

Consonantism problems in SFL teaching to Chinese immigrants living in Granada

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ABSTRACT: This article examines the phonetic characteristics of Chinese immigrants in their pronunciation of consonants. The research was conducted based on surveys collected from a sample of adult, non-bilingual Chinese population residing in Granada for more than 10 years. The study presents a phonetic and acoustic description and comparison (through analysis using the PRAAT software) of the consonants considered to be the most problematic. This article presents and describes the different methods of consonant realization in Spanish by Chinese immigrants and the degree of their phonetic dissimilation in specific contexts. Additionally, it details the levels of adjustment and assimilation with native consonant pronunciation.

Keywords: acoustic phonetics, Chinese, immigration, consonant adaptation.

Problemas del consonantismo en la enseñanza del ELE a los inmigrantes chinos residentes en Granada

RESUMEN: El presente artículo analiza las características fonéticas de los inmigrantes chinos en su pronunciación de las consonantes. La investigación se ha realizado a partir de las encuestas recogidas en una muestra de población china adulta y no bilingüe residente en Granada más de 10 años. El trabajo presenta la descripción y la comparación fonética y acústica (a través del análisis mediante el programa informático PRAAT) de las consonantes que se han considerado como las más problemáticas. En el presente artículo se presentan y describen las diferentes maneras de realización consonántica en español por los inmigrantes chinos y el grado de su disimilación fonética en determinados contextos. Asimismo, se detallan los niveles del ajuste y asimilación con la pronunciación consonántica nativa.

Palabras clave: fonética acústica, chinos, inmigración, adecuación consonántica.

1. INTRODUCTION

In the process of acquiring Spanish as a foreign language, it is common to encounter a wide variety of phonetic phenomena that deviate from the established norms of the target language. These phenomena encompass irregularities and inconsistencies in the articulation of sounds, particularly among speakers whose mother tongue possesses a markedly divergent phonological structure. In the specific context of Granada, one of the most representative groups in this area is that of speakers of Chinese origin, whose significant presence in the

city has aroused particular interest in studies on the interlanguage and phonetic acquisition of Spanish. Specifically, Chinese speakers exhibit distinctive phonetic patterns that reflect the influence of their mother tongue on the acquisition of Spanish.

The primary objective of this article is to analyse, from a contrastive phonetic perspective (articulatory and acoustic), the production of peninsular Spanish consonants by Chinese immigrants residing in Granada. The incorporation of acoustic analysis represents a significant novel contribution of this research, as it employs tools such as spectrograms obtained with PRAAT software, enabling a more detailed and objective description of the phonetic phenomena observed.

2. BACKGROUND, OBJECTIVES AND HYPOTHESES

A number of studies have been conducted on the pronunciation of Spanish by Sino-Spanish speakers. However, these studies have focused on general intonation or vowel systems rather than on specific aspects of pronunciation. Conversely, consonantal phenomena have received comparatively less attention, despite the fact that they constitute an important focus of phonetic interference. Notable authors in this field include Igarreta Fernández (2015, p. 191), Cortés Moreno (2002, pp. 77–98), Varela Rivera (2014, p. 40), Pose (2017, p. 7) and Pan (2023, p. 112). These scholars have identified notable phenomena, such as rotacism, the absence of voiced/voiceless oppositions, and the tendency to substitute the Spanish voiced stops /d/, /b/ and /g/ for their voiceless counterparts. However, it should be noted that these observations are not always accompanied by spectrographic analyses that allow empirical verification of these difficulties.

Furthermore, certain studies concentrate on regional phonological dissimilarities in Chinese, which, while pertinent, do not directly impact the acquisition of Peninsular Spanish. Other studies address sound perception from a phonoaudiological perspective, yet lack a contrastive basis based on real speech registers. Furthermore, there is a paucity of research that considers the interaction between the dialectal variety of Spanish learned –such as the Spanish spoken in Granada– and articulatory errors.

The present study is based on the hypothesis that the most frequent errors in consonant production by native speakers of Chinese are not only due to the absence of certain phonemes in their phonological system, but also to a series of interference processes related to auditory perception, articulation and formal teaching. It is also hypothesised that some errors stem from incorrect graphemic correspondences or imitations of non-native teacher pronunciation in initial learning contexts in China.

The primary objectives of this research are as follows:

- 1) To describe, from an acoustic and articulatory approach, the most frequent errors in the production of Spanish consonants by Sino-Spanish speakers.
- 2) To categorise the phonetic phenomena identified according to their presence or absence in the Chinese phonological system.
- 3) The degree of influence of the various dialects of Spanish, particularly that spoken in Granada, on the acquisition of sounds by Chinese learners will also be determined.

- 4) The proposal of contrastive criteria that contribute to more effective phonetic teaching of L2 Spanish for Sinitic speakers.

3. METHODOLOGY

This study has been conducted as a qualitative phonetic-acoustic analysis aimed at examining the difficulties presented by native speakers of Chinese in the production of certain Spanish consonants. The methodology employed facilitates accurate observation of the phenomena involved in the articulation and perception of target sounds, with a particular focus on relevant aspects of linguistic contrast between Chinese and Spanish.

The analytical framework follows the methodology outlined by Sosinski (2022) in his study on Polish and Spanish consonants and is based on the PRESEE-Granada corpus. Instrumental support is provided by the PRAAT software (version 6.4), developed by Paul Boersma and David Weenink at the University of Amsterdam. This tool enables the spectrographic analysis of consonantal segments that have been identified as problematic for Chinese speakers. As endorsed in the *Nueva gramática de la lengua española* (RAE and ASALE, 2011: 2.4i, 2.4j), this approach includes both articulatory and perceptual assessment, supported by phonoaudiological testing and tonal audiometry when necessary.

In line with prior studies on vowels (Waluch-de la Torre and Herrero del Haro, 2025), frequency thresholds of 5,500 Hz for female voices and 5,000 Hz for male voices were applied, with a DotSize of 0.5 mm, as is standard in similar studies.

Additionally, the methodology takes into account Spanish dialectal phenomena such as *seseo* and *yeísmo*, which are prominent in the variety spoken in Granada. Although not specific to Chinese, these phenomena influence the perception and production of Spanish phonemes by foreign learners and are therefore relevant to the context of this study.

Overall, the study focuses on specific words and phonic sequences that represent critical points in the acquisition of the Spanish consonant system by Chinese learners. These phenomena occur with sufficient regularity to yield generalisable conclusions. In some cases, such as that of *seseo*, they even constitute majority patterns within the learner population.

4. DATA AND CORPUS

According to data from the National Statistics Institute (January 2024), the Chinese population in Spain totals 226,718 individuals, ranking as the country's twentieth largest immigrant group. Of these, 2,180 reside in the province of Granada (January 2022).

This study draws on two primary corpora. The CHIN-GRAN corpus includes interviews with Chinese immigrants in Granada (Agenda 2050 and ECOS projects), while the PRESEEA-Granada corpus consists of recordings of local native speakers. Both were compared to general Spanish and Chinese data, using as references the *Nueva gramática de la lengua española* (RAE & ASALE, 2011) and the *Xinhua Zidian* (Commercial Press, 2020).

To identify and compare speech registers, a labelling system was employed: H (men), M (women), CHIN (Chinese), ESP (Standard Spanish), ESPG (Granada Spanish), and GCHIN (Spanish spoken by Chinese residents in Granada). The standard Spanish variety referenced

is the central-northern modality, regarded as prestigious and widely disseminated, thus frequently used in teaching Spanish as a foreign language.

The PRESEEA-Granada corpus (Moya Corral, 2007, 2009, 2010) comprises 54 audio recordings (45 minutes each) from 54 informants, selected through stratified sampling based on age, gender, and educational level. Age groups include 20–34, 35–54, and 55+; education levels are primary (≤ 10 years), secondary (10–14 years), and tertiary (15+ years), each with 18 participants. The corpus contains 251,000 linguistic forms.

In contrast, the CHIN-GRAN corpus reflects the specific challenges of studying immigrant populations. The ten-year residency requirement in Granada limited participant selection. Additional constraints—privacy concerns, interview length, and anonymity preference—prevented symmetric stratification. Nonetheless, 30 interviews (each 30 minutes) were obtained, totaling over 16 hours, and allowing validation of initial phonetic observations. Reliability was enhanced using a dual-interviewer method: half the interviews were conducted by native Spanish speakers, the other half by Chinese co-ethnics.

Although classical stratification by age, gender, and education was not feasible due to group homogeneity, the sample remains analytically rich. All participants are native Chinese speakers living in Granada for over ten years, with Spanish as a second language. Most are adults aged 29–53, divided into two age groups: under and over 40. The sample includes 10 men and 20 women: 4 with primary education, 15 with secondary, and 12 with higher education. The CHIN-GRAN corpus comprises 584,795 language forms.

Most participants reported learning Spanish before arriving in Spain, which, per DeKeyser (2000, pp. 518–519), rules out native bilingualism or childhood L2 acquisition. No speech disorders or impairments were observed. In sum, both corpora meet methodological standards in qualitative and quantitative terms and are appropriate for analysing Spanish consonant production by native Chinese speakers.

5. THE SPANISH CONSONANT SYSTEM VS. THE CHINESE CONSONANT SYSTEM

To identify the phonetic aspects central to this study, it is essential to examine the phonological systems of Chinese and Spanish in detail. A comparative analysis of their consonant phonemes, and selected allophones, will help determine whether observed divergences contribute to pronunciation difficulties for native Chinese speakers learning Spanish.

Given the lack of consensus regarding the exact number and classification of Spanish consonant phonemes, this study adopts the proposal from the *Nueva gramática de la lengua española* (RAE and ASALE, 2011: s.v. *consonantes*), which identifies 27 graphemes (plus two digraphs) and 19 consonant phonemes, expressed through 29 regional variants.

As previously noted, this analysis excludes features such as *lisps*, *heheo*, and other dialectal traits deemed irrelevant for the study's contrastive focus. However, it does include *yeísmo* and references *seseo*, a phenomenon not dominant in Granada but potentially influential in the phonetic perception and production of Chinese learners (Sosiński and Waluch de la Torre, 2026). Consequently, the Spanish system used here consists of 18 consonant phonemes.

In contrast, Chinese presents a complex consonant inventory with systematic contrasts between voiceless and aspirated consonants. It lacks voiced stops and initial consonant clusters,

setting it apart from Spanish (Miranda Márquez, 2014, pp. 55–56). Moreover, Chinese is a tonal language, where pitch variation affects not only intonation but also phonological meaning, potentially altering the lexical or syntactic interpretation of utterances (Pose, 2017: 6–7).

While dialectal variation and sociolinguistic stratification (Suo, 2021, p. 11) influence the pronunciation of Chinese consonants, no such variation was observed in the current sample, and it was excluded from analysis.

Standard Mandarin includes 21 consonant phonemes represented by 19 pinyin letters (excluding digraphs like *zh*, *ch*, *sh*). Their phonetic realisations may vary with phonological context or dialect.

For comparative purposes, three categories were established:

1. Consonants realised equivalently in both languages.
2. Consonants with different but phonetically similar realisations.
3. Consonants (phonemes or allophones) present in Spanish but absent in Chinese.

The first group comprises six phonemes. These were analysed contrastively using PRAAT (version 6.4), and no substantial differences were found. Thus, spectrographic representations were deemed unnecessary.

Table 1. *Consonants with the same realisation and representation in Chinese and in Spanish*

	GRAPHEME	PHONEME	DESCRIPTION	EXAMPLE SPANISH	EXAMPLE CHINESE
1	<f>	/f/	fricative, labiodental, voiceless	['fa.se]	['fa.se]
2	<k>	/k/	occlusive, velar, voiceless	['ka.sa]	['ka.sa]
3	<l>	/l/	lateral, alveolar, voiced	['la.ta]	['la.ta]
4	<m>	/m/	nasal, bilabial, voiced	[ma'ma]	[ma'ma]
5	<n>	/n/	nasal, alveolar, voiced	['na.ða]	['na.ða]
6	<s>	[s]	sp. fricative, predorsodental , voiceless	['su.θjo]	['su.θjo]

Note: Own elaboration

Table 1 presents an adaptation of the description of articulatory features proposed by Quilis (1983). While it is indeed the case that secondary realisations or minority variants can be identified, these articulations have been excluded from the present analysis due to their infrequency or non-existence in the Grenadian modality of Spanish.

Table 2. *Phonetic equivalences of graphically divergent consonants in Chinese and Spanish*

	GRAPHEME	PHONEME	DESCRIPTION	EXAMPLE SPANISH	EXAMPLE CHINESE
1	<j><g>/<h>	/x/	fricative, velar, voiceless	[xwan]	[xwan]
2	<c> <qu>/<g>	/k/	occlusive, velar, voiceless	['ka.sa]	['ka.sa]
3	<p>/	/p/	occlusive, bilabial, voiceless	['po.ʝo]	['po.ʝo]
4	<t>/<d>	/t/	occlusive, dental, voiceless	['ta.pas]	['ta.pas]

Note: Own elaboration.

Table 2 illustrates five phonemes shared by Spanish and Chinese whose orthographic representations differ, often leading to pronunciation errors by native Chinese speakers. A clear example is the Spanish word *baba*, where the grapheme may be misinterpreted as equivalent to the Chinese pinyin <bā>, which phonetically corresponds to [pa]. This misassociation consistently results in the substitution of /b/ with /p/. Such phonetic replacement, influenced by the speakers' mother tongue, also affects other phoneme pairs like /d/ and /g/.

This issue stems from a fundamental structural difference between Spanish and Mandarin phonological systems. Spanish phonology contrasts voiced and voiceless consonants, whereas Mandarin lacks this phonemic distinction. Instead, Mandarin distinguishes between aspirated and unaspirated plosives: the pinyin graphemes , <d>, and <g> denote unaspirated voiceless plosives [p], [t], and [k], while <p>, <t>, and <k> correspond to the aspirated counterparts [p^h], [t^h], and [k^h] (Varela Rivera, 2014, p. 40). As a result, native Chinese speakers tend to neutralize the voiced–voiceless contrast in Spanish, pronouncing /b/ as /p/ and /d/ as /t/.

The same interference can be observed among native Spanish speakers learning Chinese. They often produce the pinyin letter as a voiced consonant, mirroring its use in Spanish, rather than as the unaspirated voiceless plosive /p/ it represents in Chinese, resulting in non-native pronunciation.

However, not all phonemes are equally susceptible to this interference. The Spanish phoneme /x/, for example, generally poses little difficulty for Chinese speakers. The pinyin grapheme <j>, pronounced [tɕ], differs substantially in articulation from the Spanish voiceless velar fricative. This clear divergence prevents direct association and reduces the likelihood of error. Thus, while /p/ and /b/ are easily confused, /x/ and [tɕ] are less likely to be conflated due to their more marked phonetic differences.

The third group includes phonemes whose realisation differs markedly between Spanish and Chinese, posing some oral production challenges for the Chinese speakers interviewed. However, unlike the cases in Table 2, these phonemes do not lead to high error rates, as speakers tend to adjust their articulation relatively quickly. Their similarity to sounds in the native language also facilitates assimilation.

Another reason for the low error incidence is the absence of easily confusable phonemes in Spanish. Therefore, any deviations tend to have limited communicative impact.

As with previous groups, only those phonetic phenomena with sufficient frequency to be considered representative have been selected. The following realisations are included in this category:

Table 3. *Divergent Consonantal Realisations in Chinese and Spanish*

	GRAPHEME	PHONEME	DESCRIPTION	EXAMPLE SPANISH	EXAMPLE CHINESE
1	<ch> <ch>	$\widehat{[tʃ]}$ $[tʃ]$	spa: voiceless, (pre)palatal , affricate chi: voiceless, retroflex , affricate	[ˈmutʃo]	[ˈmutʃo]
2	<ll> <y>/ <y>	$[j]$ $[j]$	spa: voiced, palatal, fricative chi: voiced, palatal, approximant	[ˈjeyan]	[ˈjekan]
3	<ñ> <ni>	$[ɲ]$ $[ɲ]$	spa: voiced, palatal , nasal chi: voiced, alveolar , nasal	[ˈni.ɲa ^h]	[ˈni.ɲ ^h ias]

Note: Own elaboration.

A notable phonetic contrast arises in the articulation of the phoneme represented by the grapheme <ch>. In Chinese, its counterpart is the voiceless retroflex affricate $\widehat{[tʃ]}$, while in Spanish, it corresponds to the voiceless (pre)palatal affricate $[tʃ]$. The primary distinction lies in tongue retraction: Chinese requires a posterior articulation in the post-alveolar or retroflex region, adding complexity. However, since $\widehat{[tʃ]}$ is part of Standard Chinese and occurs systematically, native speakers usually acquire $[tʃ]$ in Spanish with little difficulty. The only adaptation—removing tongue retraction—does not pose a major challenge. In contrast, Spanish learners of Chinese may find $\widehat{[tʃ]}$ more demanding, as retroflexion is not present in Spanish. Still, once internalized, production stabilizes and rarely hinders long-term acquisition.

The phenomenon of *yeísmo*, marked by the neutralization of the phonemes traditionally represented by <ll> and <y>, also illustrates phonetic divergence. In Spanish, this results in a single phoneme whose realization— $[j]$, $[ʝ]$, or $[j]$ —varies regionally. In Chinese, however, <y> has no phonetic value per se, serving only as a pinyin marker in syllable-initial position (e.g., *yi*, *ya*, *yu* = $/i/$, $/ia/$, $/iu/$). This structural difference prompts native Chinese speakers to approximate the Spanish <y> as a vowel-like $[i]$. Given the broad social acceptance of *yeísmo*, this approximation rarely impedes intelligibility or communicative efficiency. Even when learners attempt to distinguish <ll> and <y>, dialectal variation in Spanish allows for flexibility, making deviations largely unproblematic.

With regard to <ñ> in Spanish and the <ni> sequence in Chinese, these differ phonetically, but not always perceptually. The Spanish $/ɲ/$ is a voiced palatal nasal, characterized by wide dorsal-palatal contact. The Chinese <ni> reflects a voiced alveolar nasal $/n/$ followed by $/i/$. While phonologically distinct, the transition from $/n/$ to $/i/$ can approximate the acoustic quality of $/ɲ/$, encouraging perceptual convergence. This articulatory similarity facilitates acquisition, particularly when explicit instruction guides learners to increase palatal contact. As a result, Chinese speakers tend to reproduce $/ɲ/$ with relative accuracy and ease.

Finally, the acquisition of the phonemes listed in Table 3, which differ significantly in realisation between Spanish and Chinese, requires specific learning strategies. Learners reported various paths: some learned these sounds through imitation of non-native Spanish instructors during training in China, others drew on exposure to native Spanish speakers after migrating to Spain, while a third group relied on analogical reasoning—linking new sounds to known elements in Chinese, English, or other previously learned languages.

Table 4. *Spanish Sounds Absent from the Chinese Phonetic System*

	GRAPHEME	PHONEME	DESCRIPTION	EXAMPLE SPANISH	EXAMPLE CHINESE
1	<r>	[r]	trill, alveolar, voiced tap (or flap), alveolar, voiced	['raro]	['laro]
2	<r>	[r]	trill, alveolar, voiced tap (or flap), alveolar, voiced	['graðo]	['klato]
3	<z> / <c>	[θ]	θ; fricative, postdental (or postinterdental), voiceless	[θer.'βe.θa]	[θer.'βe.sa]
4	<v>	[b]	stop, bilabial, voiced	[ba'riya]	[pa'riya]
5	<v>	[β]	approximant, bilabial, voiced	[be'βer]	[be'βer]
6	<d>	[d]	stop, dental, voiced	['daðo]	['d̄zaðo]
7	<d>	[ð]	approximant, dental, voiced	['graðo]	['klato]
8	<g>	[g]	stop, velar, voiced	['graðo]	['klato]
9	<g>	[ɣ]	approximant, velar, voiced	['jeɣan]	['jekan]

Note: Own elaboration.

As shown in Table 4, the nine sounds represented therein constitute a relatively broad set of phonological units that are entirely absent from the Chinese language. When these are added to the four cases identified in Table 2 and the three outlined in Table 3, a total of twelve consonantal phonemes can be identified which, in general terms, tend to pose challenges in their production by native Chinese speakers.

It is worth noting that, despite the common perception among Chinese speakers—according to which the Chinese phonological system is more complex and the Spanish system comparatively simple—the data resulting from this comparison reveal the existence of up to twelve distinct phonemes in Spanish that have no equivalent in Chinese. This absence implies a potential difficulty for their acquisition and production, particularly in cases where no articulatory precedent exists in the learner's mother tongue.

6. RESULTS

This section presents the contrastive acoustic analysis of the selected sounds, complemented by graphic illustrations of their articulation. Its aim is to offer a clearer basis for the discrepancies observed in the pronunciation of Spanish consonants by native Chinese speakers. The articulatory diagrams are sourced from Martínez Celdrán and Fernández Planas (2007). A detailed description is also provided of the most relevant and distinctive phonetic features of each sound pair, considering their behaviour in similar phonological contexts. The analysis follows the order set out in Tables 2, 3, and 4, starting with the sounds that show the greatest similarity between the two languages.

6.1. Phonetically related consonants in the chinese and spanish systems

The first pair of sounds analysed comprises the Spanish phoneme <ch> and its Chinese counterpart. These affricates, $\sqrt{tʃ}$ in Spanish and $\sqrt{tʂ}$ in Chinese, differ phonetically in their place of articulation. In both languages, they are voiceless affricates; for the purposes of this analysis, the possible fricative realisations mentioned by Moya and Wiedemann (1998) are not considered.

The main distinction lies in the palatalisation typical of the Spanish phoneme, in contrast to the retroflexion of the Chinese one. Specifically, the Spanish *ch* is articulated in the (pre)palatal region, whereas in Chinese, the tongue tip retracts toward the retroflex zone of the vocal tract. This articulatory contrast is clearly depicted in the diagrams (Figures 1 and 2), which highlight the different configurations of the two sounds.



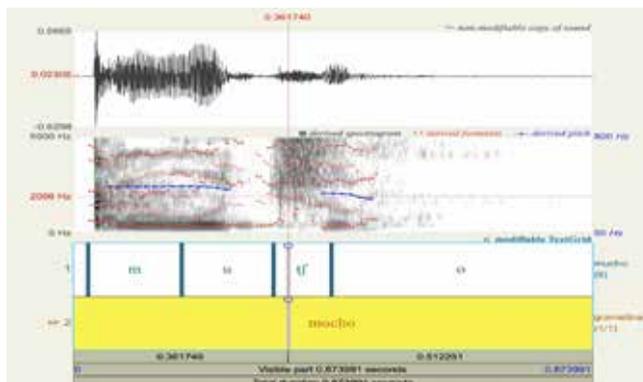
Figure 1. $\sqrt{tʃ}$ in Spanish



Figure 2. $\sqrt{tʂ}$ in Chinese

Note: <http://polfon.upol.cz/index.php?table=ipa>

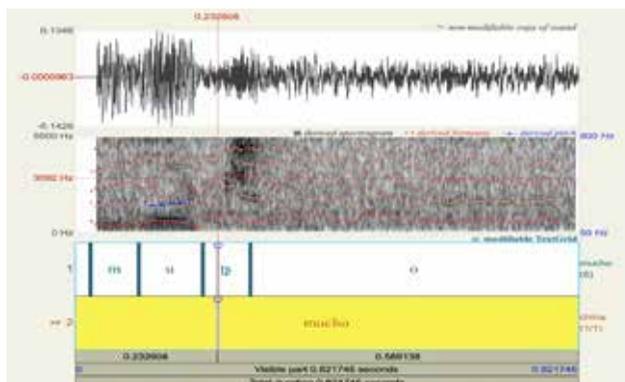
Native speakers of Spanish and native speakers of Chinese display significant phonetic differences in their production of the sound $\sqrt{tʃ}$, corresponding to the grapheme <ch> in words such as *mucho*.



Spectrogram 1. $\widehat{tʃ}$, vernacular pronunciation (GRAN_M32_034)

Note: Generated with Praat (v. 6.4), using the word *mucho* from the PRESEEA Granada corpus.

In Spectrogram 1, the waveform of the phoneme $\widehat{tʃ}$ as produced by native Spanish speakers displays the typical features of a voiceless affricate. A relatively long closure phase precedes a clearly marked fricative release, reflected by the near absence of acoustic energy during the occlusion and a subsequent energy concentration between 2,500 Hz and 3,500 Hz. This homogeneous energy distribution indicates a stable and consistent articulation, consistent with the expected realisation of a voiceless palatal affricate in Spanish.



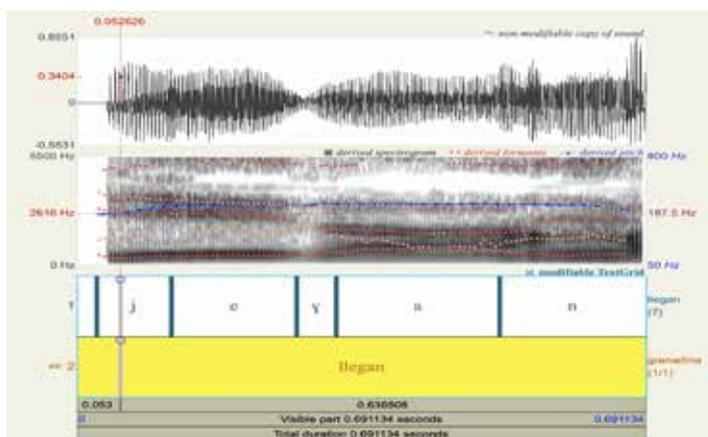
Spectrogram 2. $\widehat{tʃ}$, immigrant pronunciation (CHIN_M22_04)

Note: Generated with Praat (v. 6.4), using the word *mucho* from the author's corpus.

In Spectrogram 2, the articulation of $\widehat{tʃ}$ by native Chinese speakers displays a distinct pattern. Compared with the Spanish realisation, the closure phase is notably shortened or absent, resulting in a rapid onset of the fricative phase. This yields an articulation closer to a fricative than a typical affricate. Additionally, fricative energy begins around 3,500 Hz, indicating a more anterior place of articulation, consistent with dentoalveolar rather than palatal articulation.

Temporally, Spanish speakers show a balanced distribution between closure and fricative phases, while Chinese speakers exhibit a prolonged fricative with a minimal closure, reinforcing the tendency toward a fricative-like production. Spectrographically, $/tʃ/$ as pronounced by Chinese speakers concentrates energy at higher frequencies, whereas the Spanish $/tʃ/$ begins around 2,500 Hz and disperses gradually. These differences highlight the need for Chinese-speaking learners to adjust both the place of articulation and the duration of the closure to approximate the Spanish model more accurately.

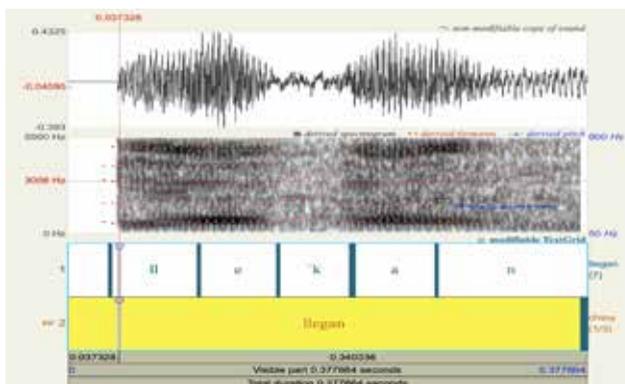
The analysis of spectrograms for the sequence *llegan* reveals additional contrasts in phonetic realisation between native speakers of Granada and Chinese learners. These divergences—both articulatory and acoustic—underscore key phonological challenges for Chinese speakers in producing specific consonantal sequences in Peninsular Spanish.



Spectrogram 3. /j/, vernacular pronunciation (GRAN_M22_028)

Note: Generated with Praat (v. 6.4), using the word *llegan* from the PRESEEA Granada corpus.

In Spectrogram 3, the realisation of the phoneme /j/ by a native speaker from Granada displays the acoustic profile of a palatal fricative approximant. Spectral energy emerges around 2,500 Hz and rises gradually. The fricative phase, though weak, is perceptible, reflecting partial constriction that retains mild turbulence. The transition into the following vowel is smooth, without noticeable acoustic breaks, and intensity remains stable throughout, indicating effective articulatory control and prosodic integration.



Spectrogram 4. /j/, immigrant pronunciation (CHIN_M22_04)

Note: Generated with Praat (v. 6.4), using the word *llegan* from the author's corpus.

In Spectrogram 4, corresponding to a native Chinese speaker, the realisation of the grapheme *ll* approximates the palatal approximant /j/, with no perceptible frication. Acoustic energy is initially concentrated around 2,800–3,000 Hz, showing a uniform distribution typical of vowel-like sounds. This pattern indicates the articulation of a semivowel rather than a fricative consonant.

In contrast with Spectrogram 3, which shows slight amplitude irregularities and mild fricative turbulence in the speech of Granada, Spectrogram 4 exhibits stable amplitude and no oscillatory features, confirming the absence of frication and reinforcing the vowel-like nature of the segment.



Figure 3. /j/ in Spanish



Figure 4. /j/ in Chinese

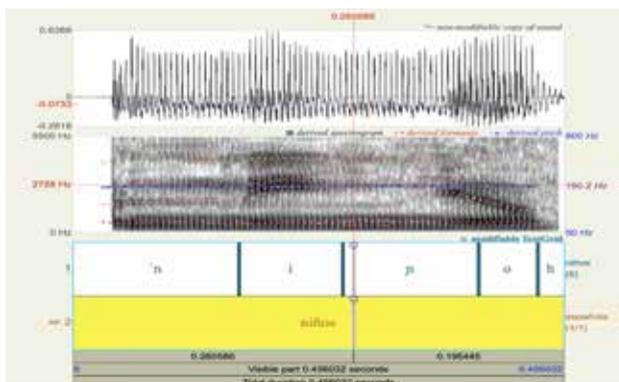
Note: <http://polfon.upol.cz/index.php?table=ipa>

In articulatory terms, tongue positioning plays a key role in the phonetic variation observed. *Figure 3*, showing the articulation of /j/ in Spanish, reveals the tongue close to the palate without intense frication, confirming its realisation as a palatal fricative approximant in the Granadan variety. In contrast, *Figure 4* depicts the articulation of /j/ in Chinese, with the tongue more fronted and raised but lacking close palatal contact, producing a frictionless approximant similar to the semivowel linked to the vowel /i/.

This difference results from phonetic interference: while /j/ is common in Chinese, /j/ is absent from its phonological system. Consequently, Chinese speakers often reduce or omit frication in the production of *ll*, realising it as a semivowel. Due to the articulatory proximity between /j/ and vowels, syllabic restructuring may occur, producing forms like *llecán* instead of *llegan*.

The contrast between Granadan and Chinese productions of *ll* lies in the presence or absence of frication. While the former produce a fricative approximant /j/, the latter tend to realise a plain approximant /j/, yielding a more vowel-like acoustic quality. To improve phonetic accuracy, Chinese learners are encouraged to introduce slight frication in *ll*, thus aligning more closely with the Granadan model.

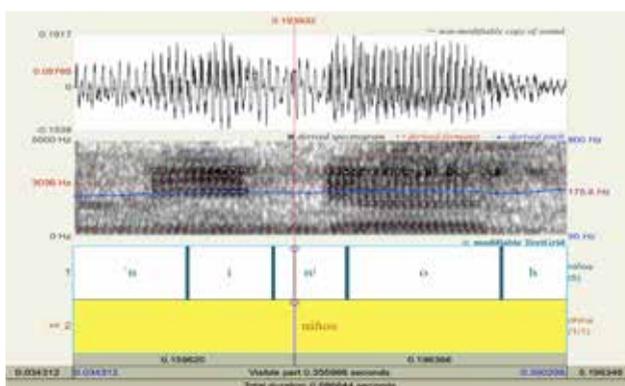
The analysis of /ɲ/ in Spanish, based on data from native Granadan and Chinese speakers, also reveals notable differences in segment duration, formant structure, and the presence of transitional elements during articulation.



Spectrogram 5. /ɲ/, vernacular pronunciation (GRAN_M21_046)

Note: Generated with Praat (v. 6.4), using the word *niños* from the PRESEEA Granada corpus.

In Spectrogram 5, produced by a native speaker of Granada, the realisation of the phoneme /ɲ/ in the word *niños* has a duration of 0.126 seconds. Acoustic energy is centred around 2,700 Hz, and the transition to the following vowel occurs smoothly, with no abrupt formant shifts. This configuration indicates a stable, compact articulation of the palatal nasal, with no signs of transitional elements altering the primary articulatory setting.

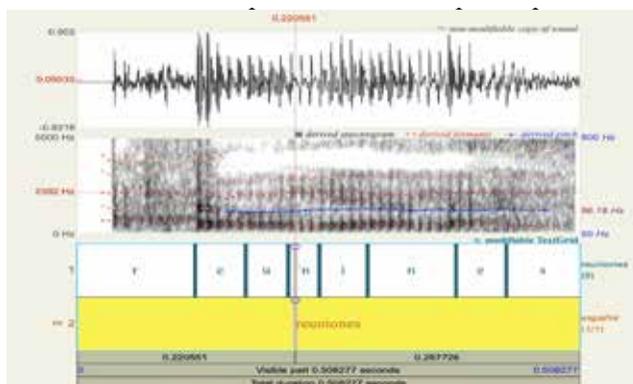


Spectrogram 6. /ɲ/, immigrant pronunciation (CHIN_M12_28)

Note: Generated with Praat (v. 6.4), using the word *niños* from the author's corpus.

In contrast, Spectrogram 6, corresponding to a native Chinese speaker, shows a much shorter duration for the phoneme *n*—only 0.053 seconds. Acoustic energy is concentrated around 3,000 Hz, indicating a more anterior articulation. Additionally, the presence of an extra component during the vowel transition suggests the insertion of a semivowel. Rather than a fully palatal nasal, as expected in Spanish, the realisation approximates [nʲ], showing incipient palatalisation.

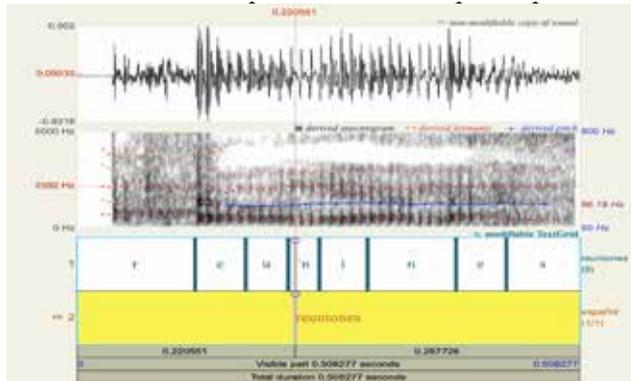
This outcome reflects an articulatory pattern aligned with Chinese syllabic structure, where nasal + high front vowel combinations are common. The *ni* sequence in words like *reuniones*, *unión*, or *compañía* is typically unproblematic for Chinese speakers, given its presence in their L1. However, difficulties arise with the palatal nasal *n*, which has no direct equivalent in Chinese. Learners often substitute it with [nʲ], leading to perceptible deviations in words like *niños* or *señor* when compared with native Spanish pronunciation.



Spectrogram 7. /ni/, vernacular pronunciation (GRAN_H13_001)

Note: Generated with Praat (v. 6.4), using the word *reuniones* from the PRESEEA Granada corpus.

In Spectrogram 7, corresponding to a native speaker from Granada, a fluid transition is observed between the vowels /u/ and /i/ in the /ni/ sequence, evidenced by a progressive rise in the second formant (F2), reaching approximately 2,392 Hz. The absence of abrupt changes in frequency confirms a stable articulation consistent with the Spanish phonological pattern.



Spectrogram 8. /ni/, immigrant pronunciation (CHIN_M13_06)

Note: Generated with Praat (v. 6.4), using the word *reuniones* from the author's corpus.

In Spectrogram 8, corresponding to a native Chinese speaker, the articulation of the /ni/ sequence shows a similar acoustic pattern to that of the Granadan speaker, with no significant formant disruptions. This suggests that Chinese learners can produce /ni/ in Spanish without notable difficulty. However, comparison with the realisation of /ɲ/ reveals that, in words like *niños*, the articulation more closely resembles [ni], supporting the hypothesis that learners substitute /ɲ/ with this sequence due to the lack of a palatal nasal in Chinese.

6.2. Spanish consonants absent from the chinese phonological system

This section introduces Spanish consonants absent from the Chinese phonological system. A prominent case is the lack of the phoneme /r/ in Chinese, which causes considerable interference in the production of Spanish liquids, especially in distinguishing between the tap and the trill (*r* vs. *rr*) (Flechchia Ramos, 2020). As documented in the literature, native Chinese speakers show persistent difficulties in both perception and articulation of these rhotics (see Figures 5 and 6) (Sorbet, 2018).



Figure 5. /r/ simple tap

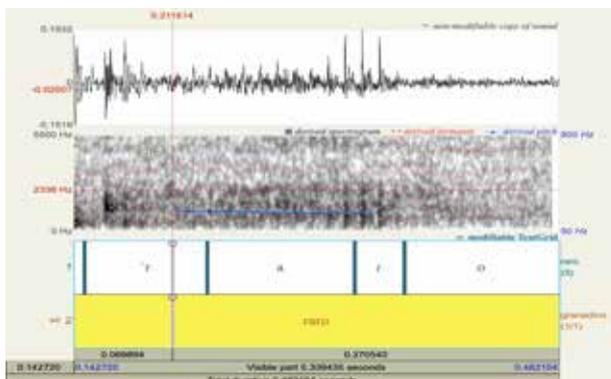


Figure 6. /r/ multiple trill

Note: <http://polfon.upol.cz/index.php?table=ipa>

The articulation of this phoneme can be examined through spectrograms generated with Praat. In Spanish, the rhotics /r/ and /r/ differ solely in the number of opening–closing gestures during articulation, a distinction clearly visible in the spectrographic data. For /r/,

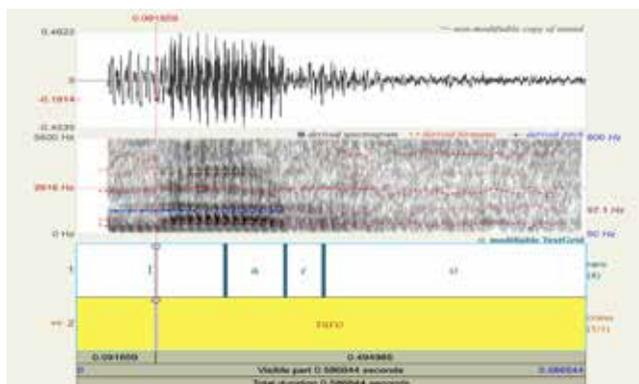
three closure bursts—corresponding to full contact cycles—are typically observed, reflecting its trill nature (Machač & Skarnitzl, 2009, p. 67). This phoneme occurs word-initially or between vowels when orthographically represented as *rr*.



Spectrogram 9. /r/ and /r/, vernacular pronunciation (GRAN_H11_038)

Note: Generated with Praat (v. 6.4), using the word *raro* from the PRESEEA Granada corpus.

A comparative analysis of *Spectrograms 9* and *10* reveals that native Chinese speakers often fail to reproduce the articulatory features of the phoneme /r/, frequently realising it as a lateral approximant [l]. In some instances, /r/ is replaced by [l] or even by a nasal [n]. In others, the trill is reduced to a tap, with only a single contact, reflecting systematic phonetic interference in the acquisition of this phoneme by Chinese-speaking learners.

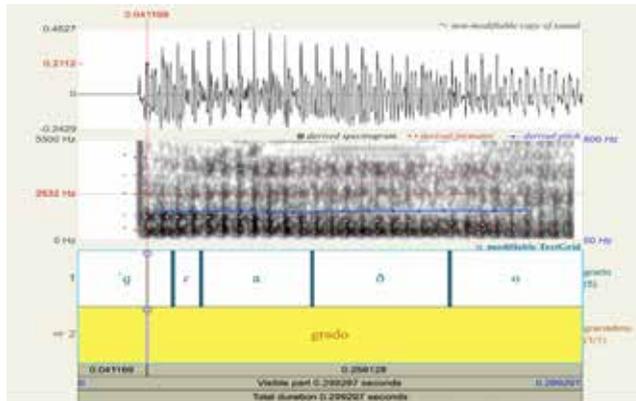


Spectrogram 10. /r/ and /r/ realised as [l/n], immigrant pronunciation (CHIN_M21_29)

Note: Generated with Praat (v. 6.4), using the word *raro* from the author's corpus.

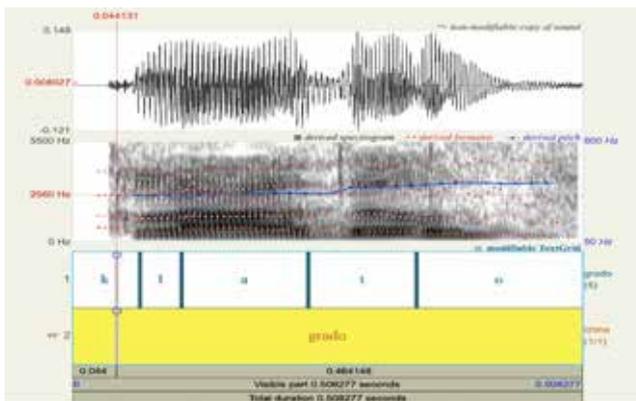
A similar pattern emerges in the production of the tap /ɾ/. A comparison of *Spectrograms 11* and *12*, based on the word *grado*, shows that native Chinese speakers frequently substitute this rhotic with the lateral [l], due to the absence of a phonemic distinction between rhotics and laterals in Chinese. This interference affects articulatory precision in Spanish.

Analysis across both corpora confirms that this substitution is not position-dependent, but rather linked to native-language influence and learner-specific factors. Similar deviations were found in words such as *barriga*, *barrio*, *rápido*, and *cerrar*. In all cases, misarticulation of /r/ often results in substitution with /l/ or /n/, undermining phonetic accuracy.



Spectrogram 13. /g/, /r/, and /ð/, vernacular pronunciation (GRAN_H11_038)

Note: Generated with Praat (v. 6.4), using the word *grado* from the PRESEEA Granada corpus.



Spectrogram 14. /g/ as /k/, /r/ as [l], and /ð/ as /t/, immigrant pronunciation (CHIN_M13_16)

Note: Generated with Praat (v. 6.4), using the word *grado* from the author's corpus.

Spectrograms 13 and 14 reveal that the rhotic phoneme lacks the brief interruption typical of the tap /r/. Instead, the sound exhibits increased duration, higher energy concentration, and a more compact spectrographic structure. These features suggest the absence of the defining vibratory quality that characterises /r/ in Spanish.

This deviation is consistently observed in other lexical items such as *nosotros*, *trabajo*, *para*, *tarde*, *verdad*, and *afueras*, confirming the systematic nature of this phenomenon in the Spanish of native Chinese speakers.

The following section analyses the production of the Spanish interdental and alveolar fricatives. As noted by Wang (2001, pp. 88–89), Chinese lacks an interdental fricative, which may hinder acquisition. However, since Chinese does include the alveolar fricative /s/, learners frequently substitute the interdental phoneme with /s/ in the absence of specific phonetic instruction.

From an articulatory perspective, producing the Spanish interdental involves advancing the tongue to an interdental position, distinct from the alveolar placement of /s/. This proximity facilitates acquisition, provided learners receive explicit guidance on tongue positioning.

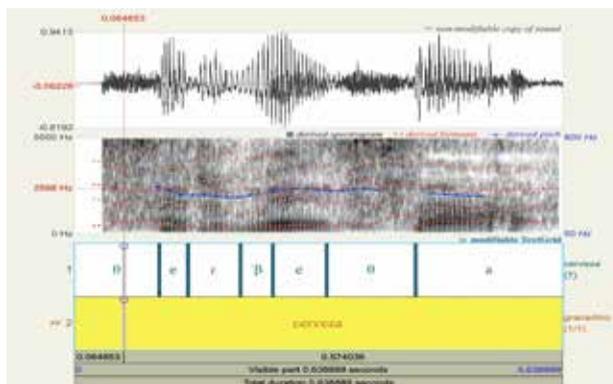


Figure 7. [s]



Figure 8. /θ/ interdental

Note: <http://polfon.upol.cz/index.php?table=ipa>

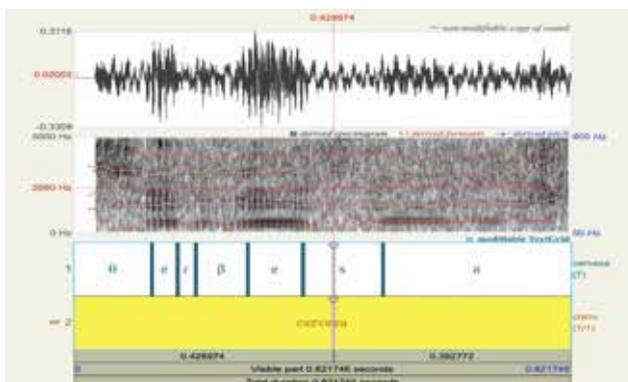


Spectrogram 15. /θ/ from <c> and /θ/ from <z>, vernacular pronunciation (GRAN_H22_026)

Note: Generated with Praat (v. 6.4), using the word *cerveza* from the PRESEEA Granada corpus.

Nevertheless, dialectal variation in Spanish can influence the production of these phonemes by native Chinese speakers. In some varieties, phenomena such as *seseo*, *ceceo*, or even *heheo* may cause instability in the perception and production of the interdental phoneme by Chinese learners.

Spectrograms 15 and 16 clearly contrast the acoustic profiles of /s/ and /θ/. The interdental fricative /θ/ displays a continuous waveform without interruptions, whereas /s/ exhibits a segmented structure with distinct pauses between energy bursts. This spectrographic contrast serves as a crucial cue for diagnosing and addressing phonetic interference in L2 Spanish acquisition by Chinese speakers.



Spectrogram 16. /θ/ from <c> and /θ/ from <z>, immigrant pronunciation (CHIN_M21_21)
 Note: Generated with Praat (v. 6.4), using the word *cerveza* from the author's corpus.

In addition to *cerveza*, other words such as *empezar*, *esfuerzo*, *andaluces*, *conocemos*, and *escenario* were analysed, revealing a consistent pattern in the production of fricative sounds by native Chinese speakers.

The analysis then shifts to the Spanish phoneme /b/ and its bilabial approximant variant [β]. Figures 9 and 10 illustrate their articulatory differences, which pose a major challenge for Chinese-speaking learners, as the Chinese phonological system lacks the plosive–approximant contrast (Cao, 2007, p. 92).



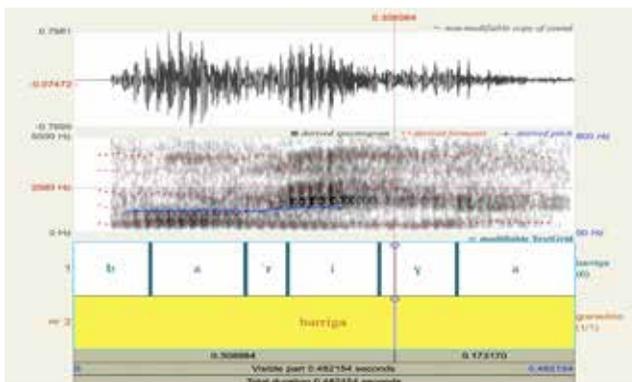
Figure 9. [b]



Figure 10. [β] approximant

Note: <http://polfon.upol.cz/index.php?table=ipa>

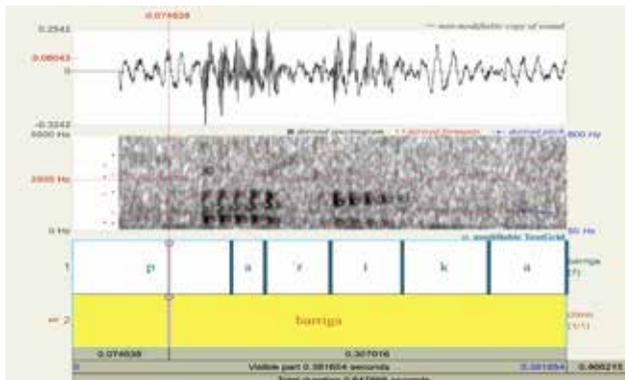
Spectrogram 17 shows the production of the phoneme /b/ by a native Spanish speaker. A clear closure phase is followed by the typical release of the bilabial plosive in word-initial or post-pausal position. In intervocalic contexts, however, the phoneme is realised as the bilabial approximant [β], with a spectrographic pattern that displays more diffuse vibration and a smoother acoustic transition. This alternation, characteristic of Spanish, often poses difficulties for learners whose native language lacks this type of phonological contrast.



Spectrogram 17. /y/ and /b/, vernacular pronunciation (GRAN_H33_015)

Note: Generated with Praat (v. 6.4), using the word *barriga* from the PRESEEA Granada corpus.

In Chinese, the phonological system lacks both the phoneme /b/ and its approximant allophone [β]. The grapheme *b* in *pinyin* represents a voiceless bilabial plosive, equivalent to the Spanish /p/. As a result, many native Chinese speakers substitute /b/ with /p/ in Spanish, leading to systematic phonetic interference. This is evident in the mispronunciation of words such as *también*, *bachillerato*, *cambia*, *bueno*, *bazar*, *bienvenida*, and *diciembre*.



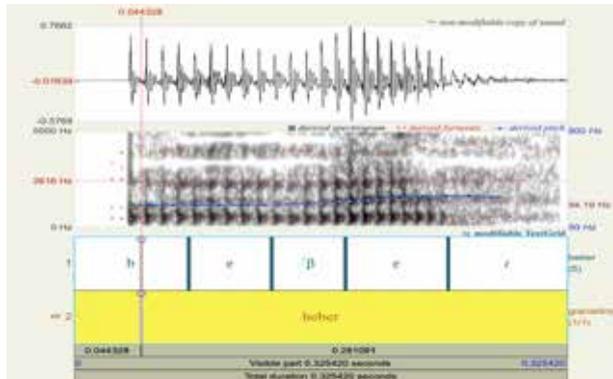
Spectrogram 18. /y/ as /k/ and /b/ as [p], immigrant pronunciation (CHIN_H21_21)

Note: Generated with Praat (v. 6.4), using the word *barriga* from the author's corpus.

This phenomenon is clearly illustrated in *Spectrogram 18*, which shows the production of /b/ in the word *barriga* by a native Chinese speaker. Unlike *Spectrogram 17*—which displays dense, regular waveforms indicative of vocal fold vibration—*Spectrogram 18* presents weaker, more dispersed energy in the bilabial segment. This suggests reduced voicing and a tendency toward /p/, evidencing systematic phonetic interference in the acquisition of /b* in Spanish.

The analysis proceeds with the production of the bilabial approximant [β]. Words such as *trabaja*, *acercaba*, *haber*, *aventurera*, and *primavera* were considered. The word *beber* was

selected to highlight the contrast between the voiced bilabial plosive /b/ in initial position and its approximant variant [β] in intervocalic position.



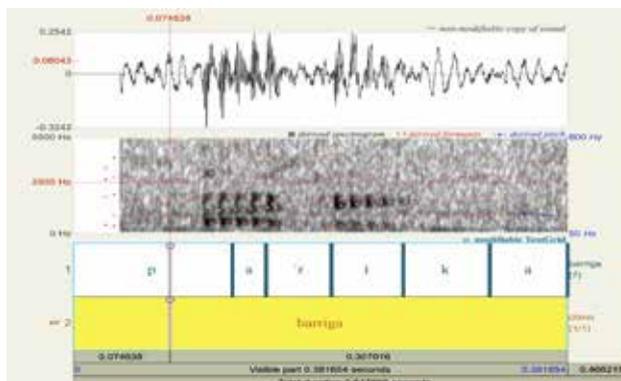
Spectrogram 19. /b/ and /β/, vernacular pronunciation (GRAN_H12_019)

Note: Generated with Praat (v. 6.4), using the word *beber* from the PRESEEA Granada corpus.

In *Spectrogram 19*, produced by a native Spanish speaker, the acoustic features of [β] are clearly present. The transition from /b/ to [β] is smooth and uninterrupted, with stable amplitude, indicating minimal articulatory effort. A clear contrast is maintained between the plosive form in initial position and the approximant variant in intervocalic contexts.

In *Spectrogram 20*, generated by a native Chinese speaker, notable differences emerge. In both /b/ and [β], an energy build-up is observed at the onset, suggesting a prolonged articulatory preparation. This reflects coordination difficulties that slow down pronunciation and affect fluency.

Unlike the Granadan speaker's waveform, which remains consistent, the Chinese speaker's signal shows greater intensity fluctuations. An initial dip is followed by a gradual rise, pointing to increased articulatory effort to achieve the intended phonetic target.



Spectrogram 20. La /b/ y /β/, pronunciación inmigrante (CHIN_H22_13)

Note: Generated with Praat (v. 6.4), using the word *beber* from the author's corpus.

Another key factor is the absence of both /b/ and [β] in the Chinese phonological system, which often leads native speakers to confuse them with the voiceless plosive /p/. This interference results in systematic pronunciation errors in Spanish, especially in contexts requiring a clear contrast between voicing.

The following section examines the two phonetic variants of the grapheme *d* in Spanish: the voiced dental plosive /d/ and the voiced interdental approximant [ð], illustrated in Figures 11 and 12.



Figure 11. [d]



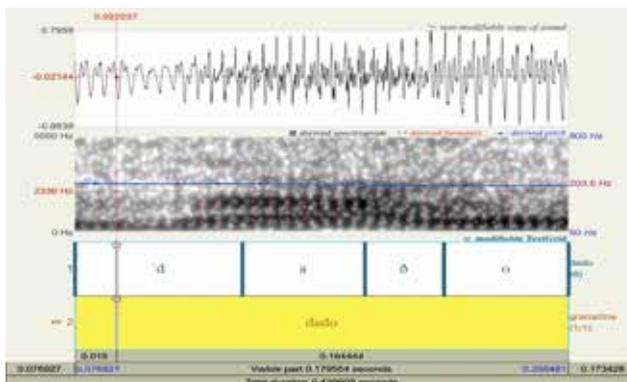
Figure 12. [ð] approximant

Note: <http://polfon.upol.cz/index.php?table=ipa>

The pronunciation of the grapheme *d* in Spanish poses challenges similar to those observed with *b*, as Chinese lacks a phonemic distinction between the plosive /d/ and the approximant [ð]. In pinyin, *d* corresponds to a voiceless dental plosive—essentially equivalent to the Spanish /t/. Consequently, native Chinese speakers frequently replace /d/ with /t/, leading to systematic errors in both the plosive and approximant variants, and reducing articulatory precision. This pattern has been consistently observed in words such as *dedicar*, *dejado*, *divertido*, *doctorado*, *dado*, and *duda*.

Although dialectal features such as /d/ elision have been documented in Granadan Spanish (Malaver & Samper Padilla, 2016), the present study centres exclusively on the contrast between /d/ and [ð], excluding elision phenomena.

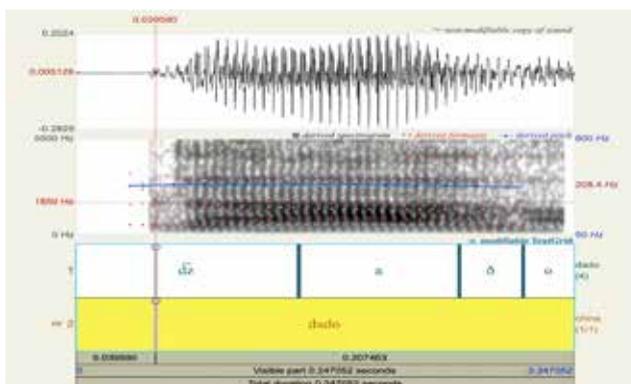
Spectrogram 21, corresponding to a native Spanish speaker, displays clear acoustic distinctions: [ð] exhibits greater spectrographic density than /d/, indicating reduced occlusion and a smoother articulatory transition.



Spectrogram 21. /d/ and /ð/, vernacular pronunciation (GRAN_M23_010)

Note: Generated with Praat (v. 6.4), using the word *dado* from the PRESEEA Granada corpus.

In Spectrogram 22, which reflects the articulation of /d/ by a native Chinese speaker, patterns akin to those observed in the production of /b/ emerge. Similar to that case, Chinese speakers tend to exhibit a longer preparatory phase before articulation, leading to an extended onset and reduced fluency. Frequently, the /d/ phoneme is realized as an affricate, [d͡z], rather than a canonical voiced dental plosive. This deviation reflects phonological interference from Chinese, which lacks a functionally equivalent phoneme to facilitate a direct transfer of Spanish /d/.



Spectrogram 22. /d/ as /d͡z/ and /ð/, immigrant pronunciation (CHIN_M13_25)

Note: Generated with Praat (v. 6.4), using the word *dado* from the author's corpus.

In an attempt to avoid substituting /d/ with /t/, Chinese speakers often resort to a hyperarticulated production of /ð/, placing the tongue in firm contact with the teeth. This strategy, however, results in an exaggerated and unnatural sound. Despite such corrective efforts, the replacement of /d/ with /t/ remains frequent. This pattern is observable in the word *grado*, as previously shown in Spectrograms 13 and 14, where /d/ is realized as the voiceless plosive /t/, identifiable by a distinct burst phase in the acoustic signal.

Figures 13 and 14 further illustrate the two phonetic realizations of the grapheme <g> in Spanish: the voiced velar plosive /g/ and the voiced velar approximant [ɣ]. The primary difference between them lies in the degree of articulatory closure. In the production of /g/, there is complete occlusion between the tongue dorsum and the velum, momentarily obstructing airflow prior to release. In contrast, [ɣ] involves partial contact, allowing airflow with friction, resulting in a softer sound devoid of the plosive's explosive quality.



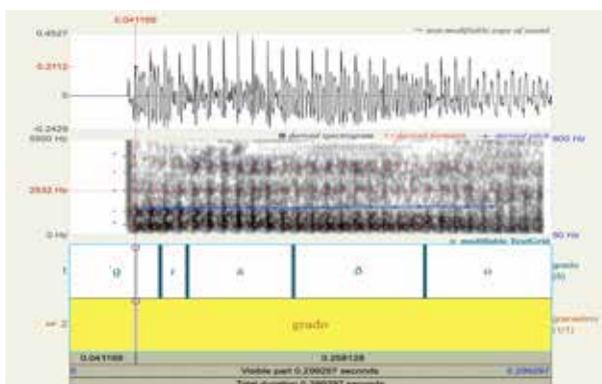
Figure 13. /g/



Figure 14. [ɣ] approximant

This phenomenon is closely related to what was observed in the production of /b/ and /d/, as the Chinese phonological system does not include a functional distinction between voiced plosives and their corresponding approximants. In Chinese, the grapheme <g> represents a voiceless velar plosive /k/, resulting in a systematic tendency to replace the Spanish /g/ with /k/.

In Spectrogram 13, analysing the word *grado*, it is evident that the Chinese speaker does not produce the characteristic laryngeal vibration of the /g/ phoneme. Instead, a complete occlusion without voicing is recorded, suggesting a voiceless realisation typical of /k/. This same pattern is reproduced in Spectrogram 14, confirming the clear tendency toward devoicing in the production of /g/ by Chinese speakers.

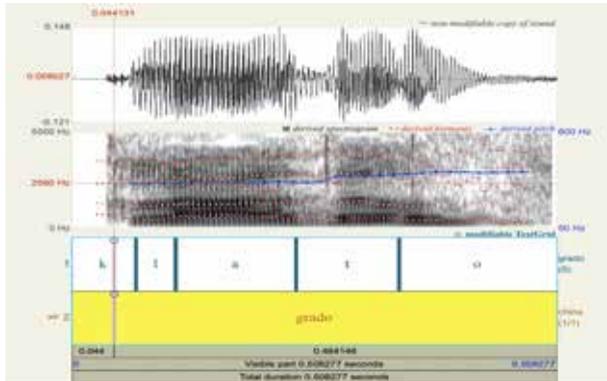


Spectrogram 13. /g/, /r/, and /ð/, vernacular pronunciation (GRAN_H11_038)

Note: Generated with Praat (v. 6.4), using the word *grado* from the PRESEEA Granada corpus.

A similar phenomenon is observed in the word *llegan*, analysed in Spectrograms 3 and 4, where the initial consonant is articulated with features more akin to a voiceless plosive

/k/. This is reflected in the spectrographic structure by the absence of laryngeal vibration and reduced amplitude in the acoustic wave, once again confirming the devoicing trend among Chinese learners.



Spectrogram 14. /g/ as /k/, /r/ as [l], and /ð/ as /t/, immigrant pronunciation (CHIN_M13_16)
 Note: Generated with Praat (v. 6.4), using the word *grado* from the author's corpus.

A similar phenomenon is observed in the production of the word *llegan*, as analysed in Spectrograms 3 and 4, where the initial consonant is articulated with features more closely resembling those of the voiceless plosive /k/. This realisation is reflected in the spectrographic structure by the absence of laryngeal vibration and a lower amplitude in the acoustic waveform, confirming the lack of voicing in the production of the phoneme. This once again evidences a tendency towards devoicing among native Chinese speakers.

7. DISCUSSION

The acoustic and articulatory analysis of the Chinese-speaking learners' corpus reveals systematic deviations from native Spanish, which can be attributed to three main factors.

First, negative L1 transfer explains many patterns. The absence of voiced–voiceless contrast in Mandarin leads to the neutralisation of pairs like /b/–/p/, while the lack of rhotics results in substitutions (e.g., [l], [d]) or omissions. Mandarin's syllabic restrictions also contribute to coda elision, and these phonological gaps weaken acoustic cues such as voicing and closure duration.

Second, the influence of formal instruction often promotes hypercorrect or artificial articulations. Learners tend to follow Peninsular Spanish norms, disregarding local varieties (e.g., Granadan), leading to strained realisations of rhotics or final /s/.

Third, perceptual and articulatory difficulties arise with unfamiliar segments, notably rhotics and palatal fricatives. Producing [r] and [r̄] requires fine motor control, and spectrograms often reveal incomplete or irregular tongue vibrations.

Ultimately, these deviations reflect the combined effects of L1 phonology, learning context, and learners' internalised models of Spanish phonology.

8. CONCLUDING REMARKS

This study has examined the main challenges faced by Mandarin speakers in articulating Peninsular Spanish consonants, highlighting systematic patterns of deviation as compared to native Granadan speakers. Acoustic analyses conducted with *PRAAT* confirm that these deviations fall into three categories: *L1 transfer*, *norm-driven production*, and *perceptual-articulatory limitations*.

The most problematic areas include:

1. Neutralisation of voiced–voiceless contrasts in initial plosives (/b/-/p/, /d/-/t/, /g/-/k/).
2. Difficulty with rhotics (/r/ and /r̄/), often replaced, elided, or realised non-canonically.
3. Omission or aspiration of final consonants.
4. Confusion between laterals and rhotics in intervocalic or final positions.

These findings reinforce the need for explicit phonetic instruction grounded in empirical analysis and tailored to learners' phonological backgrounds. Teaching practices should integrate auditory perception tasks, acoustic feedback, and spectrogram-based visual materials.

Following Sosinski (2022), future research should explore error frequency quantitatively, consider proficiency and immersion variables, and examine how input and perception affect production. Learner corpora remain vital for deepening our understanding of *phonetic interlanguage* and enhancing *Spanish L2 phonetic pedagogy*.

9. REFERENCES

- Cortés Moreno, M. (2002). *Dificultades lingüísticas de los estudiantes chinos en el aprendizaje de ELE*. Madrid: SGEL. https://www.orientacionandujar.es/wp-content/uploads/2014/11/fonema_r.pdf (Retrieved April 13, 2025).
- Igarreta Fernández, A. (2015). *La corrección de la pronunciación de los estudiantes sinohablantes en el aula de E/LE*. *Foro de Profesores de E/LE*, 11, 189–196. <https://turia.uv.es/index.php/foroELE/article/view/7115/9419> (Retrieved April 13, 2025).
- Pan, L. (2023). *Propuesta de mejora para los estudiantes hispanohablantes y sinohablantes, con especial atención hacia /e/, /r/-/r̄/, /p/ y /b/*. *Sabir. International Bulletin of Applied Linguistics*, 3, 99–123. <https://ojs.ual.es/ojs/index.php/IBAL/article/view/9110> (Retrieved April 13, 2025).
- Pose, R. (2017). *Fonética del español para sinohablantes: de la teoría a la práctica*. En A. Paccagnini (Coord.), *SIGNOS ELE*, diciembre 2017. <http://p3.usal.edu.ar/index.php/ele/article/view/4120> (Retrieved April 13, 2025).
- Varela Rivera, N. (2014). *La pronunciación del chino para hispanohablantes*. *Asiadémica: Revista Universitaria de Estudios sobre Asia Oriental*, 4, 36–50. https://ddd.uab.cat/pub/asiademica/asiademica_a2014m7n4/Asiademica_a2014n4p36.pdf (Retrieved April 13, 2025).
- Sosiński, M. (2022). *Realización de consonantes españolas por inmigrantes polacos en Granada: Estudio contrastivo*. *Círculo de Lingüística Aplicada a la Comunicación*, (92), 63–86. <https://doi.org/10.5209/clac.83916> (Retrieved April 13, 2025).

- Herrero de Haro, A. (2019). *Catorce vocales del andaluz oriental: Producción y percepción de /i/, /e/, /a/, /o/ y /u/ en posición final y ante /-s/, /-r/ y /-θ/ subyacentes en Almería*. *Nueva Revista de Filología Hispánica*, 67(2), 411–446.
- Real Academia Española y Asociación de Academias de la Lengua Española. (2011). *Nueva gramática de la lengua española. Fonética y fonología. CD: Las voces del español*. Madrid, España: Real Academia Española. <https://www.rae.es/obras-academicas/gramatica/nueva-gramatica/nueva-gramatica-fonetica-y-fonologia> (Retrieved April 13, 2025)
- Waluch-de la Torre, E., & Herrero del Haro, A. (2025). Acquisition of segmental and suprasegmental features of Granada accent by long-term resident with L1 Polish. *Spanish in Context*. (in press)
- Commercial Press. (2020). *Diccionario Xinhua (新华字典, 12.^a ed.)*. Pekín: The Commercial Press.
- Instituto Nacional de Estadística. (2022, enero). *Población extranjera por provincias, nacionalidades y sexo*. <https://www.ine.es/jaxi/Datos.htm?path=/t20/e245/p04/provi/10/&file=0ccaa002.px> (Retrieved April 13, 2025).
- Instituto Nacional de Estadística. (2024, enero). *Población por nacionalidad, comunidades y provincias, sexo y año*. <https://www.ine.es/jaxiT3/Datos.htm?t=56936> (Retrieved April 13, 2025).
- Moya Corral, J. A. (2007). *El español hablado en Granada. Corpus oral para su estudio sociolingüístico. PRESEEA-Granada, I Nivel de estudios alto*. Granada: Editorial Universidad de Granada.
- Moya Corral, J. A. (2009). *El español hablado en Granada II. Corpus oral para su estudio sociolingüístico. PRESEEA-Granada, II Nivel de estudios medio*. Granada: Editorial Universidad de Granada.
- Moya Corral, J. A. (2010). *El español hablado en Granada III. Corpus oral para su estudio sociolingüístico. PRESEEA-Granada, III Nivel de estudios bajo*. Granada: Editorial Universidad de Granada.
- DeKeyser, R. (2000). *The robustness of critical period effects in second language acquisition. Studies in Second Language Acquisition*, 22, 499–534. <https://www.cambridge.org/core/journals/studies-in-second-language-acquisition/article/robustness-of-critical-period-effects-in-second-language-acquisition/6963A1AFEB8148B7F3B719D60994CD65> (Retrieved April 13, 2025).
- Sosiński, M., & Waluch de la Torre, E. (2026). *New findings about the distinction s/θ in Granada. Sociolinguistic Studies* (en prensa).
- Miranda Márquez, G. (2014). *Distancia lingüística, a nivel fonético-fonológico, entre las lenguas china y española. Philologia Hispalensis*, 28(1), 51–68. <https://doi.org/10.12795/PH.2014.v28.i01.04> (Retrieved April 14, 2025).
- Suo, Y. (2021). *Dificultades de comprensión fonética entre los estudiantes sinohablantes de español: una propuesta didáctica* (Tesis doctoral). Universidad Carlos III de Madrid. <https://e-archivo.uc3m.es/entities/publication/06633bc6-59d6-40fa-b004-3e67a5782c77> (Retrieved April 14, 2025).
- Quilis, A., & Esgueva, M. (1983). Realización de los fonemas vocálicos españoles en posición fonética normal. En M. Esgueva & M. Cantarero (Eds.), *Estudios de fonética I* (pp. 137–252). Consejo Superior de Investigaciones Científicas.
- Martínez Celdrán, E., & Fernández Planas, A. M. (2007). *Manual de fonética española*. Barcelona: Ariel.

- Flecchia Ramos, C. (2020). La pronunciación del fonema /r/ para los estudiantes sinohablantes de ELE: Propuesta de materiales didácticos. *Revista de Enseñanza de Español a Sinohablantes, Suplementos*, (20). https://www.sinoele.org/images/Revista/20/Suplemento_Flecchia/SinoELE_TFM_Flecchia.pdf (Retrieved April 14, 2025)
- Sorbet, P. (2018). Consideraciones acerca de las consonantes róticas. *Studies in Modern Languages and Literature*, 42(1), 66–80. Retrieved April 15, 2025, from <http://lsml.journals.umcs.pl>
- Machač, P., & Skarnitzl, R. (2009). *Principles of phonetic segmentation*. Praga: Epoque.
- Wang, H.-Y. (2001). Estudio fónico del chino mandarín y del español. *Encuentros en Catay*, 15, 70–118. [https://www.sinoele.org/images/Encuentros/wang%20\(2001\).pdf](https://www.sinoele.org/images/Encuentros/wang%20(2001).pdf) (Retrieved April 15, 2025)
- Cao, Y. (2007). Un estudio contrastivo de los fonemas oclusivos entre español y chino. *México y la Cuenca del Pacífico*, 10(28), 91–98. <https://dialnet.unirioja.es/descarga/articulo/7942212.pdf> (Retrieved April 15, 2025)
- Malaver, I., & Samper Padilla, J. A. (2016). Estudio de la /d/ intervocálica en los corpus PRE-SEEA. *Boletín de Filología*, 51(2), 325–345.