.53	1294.15
Middle vowel [ə:]	769.96	1601.99
Middle vowel [ə]	799.63	1672.54
Back vowels [ɒ]	717.10	988.72
Back vowel [ɔ:]	464.20	946.02
Back vowel [u:]	413.25	1031.00
Back vowel [u]	483.73	964.84
Back vowel [ɑ:]	853.94	1185.81

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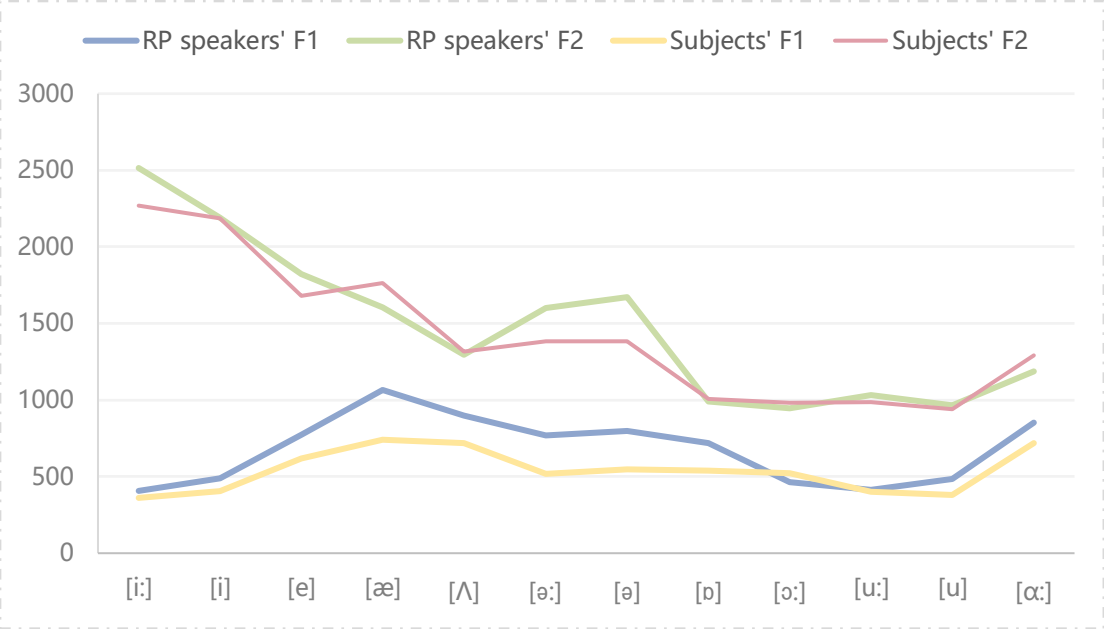

Figure 1: Line plots of F1 and F2 between RP speakers and subjects.

As can be seen from Figure 1, the trend of the subjects' F1 across the 12 collected single tones is generally more similar to that of the RP speakers' F1. This suggests that the subjects' changes in tongue height during the production of the unit sounds were roughly the same as those of the RP speakers, although there were still differences in some details.

Subjects' F1 values were smaller than those of RP speakers when they pronounced most of the vowels, such as [i:], [ɪ], [e], [æ], [ʌ], [ə:], [ə], [ɒ], [ʊ], and [ɑ:]. In particular, for [æ], the subject's F1 value was 740.83 Hz, while the RP speakers' F1 value was 1065.64 Hz, a difference of 324.81 Hz, which implies that the subject's tongue position was higher than that of the RP speakers and that the lip opening was smaller when articulating these vowels.

It can also be seen from the line graphs that the F1 values of the subjects hardly changed when they pronounced the long vowel [i:] and the short vowel [ɪ], suggesting that the subjects' tongue heights were almost the same when they pronounced these sets of vowels. In addition, the subjects' F1 values were greater than those of the RP speakers when pronouncing only [ɔ:], with the subjects' F1 value of 521.96 Hz when pronouncing [ɔ:] being 57.76 Hz higher than that of the RP speakers at 464.2 Hz.This suggests that the subjects' tongue position was lower than that of the RP speakers when pronouncing this vowel and that they had a greater degree of lip opening, although the difference was not significant.

In addition, there was almost no change in F1 values when subjects produced the vowels [ə:], [ə], [ɒ], and [ɔ:], suggesting that the tongue heights were consistent in the production of these vowels, which led to confusion between the vowels. The line graph shows that the subjects' F1 values for the vowels [i:], [ɪ], [ɔ:], and [u:] almost coincide with those of the RP speakers, indicating that the subjects' tongue heights for these vowels are consistent with those of the RP speakers.

From the line graph, it can be seen that the trend of the subjects' F2 in the 12 collected unit sounds is generally similar to the trend of the F2 of the RP speakers. This suggests that there are similarities between the subjects' anterior-posterior changes in tongue position on these units and the trends of the RP speakers' changes, but there are still significant differences on some vowels.

When subjects pronounced most of the vowels (e.g., [i:], [e], [ə:], [ə], [u:], [ʊ]), the values of F2 were smaller than the values of F2 for the corresponding vowels of the RP speakers. For example,

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the subject's F2 value when pronouncing [i:] was 2269.21 Hz, which was 245.67 Hz smaller than the RP pronouncer's 2514.88 Hz; the F2 value when pronouncing [ə] was 1385 Hz, which was 287.54 Hz smaller than the RP pronouncer's 1672.54 Hz; and when pronouncing [e] and [ə:] the subject's F2 value was also smaller than the RP pronouncer's F2 value of 100 Hz or more. This suggests that the subjects' tongue position was more backward than that of the RP speakers when producing these vowels.

However, when producing the vowels [æ], [ɑ:], the subjects' F2 values were greater than those of the RP speakers. Specifically, the subject's F2 value for [ɑ:] was 1292.56 Hz, which was 106.75 Hz greater than the RP speakers' value of 1185.81 Hz, indicating that the subject's tongue position was more anterior than the RP speakers' when producing [æ], [ɑ:]. In addition, the subjects' F2 values when pronouncing the vowels [ʌ], [ə:], and [ə] were almost the same as those of the RP speakers, and the points in the line graphs almost completely overlapped, which indicated that the subjects' tongue position was almost the same as that of the RP speakers before and after pronouncing these two vowels.

It can also be seen from the line graph that the F2 values of the subjects remained almost above and below the same straight line when pronouncing paired long and short vowels such as [ɑ:] and [ʌ], which indicates that there was almost no change in the tongue position before and after the subjects pronounced these paired long and short vowels.

In summary, although the subjects' F2 trends on most vowels were similar to those of the RP speakers, there were still differences in tongue position backward and forward on some vowels, which led to differences in pronunciation details.

8. Conclusion

8.1. Main Findings

Based on the analysis of the mean values of F1 and F2 of the subjects in pronouncing the different English unit sounds, it was found that the differences between long and short vowels were not significant. Subjects showed less variation in F1 and F2 values when producing vowels such as [ə:] and [ə], [ɑ:] and [ʌ], [u] and [u:], suggesting that there was little variation in the front-to-back and high-to-low position of the tongue, and that the overall tongue position was low. In particular, [i:] has the lowest F1 value, indicating the highest tongue position, while [æ] has the highest F1 value, indicating the lowest tongue position. Meanwhile, the long vowel [i:] had the highest F2 value, further confirming the highest tongue position, while the short vowel [u] had the lowest F2 value, indicating the lowest tongue position. These data suggest that the subjects did not show significant changes in tongue position when producing these vowel sounds, and that the distinction between some of the vowels was not obvious. In addition, some subjects read long and short vowels together in the test, and although the difference in duration was obvious, it was not obvious enough to differentiate between the tension of the articulation site and the shape of the oral cavity. To sum up, the subjects did not show significant changes in tongue position when pronouncing these English unit sounds, and overall showed low tongue position and low awareness of the details of differentiation between long and short vowels.

8.2. Implications for Foreign Language Teaching

Combined with the negative transfer of Shanghai dialect on the acquisition of English vowel phonology by Shanghai high school students, the following pedagogical guidelines and insights can be drawn:

Firstly, identifying and overcoming the negative migration phenomenon is crucial. The vowel system in the Shanghai dialect is different from that of English, and Shanghai high school students

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may be affected by the negative transfer of their mother tongue, such as the lack of accurate control of tongue position and oral shape during pronunciation, resulting in substandard pronunciation of English vowels. Teachers should identify common negative transfer phenomena in students' pronunciation, such as the difficulty in distinguishing long and short vowels like [ə:] and [ə], [ɑ:] and [ʌ], [u] and [u:], and provide targeted pronunciation training to help students overcome these negative transfers.

Secondly, it is important to strengthen the training of tongue position and oral shape. Help students visually understand and practice correct tongue position by using tools such as mirrors, mouth models, or tongue illustrations, especially for long vowels [i:] and short vowels [æ], focusing on training students to change their tongue height. Using videos, pictures and demonstrations, we can help students to grasp the shape of the mouth when pronouncing different vowels, for example, the shape of the mouth is flatter when pronouncing the [i:] sound, and the mouth is more open when pronouncing the [æ] sound.

The use of multimedia technology to assist teaching can also significantly improve students' pronunciation accuracy. The pronunciation software provides instant feedback so that students can see and hear the changes in their pronunciation resonance peaks and make timely self-corrections. Recording and analysing is also an effective method, allowing students to record their pronunciation and compare it with the standard pronunciation to find out the gaps and improve it gradually.

In addition, targeted speaking activities can provide more opportunities for pronunciation practice. Through group discussion and reading aloud activities, teachers can provide real-time correction and guidance for students' pronunciation problems. Pronunciation competitions and mimicry exercises can also encourage students to imitate standard English pronunciation and enhance their pronunciation awareness and accuracy.

Finally, providing personalised tutoring can help students with more serious pronunciation problems. For these students, teachers can provide individual tutoring, focusing on their pronunciation difficulties, and formulate personalised pronunciation correction plans according to each student's specific situation, so as to gradually improve their pronunciation level.

Taking into account the negative transfer phenomenon of Shanghai dialect on Shanghai high school students' English vowel phonological acquisition, foreign language teaching should focus on identifying and overcoming the negative transfer, and help students better master the correct pronunciation skills through a variety of methods and tools, especially the training of tongue position and oral cavity shape. At the same time, multimedia technology and personalised tutoring are used to improve students' pronunciation accuracy and fluency, and ultimately enhance their oral English proficiency.

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