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International intelligibility of English spoken by college students in the Bashu dialect area of China

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Exploring English intelligibility in linguistically diverse environments, such as China, is crucial for improving cross-cultural dialog and tailoring language instruction to address the phonetic hurdles of non-native speakers. This research employed a phonetic experimental methodology to assess the intelligibility of English spoken by college students from the Bashu dialect region of Southwest China to an international audience. Data from 40 intermediate English-proficient students in Sichuan and Chongqing were analyzed using open-ended questionnaires and evaluative scales. The findings revealed that the influence of the Bashu dialect significantly impeded the accurate articulation of specific English phonemes, thereby exerting an impact on the international intelligibility of their spoken English. Notably, notwithstanding their conspicuous accents, the research concluded that the English enunciated by these students generally retained intelligibility for global audiences. The study identified a spectrum of pronunciation challenges, encompassing issues with phonetic sounds, recurrent mispronunciations, and variances in accent and prosody, collectively contributing to an overarching influence on intelligibility. Grounded in international listener feedback, this study proffers strategies to augment the intelligibility of spoken English among Chinese learners originating from dialect-specific regions, thereby fostering the amelioration of their communicative skills and bolstering their confidence when engaging with global audiences.

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Introduction

The Bashu dialect, also known as the Sichuan dialect, is predominantly spoken in Sichuan Province, Chongqing Municipality, and adjacent regions of China. It is distinguished by its unique phonetic and tonal variations from Standard Mandarin, reflecting the rich linguistic heritage of China's southwestern part. The dialect exhibits notable distinctions from Putonghua (Standard Mandarin) in various linguistic aspects, encompassing syllable structure, tonal patterns, lexicon, and grammatical features (Tang, 2017). Sichuan and Chongqing speakers share the Bashu dialect due to their shared historical and cultural backgrounds, stemming from the ancient Ba and Shu states that once unified this region, fostering a common linguistic heritage. Additionally, the Bashu dialect demonstrates regional variations within Sichuan, Chongqing, and other Bashu dialect-speaking areas. This linguistic diversity, particularly in pronunciation characteristics, often gives rise to adverse transfer effects when native Sichuan speakers attempt to pronounce English, thereby posing challenges to their international intelligibility.

In the current era of globalization and China's expanding economic influence, especially following its accession to the World Trade Organization (WTO), proficiency in the English language has gained paramount importance in facilitating cross-cultural and international interactions. This paradigm shift underscores the need for a more profound comprehension of English intelligibility among Sichuan speakers. Such an endeavor serves a dual purpose: it promotes the dissemination of the region's culture on the global stage and enhances its capacity to forge global economic and cultural connections.

With English evolving beyond its traditional native-speaker domain to become a global lingua franca, there has been a paradigm shift in linguistic research toward the theory of World Englishes (Jenkins, 2006). This perspective recognizes the role of English in various fields, such as trade, culture, and education in China, prompting increased academic interest in the phonetics of China English (He, 2017; Liu & Fang, 2022). Contemporary research challenges the notion that speakers who speak English as the first language (L1) are the sole arbiters of intelligibility, acknowledging the growing prevalence of English as a second (ESL) or foreign language (EFL).

This study is situated within the broader context of global linguistics, where the intelligibility of L2 or EFL English speakers, particularly in multilingual settings, is gaining attention. It underscores the need for comprehensive studies on English intelligibility that reflect diverse linguistic and cultural backgrounds. This research aims to address phonetic barriers encountered by L2 or EFL English speakers and to optimize English teaching models, thereby enhancing global communication and furthering international cooperation. Studying Chinese English intelligibility is vital for facilitating cross-cultural communication and shaping global English education, providing insights into effective teaching methods and assessment standards that accommodate diverse student backgrounds. The research also contributes to understanding the diversity and complexity of global English, ultimately supporting the development of English as an international language.

Within this theoretical and practical context, the present study aims to explore the international intelligibility of English pronunciation among students in the Bashu dialect area. Given the region's status as a significant economic hub in Western China and its increasing engagement in global trade and cultural exchanges, the investigation of language capacity building and English language development in the Bashu dialect area has become increasingly relevant. The unique pronunciation traits of the Bashu dialect often result in a negative transfer to English

pronunciation, posing challenges for effective international communication. This research seeks to identify these phonetic barriers and develop strategies to overcome them, thereby enhancing the international intelligibility of English spoken by students in this area.

Given the academic and practical value of this field, the present study aims to address the following research questions:

1. What is the level of international intelligibility of English among Bashu dialect-speaking college students with an intermediate English language proficiency level?
2. How does the intelligibility of English spoken by Bashu dialect speakers with minor regional variations differ?
3. Which factors influence the international intelligibility of English spoken by these Bashu dialect-speaking college students?
4. What strategies can effectively enhance the intelligibility of English spoken by college students in the Bashu dialect area, thereby improving their efficiency in international communication?

Literature review

English intelligibility studies. The study of English Intelligibility dates back to the mid-20th century, originating in the linguistic and psychological exploration of speech and auditory processing. The notable linguist J.C. Catford, in his 1950 paper "Intelligibility," first systematically introduced this concept, setting it apart from "effectiveness of speech (p. 8)." He posited that intelligibility should be evaluated based on communicative success, defining it as the "appropriate response to discourse objectives (p. 8)." Catford highlighted that language intelligibility is a collaborative tool encompassing not only the precise understanding of linguistic elements but also the effective encoding of information by the speaker and its successful decoding by the listener. Although the study of world English intelligibility has evolved in terms of conceptual frameworks, research paradigms, and experimental methods, significant disparities in these studies persist.

To advance the standardization and systematization of Intelligibility research, Smith and Nelson (1985) provided an in-depth theoretical exposition. They differentiated Comprehensibility as the ability to grasp the speaker's intent and proposed a three-tier classification: (1) Intelligibility, (2) Comprehensibility, and (3) Interpretability. In this framework, Intelligibility pertains to the recognition of words and utterances, Comprehensibility to understanding the discourse's meaning, and Interpretability to perceiving and interpreting the speaker's intention. Smith and Nelson advocated for adopting this multi-level taxonomy in future studies to foster academic advancement. They emphasized that "comprehensibility results from the interaction between speaker and listener (p. 333)", moving beyond a focus on either party individually. In his 1992 research, Smith expanded this concept, asserting that intelligibility encompasses literal understanding and a profound comprehension of discourse meaning, representing the highest level of intelligibility research. This perspective significantly contributes to grasping the complexity of intelligibility across diverse contexts and communicative scenarios.

Research paradigms. The study of English intelligibility mainly includes the following paradigms. (1) Psycholinguistic paradigm: This paradigm focuses on how the listener processes and decodes the speaker's speech information. Representatives include Boersma (1998), whose research focuses on the psychological

mechanisms of speech perception and output. (2) Sociolinguistic paradigm: This paradigm emphasizes the influence of social, cultural, and regional factors on English intelligibility. Braj Kachru, a representative of this paradigm, proposed the concept of “world English,” emphasizing the diversity of English used in different cultural and regional contexts (Kachru, 1985). (3) Communicative competence paradigm: This paradigm focuses on the relationship between communicative success and English intelligibility. Jennifer Jenkins is the representative of this paradigm, and she proposed the concept of “English as a lingua franca (ELF),” emphasizing the importance of establishing a core set of phonetic norms among L2 or EFL speakers (Jenkins, 2000). (4) Educational Linguistics paradigm: This paradigm focuses on how to improve English intelligibility through teaching reform and phonological training. Larry Smith and Walt Nelson are the representatives of this paradigm, who propose a multi-level intelligibility classification in their research and emphasize its application in teaching (Smith & Nelson, 1985).

Research classification. In linguistics, intelligibility research is a multifaceted subdiscipline that extends beyond analyzing the inherent characteristics of text or speech to encompass the dynamics of interaction and communication between speakers and listeners. This aspect of interactivity is significantly influenced by the varying linguistic identities of individuals, contributing to the diversity and intricacy of the study of English intelligibility. Research in this area often categorizes studies based on different language combinations, such as interactions between first and second languages (L1–L2) (e.g., Shin et al., 2021; Tauroza & Luk, 1997), second and first languages (L2–L1) (e.g., Derwing & Munro, 1997; Munro & Derwing, 1995), or third and first languages (L3–L1) (e.g., Müller & Mair, 2023).

In a notable contribution to this field, Levis (2005) introduced an innovative framework termed the “Speaker-listener Intelligibility Matrix for World English.” This matrix methodically delineates the interaction patterns between speakers and listeners from diverse linguistic and cultural backgrounds across various contexts. It offers a multi-dimensional approach to analyzing and interpreting these interactions, thereby enriching the understanding of intelligibility in World English (see Fig. 1).

The matrix model introduced by Levis (2005) provides a thorough and nuanced theoretical framework for comprehending various intelligibility issues encountered in cross-cultural and cross-linguistic communication. This model is instrumental in guiding empirical research and practical application in this field. The diversity and complexity of English intelligibility research underscore its significance in addressing the challenges of globalization and multiculturalism.

Historically, in studying global English, listeners from Inner Circle countries, as defined by Kachru (1985), such as the United Kingdom, the United States, Canada, Australia, and New Zealand, were often prioritized in research. These listeners were traditionally viewed as “natural judges” of English intelligibility (Jenkins, 2009, p. 35) and dominated the global assessment and interpretation of English intelligibility in studies before 2010. However, this research paradigm has seen a significant shift with English’s expanding reach, particularly in non-inner circle countries. As Chan (2021) notes, the number of English speakers as a second or foreign language now vastly outnumbers L1 English speakers, prompting researchers to adopt a broader and more inclusive research perspective. This includes focusing on the mutual intelligibility of pronunciation among bilingual and trilingual English speakers.

In this evolved context, the research focus has increasingly turned towards the intelligibility of interactions within the second (OC-IC, OC, EC) and third (EC-IC, OC, EC) categories in Levis’ World English Speaker-Listener Intelligibility Matrix. These new research avenues are expanding the theoretical framework of global English intelligibility research and reflecting the complexity and diversity of English in the context of globalization and multiculturalism. This transition marks a paradigmatic shift from an Inner Circle-centric viewpoint to a more global and pluralistic perspective. This shift better captures the nuances of English use and comprehension across various cultural and linguistic contexts, aligning with the broader trends of global English usage.

Studies on the intelligibility of China English. The study of the intelligibility of China English has its roots in the 1990s, a period marked by China’s burgeoning role in the global economy and culture. This field gained substantial momentum in the early 2000s, mirroring China’s increasing influence on the world stage. During this time, there was a notable shift in focus towards the intelligibility of communication between Chinese and other English speakers globally. This shift highlighted the growing relevance of China English in the realm of international discourse.

Though limited, research on the intelligibility of spoken English among Chinese EFL learners has been impactful. A seminal study by Munro and Derwing (1995) examined the perception of English phonology by L1 English speakers towards Chinese speakers, revealing a pivotal finding: a marked Chinese accent does not necessarily detract from the comprehensibility or intelligibility of English. This conclusion, indicating no significant correlation between intelligibility and the strength of the Chinese accent, was further substantiated by subsequent studies, including those by Zhang (2012) and Zhou et al. (2019). Their research,

		LISTENER		
		Inner Circle (IC)	Outer Circle (OC)	Expanding Circle (EC)
SPEAKER	Inner Circle	IC-IC (NS-NS)	IC-OC	IC-EC (NS-NNS)
	Outer Circle	OC-IC	OC-OC	OC-EC
	Expanding Circle	EC-IC (NNS-NS)	EC-OC	EC-EC (NNS-NNS)

Fig. 1 World English speaker-listener intelligibility matrix (Levis, 2005, p. 373) This diagram depicts the communicative dynamics among various users of the English language.

which analyzed the spoken English of Chinese college students, found that international listeners could understand messages despite a prominent Chinese accent. These findings not only corroborated Munro and Derwing's (1995) initial insights but also underscored the intricate relationship between accent and intelligibility.

Empirical studies exploring the intelligibility of Chinese English in international contexts have yielded diverse and complex findings. For instance, Zhang (2015) reported a 64.4% intelligibility rate among international listeners, suggesting a category of "mostly intelligible." In contrast, Kirkpatrick et al. (2008) recorded a higher rate of 81%, indicative of "high intelligibility." When it comes to comprehensibility, studies show varying trends. Crowther et al. (2015) found that L1 English speakers struggled more to understand Chinese English compared to speakers from other linguistic backgrounds, pointing to the significant influence of cultural and linguistic factors.

On the other hand, Orikasa (2016) discovered that Chinese English was more easily recognized and understood by Japanese listeners than by American and British audiences. These findings collectively reveal that the comprehensibility and intelligibility of Chinese L2 English significantly differ based on the listener's country and cultural background, influenced by various factors, including cultural context, education level, and language habits. This underscores the need for a more comprehensive and nuanced approach in future research to accurately assess and understand the intelligibility and comprehensibility of Chinese English in the global context.

In summary, these studies offer a range of perspectives on the intelligibility of English in China, underscoring the importance of continued research in a globalized and multicultural environment. They provide essential theoretical and empirical foundations for understanding the role and status of China English in international communication, emphasizing the need for a deeper exploration of this complex and evolving field. However, despite the richness of previous insights, a notable limitation of existing research is its predominant focus on the influence of the overall Chinese accent, often overlooking other dialectical factors that contribute to intelligibility. This highlights the need for studies to adopt a more comprehensive approach, encompassing speakers from various dialect regions.

Method

Participants. This study employed questionnaire surveys and phonetic experiments to record and analyze the English pronunciation of college students in the Bashu dialect area. Eighty volunteers participated, comprising 40 speakers and 40 listeners, a sample size considered significant for speech experimental research. The speakers were undergraduate students from various counties and cities in Sichuan and Chongqing who had not resided outside their region for over three months. Participants were recruited via a stratified sampling technique and assessed using the Oxford Quick Placement Test (OQPT) (Engelhardt & Pfingsthorn, 2013; Hassaskhah & Roudsari, 2015; Meurant, 2009) to ascertain their intermediate English proficiency level and independent English language competence, aligning with the B1 level criteria established by the Common European Framework of Reference (CEFR) for Languages.

The speaker group included an equal number of students (20 each) from Sichuan and Chongqing, primarily from a university in Chengdu, with a balanced gender distribution of 20 male and 20 female students. For the listener group, the study recruited 40 educated individuals from different countries and regions, encompassing the Inner circle (e.g., the United Kingdom, the United States, Australia, Canada, New Zealand), the Outer circle

Table 1 Participants.

Speakers (n = 40)		Listeners (n = 40)		
Sichuan	Chongqing	Inner circle	Outer circle	Expanding circle
20	20	13	13	14

(e.g., the Philippines, India, Malaysia, Singapore), and the Expanding circle (e.g., China, South Korea, Japan). These listeners, ranging from 13 to 14 per circle, were predominantly from the United States, the United Kingdom, Canada, Malaysia, the Philippines, Singapore, Pakistan, China, Japan, etc., including Chinese college students, international students, teachers, and linguistics researchers. The distribution of listeners and speakers is detailed in Table 1.

Test material. The phonetic experiment reading material consists of two parts, namely, an individual word test and a short passage.

Test 1: Individual words. To avoid the influence of consonants on the tested phoneme, the target test word was selected from the *Cambridge Pronunciation Dictionary, 18 Edition*, and is taken as the carrier sentence of "Please say _ again." (Pillai & Salaemae, 2012), which contains a total of 74 words:

ship, sheep, cheap, jeep, bill, bell, men, man, hat, hut, heart, hot, height, fight, pot, port, put, full, fool, four, fur, bed, bird, bud, like, alike, wet, wait, all, oil, car, cow, burn, bone, born, bee, beer, bear, pear, sent, send, class, glass, grass, price, prize, ass, ash, safe, save, best, vest, west, joke, yolk, and, hand, sin, sing, sink, think, first, thirst, tank, thank, day, they, cloze, clothe, mine, nine, line, confusion, Confucian

Test 2: A passage. The test passage is commonly used in phonetics research, "The Boy Who Cried Wolf", which contains more test phonemes than the traditional test passage, "The North Wind and the Sun" (Deterding, 2006).

Procedure. The study began with a questionnaire survey, targeting students from various linguistic backgrounds at universities in Sichuan and Chongqing. Participants who met the selection criteria were asked to read and sign an informed consent form for academic research participation. Following this, volunteer students undertook the OQPT, and their English proficiency was further assessed using their college entrance examination and Band 4 English scores. Participants were selected based on a B1 Level of English proficiency, aligning with the CEFR standard for intermediate English learners.

For the experimental phase, the speakers were instructed to read specific materials designed to test intelligibility. These materials included selected English words and short passages from authoritative phonetic resources. The recordings were conducted using professional equipment, namely a Zoom H6 recorder, in quiet classrooms or language laboratories, with a sampling rate set at 44,100 Hz.

In the listening experiment, the process was divided into four stages. Initially, listeners were asked to transcribe the spoken words using a word-by-word transcription method. Subsequently, they completed a cloze task based on a passage read by the speaker. In the final stages, listeners rated the overall intelligibility of the speakers' English using a Likert-9 scale. They also evaluated specific aspects of the speakers' pronunciation that might affect recognition and comprehension and provided suggestions for enhancing the intelligibility of the speakers' English.

Table 2 International listeners' overall intelligibility rating of the English spoken by the Sichuan and Chongqing subjects.

Mean	Max	Min	Std. Deviation	N
6.2	9	3	1.26	40

Table 3 International listeners' overall intelligibility rating of the English spoken by Sichuan subjects.

Mean	Max	Min	Std. Deviation	N
6	8	3	1.21	20

Table 4 International listeners' overall intelligibility rating of the English spoken by Chongqing subjects.

Mean	Max	Min	Std. Deviation	N
6.4	9	4	1.31	20

Table 5 Test results of intelligibility test of words spoken by Sichuan and Chongqing subjects.

Mean	Max	Min	Std. Deviation	N
48.6	61	29	9.42	40

Table 6 Test results of intelligibility test of words spoken by Sichuan subjects.

Mean	Max	Min	Std. Deviation	N
47	61	29	9.94	20

Table 7 Test results of intelligibility test of words spoken by Chongqing subjects.

Mean	Max	Min	Std. Deviation	N
50.3	61	34	8.82	20

Data analysis. After collecting listener feedback, this study calculated the overall intelligibility of English spoken by Bashu dialect speakers. Utilizing SPSS 26.0 for data processing and analysis, a *t*-test was conducted to compare mean intelligibility ratings between subjects from Sichuan and Chongqing (two-tailed, *df* = 19). Detailed analyses were performed on the differences between transcribed recordings and original manuscripts, categorizing and analyzing the speakers' segmental errors by frequency. Additionally, the study analyzed segmental and suprasegmental issues based on the accuracy rates in the cloze tests, classifying them by occurrence frequency. The listeners' comprehension rates of the dialog content were also thoroughly examined. The study concluded with a comprehensive assessment of the listeners' understanding of the speakers' English, summarizing questions and suggestions raised by the listeners. This aimed to provide insights and recommendations for enhancing the intelligibility of spoken English among Chinese students.

Results

Intelligibility test results. Drawing on Kachru's (1985) World Englishes theory, the author compiled overall intelligibility scores, word intelligibility test scores, and essay intelligibility test scores from the evaluations of 40 listeners representing various global English-speaking circles. These listeners provided insights on factors impacting their understanding of the speakers' English and offered suggestions for enhancing their comprehension of the English spoken by the participants.

Overall intelligibility score. The findings revealed that the average intelligibility rating assigned by international listeners to the recorded speakers was 6.2 out of 9, equivalent to 69 out of 100 (see Table 2). According to Morley's (1991, p. 502) articulation index, this score suggests that the speakers' English was perceived as generally intelligible by the listeners (also see Zhang, 2015). Notably, despite the distinct accent in the English of the Sichuan-Chongqing subjects, their speech was generally intelligible to international listeners, with one listener even awarding a maximum score of 9 to a speaker's recording.

Tables 3 and 4 present the overall intelligibility scores given by international listeners to the recordings of English spoken by subjects from Sichuan and Chongqing, respectively. The data indicates that the overall intelligibility score for the Sichuan

subjects was 6, marginally lower than the 6.4 score for the Chongqing subjects. However, it's also important to consider that these scores might have been influenced by the varying listening proficiency levels of the listeners, contributing to the observed differences.

Individual word intelligibility test results. The study analyzed the accuracy of listeners' transcription of 74 test words, considering that homophones (such as 'be' and 'bee') were deemed correct due to the lack of contextual clues. The data revealed that the highest number of words accurately transcribed by a listener was 61, while the lowest was 29. On average, listeners correctly transcribed 48.6 words, with a corresponding standard deviation of 9.42 (as detailed in Table 5). Consequently, the average number of accurately transcribed words constituted 65.7% of the total test words. These results indicate that the English spoken by subjects from Sichuan and Chongqing is generally intelligible to international listeners.

Tables 6 and 7 detail the scores assigned by international listeners to the English words read by subjects from Sichuan and Chongqing, respectively. A comparative analysis reveals that the average number of correctly translated English words for Sichuan subjects is 47, marginally lower than the average for Chongqing subjects, which stands at 50.3. This slight difference suggests a variance in the intelligibility of English words read by subjects from these two regions.

The test results indicate that the intelligibility of English words read by Sichuan subjects is marginally lower than that of Chongqing subjects for international listeners. However, a pairwise sample *T*-test reveals that the difference in word comprehension between the two groups of subjects is not statistically significant ($t = -0.924, p > 0.05$, paired samples, two-tailed, *df* = 19).

Paragraph intelligibility test results. In the intelligibility test, using the passage "The Boy Who Cried Wolf," which comprises 216 words, 30 words were omitted to assess the listeners' comprehension when reading the passage read by the speaker. These omitted words were content-rich, encompassing a broad range of phonemes. International participants were tasked with filling in these 30-word gaps in the essay comprehension test. A detailed analysis of accurately transcribed words found that the highest

Table 8 Paragraph intelligibility test results of Sichuan and Chongqing subjects.

Mean	Max	Min	Std. Deviation	N
26.2	30	16	2.94	40

Table 9 Paragraph intelligibility test results of Sichuan subjects.

Mean	Max	Min	Std. Deviation	N
25.8	29	20	2.69	20

Table 10 Paragraph intelligibility test results of Chongqing subjects.

Mean	Max	Min	Std. Deviation	N
26.6	30	16	3.2	20

Table 11 The correlation score of the intelligibility test results between words and the passage.

	Individual words	Passage
Individual words	1	0.105
Passage	0.105	1

number of correctly transcribed words was 30, and the lowest was 16, with an average of 26.2 words and a standard deviation of 2.94. Therefore, the average percentage of correctly transcribed words was 87.3% (Table 8). This outcome indicates that, compared to words read out of context, the passages read by subjects from Sichuan and Chongqing within context were more intelligible to international listeners.

Tables 9 and 10 present the test results from international listeners on the passages read by subjects from Sichuan and Chongqing, respectively. A comparative analysis of these results reveals that the average number of correctly completed blanks in the English passages read by Sichuan subjects is 25.8, marginally lower than that for the Chongqing subjects. This suggests a slight difference in the ability of listeners to accurately fill in the blanks for passages read by subjects from these two regions.

The test results showed that English passages read by Sichuan subjects were marginally less intelligible to international listeners than those read by Chongqing subjects. However, a paired sample *T*-test revealed that the disparity in word intelligibility between the two groups was not statistically significant ($t = -0.758$, $p > 0.05$, paired samples, two-tailed, $df = 19$).

The correlation of the intelligibility test results between words and the passage. The study employed the Pearson product-moment correlation test to examine the relationship between the intelligibility test results for individual words and the short passage, as detailed in Table 11. This analysis did not reveal a statistically significant correlation, with $r(78) = 0.105$ and $p > 0.05$. These results do not suggest a significant correlation between the two sets of intelligibility test outcomes. This indicates that there is no notable link between the intelligibility of the words and the short passages read by subjects from Sichuan and Chongqing in this study.

Comments and suggestions from international listeners. After completing both word and passage intelligibility tests, international listeners were invited to provide evaluations of the speakers' English pronunciation. A total of 22 valid comments were received. Selected excerpts from the listeners' feedback are provided below:

Listener 1: "Sheep" and "ship" are a little hard to distinguish, and the word "think" makes an 's' sound instead of a 'th' sound. "wet" has a slight 'ei' sound, so it is difficult to distinguish it from "wait". I'm also not sure if the speaker meant to say "beer" or "bear," which may have been due to the lack of context, coupled with the accent, making it a little hard to tell. In the sentence, I think the correct word is "clothe", but it sounds like "cloze". In the reading, the word "nine" is pronounced like "line," but I think this is just a mispronunciation. Finally, "confusion" and "Confucian" sound similar. In general, the speakers had few pronunciation problems. (British listener)

Listener 7: I think the reader's pronunciation problem is not particularly serious. We can understand most of the content, but the vowel pronunciation of some words is not particularly standard, and the reading process of sentences and articles is too long, without proper skipping and skimming. However, it is generally intelligible and does not affect the audience's understanding of the text and sentences. (Malaysian listener)

Listener 20: The speaker's pronunciation is not clear. Some words are difficult to understand. When recording a listening tape, you need clear, accurate, and strong pronunciation. Avoid jargon, as it often makes it more difficult for others (if they are not from your area) to understand. In order to be easily understood by people from different backgrounds, you need to speak clearly and without using jargon. Some consonants, such as "r", "v", "n", "l", confuse me. People who use jargon often have problems with vowels. The international pronunciation of each word also requires the speaker to say it correctly to reduce confusion among the audience. (Japanese listener)

The feedback provided by international listeners regarding the Bashu dialect speaker's English pronunciation was thematically analyzed (see Table 12).

In summary, the listeners' feedback revolves around specific phonetic features, the impact of accent and context, the overall clarity and quality of pronunciation, the speech rhythm, mispronunciations, and jargon. Based on their background, each listener focused on different aspects of pronunciation, reflecting a diverse range of listening experiences and expectations.

Factors affecting the intelligibility of English spoken in the Bashu dialect area. After sorting through all the listener feedback mentioned above, the main phonetic issues affecting the intelligibility of spoken English by college students from Sichuan and Chongqing include the following:

- (1) Vowel Length: Especially the distinctions between /i:/ - /ɪ/, /ʌ/ - /ɑ:/, /ɔ:/ - /ɒ/, and /ʊ/ - /u:/ vowels.
- (2) Vowel Quality: Particularly, there is some degree of confusion in pronouncing the /ɔ:/ - /ɒ/ and /ʊ/ - /u:/ vowel pairs.
- (3) Voicing of Consonants: Voiced and voiceless consonants are easily confused and replaced during pronunciation.
- (4) Nasal Consonants: Especially at the end of words, confusion between /m/ and /n/, and /n/ and /ŋ/ is common.
- (5) /l, r/ and /l, n/ Confusion: Bashu dialect influences the production of these consonants.
- (6) /w/ and /v/ Confusion: This issue frequently appears in the speaker's recordings.
- (7) Substitution of Fricatives /θ, ð/ with /s, z/ or /t, d/: This is a common pronunciation issue among Chinese students.

Table 12 A thematic analysis of the listeners' feedback on speakers' pronunciation features.

Categories	Pronunciation features
Pronunciation challenges of specific sounds and words	Most listeners noted difficulties with particular sounds and word pairs, such as "ship" vs. "sheep," "wet" vs. "wait," and "beer" vs. "bear." The 'th' sound was frequently mispronounced as an 's' or 'z' sound (e.g., "think" sounding like "sink," "them" as "zem").
Accent and contextual clarity	Some listeners mentioned issues with vowel sounds, where words like "fool" and "full" sounded similar, and the pronunciation of "nine" resembled "line." Consonants such as 'r', 'v', 'n', and 'l' were also points of confusion, with mispronunciations like "like" sounding as "nike." A British listener highlighted the role of the speaker's accent and context in understanding words like "beer" vs. "bear." The lack of contextual cues was seen as a contributing factor to misunderstandings.
Pronunciation quality and clarity	While some listeners (American, Malaysian, and Chinese) regarded the pronunciation as generally good and intelligible, a Japanese listener found it unclear and confusing. There was an appreciation for the speaker's clear and loud voice, which aided in word recognition, as noted by a Singapore listener.
Speed and rhythm of speech	The pace at which the speaker moved from word to word was easy to follow, while a Malaysian listener mentioned the reading process was too lengthy without proper skipping and skimming.
Mispronunciations and overpronunciations	Mispronunciations were a common theme, with words like "fist" becoming "fest" and "vest" sounding like "west." Overpronunciation leading to strange or incorrect syllable stress was noted, affecting the natural flow and clarity of speech.
Use of Jargon and International Pronunciation Standards	The Japanese listener emphasized the need for clear, accurate pronunciation without jargon for better understanding by people from various backgrounds. Adherence to international pronunciation standards was suggested to reduce confusion among listeners.

- (8) Deletion and Insertion of Consonant Clusters: Continuous consonants are easily omitted or replaced with other consonants during pronunciation.
- (9) Stress and Rhythm: Inappropriate stress and rhythm in words and sentences can affect listener comprehension.
- (10) Intonation Issues: Intonation problems make the pronunciation of students from Sichuan and Chongqing sound unnatural, impacting listener comprehension.

Suggestions for improving the international intelligibility of English spoken by college students in Bashu dialect area. International listeners were invited to give suggestions on improving the intelligibility of the English spoken by students from Sichuan and Chongqing. The author received many practical suggestions. Some excerpts of the listeners' feedback are listed below:

Listener 1: *This student is very confident, and a good reader, and although he speaks fairly quickly, he has relatively few pronunciation mistakes, so most of the content is intelligible overall. To practice common mistakes, such as the difference between long and short vowels: for example "feast" versus "fist"—I would suggest really trying to exaggerate long vowels, such as "Feeeeast" or "Seeeeeal" versus "Fist" and "Sell". This can be done by creating word association lists: list examples of short and long vowels, pay attention to mouth movements when emphasizing their differences, and use them in the same sentence. (British listener)*

Listener 4: *First, the speaker should learn the sounds of letters, especially when they are grouped together, such as ch, sh, etc. Speakers should learn to distinguish between similar-sounding words. When telling a story or delivering a speech, the speaker should pause at the end of each sentence so that the audience can understand the message. The speaker's intonation should vary for emphasis. (Japanese listener)*

Listener 10: *The speaker's pronunciation is already clear and loud, easy to recognize word for word. However, it would be nice if*

the speaker could make a distinction between some words that sound the same but are spelled differently. This is more helpful when the word is used in a sentence to visualize which word is actually used in that situation. Next, the speaker may try to lengthen the pronunciation of some words, which helps the listener to hear more clearly and better understand the specific letters present, thus allowing the listener to distinguish the words. (Malaysian listener)

The feedback from various listeners on speakers' English pronunciation and reading skills can be categorized into several key themes (see Table 13).

In summary, the feedback focuses on improving vowel and consonant pronunciation, employing specific techniques and exercises, enhancing fluency and intonation, learning from L1 English speakers, applying practical testing methods, and maintaining overall comprehension despite pronunciation errors. Depending on their background, each speaker offers unique insights and suggestions tailored to the individual's learning process.

Discussion

The results indicate that international listeners generally found the English spoken by Sichuan-Chongqing speakers to be intelligible, aligning with some prior research (Kirkpatrick et al., 2008; Zhang, 2015; Zhou et al., 2019). It's worth noting that this study examines explicitly the intelligibility of English spoken by individuals with intermediate English language proficiency. Additionally, differences from previous findings may be attributed to the influence of the Bashu dialect, which possesses distinct pronunciation patterns and tonal characteristics compared to the dialect regions in previous studies.

The intelligibility ratings for English speakers from Sichuan and Chongqing were 6 and 6.4, respectively. This minor discrepancy could be attributed to the impact of the unique pronunciation features of the dialect in the Chongqing area. This finding supports the notion that the intelligibility of English

Table 13 A thematic analysis of the listeners' suggestions for enhancing the pronunciation and intelligibility of speakers.

Categories	Suggestions
Pronunciation of vowels and consonants	A common suggestion across multiple speakers was the importance of differentiating between long and short vowels (e.g., "feast" vs. "fist", "shot" vs. "shoot"). Specific consonant sounds, notably 'r' and 'l', were highlighted as areas needing practice, with examples like 'bear' vs. 'bell', and 'sheep' vs. 'shape' or 'ship'.
Pronunciation techniques and exercises	British and Canadian listeners suggested exaggerating vowel lengths and using word associations as techniques to improve pronunciation. A Japanese listener recommended focusing on the sounds of letter combinations like 'ch' and 'sh', and practicing with words that sound similar. Another Japanese listener advised paying attention to mouth and tongue positioning, especially for 'th' and 's' sounds.
Fluency and Intonation	An American listener emphasized the importance of developing sentence fluency and intonation by listening and reading with L1 English speakers. A Japanese listener suggested varying intonation for emphasis and pausing at the end of sentences to aid understanding.
Understanding and mimicking L1 English speakers	Exposure to L1 English speakers through movies, radio, and other media was advised by an American listener as a way to improve pronunciation while maintaining one's accent. A Malaysian listener highlighted the clarity of the speaker's pronunciation and suggested further distinguishing words that sound similar but are spelled differently.
Practical application and testing	The Canadian listener recommended using smartphone translators to check pronunciation accuracy and distinguish between similar-sounding words. A Japanese listener proposed making lists of challenging words and practicing them in context.
Overall comprehension and intelligibility	Despite some pronunciation errors, the Canadian and Malaysian listeners felt that the average listener could still understand the speaker, indicating that the pronunciation issues did not significantly hinder intelligibility.

spoken by individuals from different dialect regions may exhibit some variation (Zhang, 2012; Zhou et al., 2019).

Regarding individual words, listeners accurately transcribed approximately 65.7% of the English words spoken by both Sichuan and Chongqing subjects, indicating a relatively high level of international intelligibility. Notably, listeners transcribed fewer English words when spoken by Sichuan subjects than Chongqing subjects. This observation suggests that speakers from both Sichuan and Chongqing share a similar accent influenced by the Bashu dialect.

In an intelligibility test utilizing the passage "The Boy Who Cried Wolf," which omitted 30 words, international participants achieved scores ranging from 16 to 30, with an average of 26.2 words and an accuracy rate of 87.3%. This indicates a better comprehension of paragraphs within a contextual framework. While Sichuan subjects scored slightly lower than Chongqing subjects in this context, the difference in intelligibility was not statistically significant for international listeners. The higher accuracy rate for correctly transcribed words in the passage compared to individual words may be attributed to the contextual cues available to listeners, enabling them to make more accurate guesses (Lieberman, 1963; Van Zeeland, 2013). This finding aligns with previous research on intelligibility (e.g., Kennedy & Trofimovich, 2008; Van Engen et al., 2014; Winn & Teece, 2021).

When considering the factors that affect the intelligibility of English spoken by individuals from the Bashu dialect area, feedback from international listeners can be summarized into several vital aspects. Listeners pinpointed difficulties with certain sounds and words, notably differentiating between pairs like "ship" and "sheep" or "beer" and "bear," and the common misarticulation of the 'th' sound as 's' or 'z'. These findings are consistent with prior research on Chinese speakers' phoneme pronunciation challenges (e.g., Huang & Evanini, 2016; Radant et al., 2009). Confusion also arose in vowel sounds and consonants like 'r', 'v', 'n', and 'l', which echoes the findings of Kho (2011). The speaker's accent and the absence of contextual clues significantly impacted comprehension. Listener responses varied: while American, Malaysian, and Chinese listeners generally found

the pronunciation clear, Japanese listeners faced difficulties with clarity. A Singaporean listener particularly emphasized the benefits of a loud and clear voice. Speech speed and rhythm were also points of contention, with some finding it too slow, affecting natural flow. Mispronunciations and overpronunciations, such as "fist" becoming "fest" and incorrect syllable stress, further disrupt natural speech patterns. Lastly, a Japanese listener emphasized the necessity of avoiding jargon and adhering to international pronunciation standards to enhance understanding for a global audience.

International listeners provided several vital suggestions regarding improving English pronunciation and intelligibility for speakers from the Bashu dialect area. A primary focus was distinguishing between long and short vowel sounds, illustrated by pairs such as "feast" versus "fist," and refining the pronunciation of specific consonants, notably 'r' and 'l'. Suggested strategies encompassed elongating vowel sounds deliberately, employing word associations, concentrating on letter clusters like 'ch' and 'sh,' and mindful positioning of the mouth and tongue for 'th' and 's' sounds. Additionally, enhanced fluency and intonation through varied intonation patterns and strategic pausing at sentence endings was highlighted as essential. Enhancing fluency and intonation by varying intonation patterns and pausing at the end of sentences was also crucial. To achieve a more natural accent, listeners are advised to be exposed to L1 English speakers through various media and mimic their pronunciation. Practical methods were also encouraged, including using smartphone translators to verify pronunciation and compiling lists of challenging words for targeted practice. Despite some pronunciation challenges, listeners from Canada and Malaysia noted that these issues did not significantly detract from overall comprehension, suggesting that the speakers were generally intelligible and understandable.

Conclusion

In summary, this study employed a combination of qualitative and quantitative research methodologies to investigate the international intelligibility of English pronunciation among college students hailing from the Bashu dialect region. By

conducting questionnaire surveys and comprehensive phonetic experiments involving 40 intermediate-level English college students from both Sichuan and Chongqing, this research unveiled prominent pronunciation challenges influenced by the underlying Bashu dialect structure, which impeded the international intelligibility and communicative effectiveness of their spoken English.

In the intelligibility assessment, the average rating by international audiences for the recorded speaker's intelligibility was 6.2 (69/100), signifying a generally intelligible pronunciation. Despite pronounced accents, the participants from Sichuan and Chongqing exhibited intelligible English pronunciation to international listeners. Notably, there were slight variations in English pronunciation intelligibility scores between Sichuan and Chongqing participants, potentially attributed to differences in vowel positions, duration, and listener proficiency. The word intelligibility test demonstrated that participants' English words were comprehensible to international audiences at a rate of 65.7%, with no significant disparity between the Sichuan and Chongqing groups. Short passage intelligibility tests highlighted the considerable role of contextual information in enhancing comprehension, with Sichuan participants slightly trailing Chongqing participants, albeit without statistical significance.

Specifically, the study identified key factors impacting the English pronunciation intelligibility of college students in the Sichuan-Chongqing area, including challenges in distinguishing specific sounds and words, common mispronunciations of certain sounds, vowel and consonant confusion, the influence of the speaker's accent and contextual cues, variations in listener responses based on nationality, the importance of clear diction, speech speed, and rhythm, and issues like mispronunciations and syllable stress errors. Lastly, adhering to international pronunciation standards and avoiding jargon were emphasized to enhance global audience understanding.

Incorporating listener feedback, key recommendations to enhance spoken English comprehension for students in Sichuan and Chongqing encompass (1) mastering the distinction of vowel pairs, (2) engaging in consistent communication with foreigners to improve vocabulary and sentence intelligibility, (3) identifying and addressing frequently mispronounced phonemes that reduce intelligibility, and (4) focusing on improving overall English intelligibility rather than striving for L1 English speaker accents, ultimately boosting communication confidence and efficiency.

This study enriches our understanding of the pronunciation challenges faced by English learners in the Sichuan-Chongqing region, providing insights for tailored improvement strategies. Beyond this locale, the findings hold relevance for Outer Circle English regions, where local dialects similarly influence English pronunciation. The research highlights the potential for broader application of these insights, suggesting that strategies effective in Sichuan-Chongqing could also benefit learners in other dialect-influenced areas. Additionally, this study may pave the way for further investigations into the global impact of local dialects on English learning, providing some insights for linguists and educators.

A notable limitation of the present study lies in its relatively small and homogenous sample size, which consists exclusively of 40 undergraduate students with intermediate English proficiency, all hailing from the Sichuan and Chongqing areas of China. While beneficial for a targeted investigation, this specific demographic focus restricts the generalizability of the study's findings to a broader population. Recognizing this constraint, it becomes imperative for future research endeavors to adopt a more inclusive approach by integrating participants from a variety of linguistic backgrounds, educational levels, and age groups. Such an expansion would enrich the data pool and enhance the overall applicability and relevance of the study's outcomes. Expanding

the scope of future research can yield a more profound understanding of English intelligibility nuances across diverse demographics, leading to more effective and widely applicable language learning approaches.

Data availability

All data generated or analyzed during this study are included in this published article and its supplementary information files.

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Author contributions

JZ: Research design, resources, conceptualization, funding acquisition, writing, review & editing.

Competing interests

The author declares no competing interests.

Ethical approval

Research Ethical Approval was obtained from the Academic Committee of the School of Foreign Languages of Chengdu Normal University (Reference No. SFLRA-2023001). All the procedures implemented in the study were in accordance with the principles of the Declaration of Helsinki.

Informed consent

Written Informed Consent was obtained from all participants who took part in the study.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-024-03112-3>.

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