

A Phonological Errors Analysis of English Consonants Produced by Thai EFL Undergraduate Non-English Major

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Abstract

English pronunciation remains a persistent challenge for Thai EFL learners, primarily due to structural disparities between the Thai and English phonological systems. This study examines consonant production errors and the extent of L1 interference across word positions. This research aimed: 1) to analyse the pronunciation errors of English consonant sounds across three phonological positions-initial, medial, and final-among Thai undergraduate students who are non-English majors and study English as a foreign language; and 2) to investigate the effects of first language (L1) interference on the pronunciation of English consonant sounds in these three phonological positions. The sample consisted of second-year students from the Faculty of Education at Loei Rajabhat University in the academic year 2023 who were non-English majors. The participants were selected using cluster sampling from 15 separate programs, totaling 142 students. The research instrument was a set of vocabulary items covering 24 English consonant sounds, with one to six words selected for each consonant in each word position. Data were analysed using descriptive statistics. The findings revealed that lateral approximants (98.58%) and affricates (97.39%) constituted the most serious pronunciation difficulties, followed by fricatives (77.30%), indicating extensive first-language transfer effects. The predominance of sound substitution, devoicing, unaspiration, unreleased final stops, and vowel epenthesis demonstrates that the Thai phonological system strongly influences English consonant production across initial, medial, and final positions. These results highlight the need for explicit pronunciation instruction targeting English consonants that are absent or phonologically distinct from Thai, particularly lateral approximants, affricates, and fricatives.

Keywords: English consonants, L1 interference, phonological errors, pronunciation across word positions, Thai EFL learners

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Introduction

In the era of globalisation, English serves as a global lingua franca for communication, education, technology, and employment (Kachru, 2005). In Thailand, it is essential at all educational levels, making effective pronunciation important for communication. Phonics supports phoneme-grapheme awareness and decoding (Lakthong et al., 2025; Mungsanti & Sukying, 2024), while Thai learners often struggle with English consonants absent from Thai, leading to substitutions such as /θ/ → [t] and /ð/ → [d] that may reduce intelligibility (Thomma, 2023).

Previous studies consistently show that Thai learners struggle with English consonants absent or different in Thai, often substituting them with the nearest L1 sounds. Kanokpermpoon (2007, p. 57), Sahatsathatsana (2017, p. 67), and Piyamat and Deekawong (2021, p. 78) reported difficulties with /ʃ, ʒ, tʃ, dʒ, v, θ, ð, z/, including substitutions such as /z/ → [s], /v/ → [w], and /θ, ð/ → [t, d]. Recent studies (Naruemon et al., 2024, p. 9-11; Peerachachayanee, 2022, p. 74.78; Pathanasin et al., 2026, p. 8-10) similarly found substitutions such as /g/ → [k], /v/ → [w], /θ, ð/ → [t, d], /z/ → [s], /r/ → [l], and /tʃ, dʒ/ → [tɕ^h]. Nasals were generally accurate, whereas final consonants showed frequent deletion, devoicing, and unreleased stops. Overall, these findings confirm the strong influence of Thai phonology and phonotactic constraints on English consonant production.

Previous research has focused mainly on specific consonants or learner groups. This study examines all English consonant errors among Thai non-English-major undergraduates to identify L1 transfer and sounds requiring targeted instruction. Limited pronunciation instruction in articulation, stress, and sound discrimination may also cause persistent and fossilised errors (Kelly, 2000, p. 11).

This issue is important for teacher education students, as accurate pronunciation is essential for future English teachers and effective language models. This study examines English consonant pronunciation among non-English-major students at Loei Rajabhat University, focusing on problematic sounds across word positions and Thai phonological influence. The findings provide pedagogical recommendations to improve pronunciation, oral communication, and English education in Thailand.

Literature Review

L2 acquisition, particularly pronunciation, reading, and phonological development, has long been studied in applied linguistics. Various theories explain persistent difficulties arising from differences between learners' L1 and the target language. This review synthesises eight key SLA theories: CA, EA, IT, MDH, ODH, PAM, SLM, and PGST.

1. Contrastive Analysis (CA)

Contrastive Analysis (CA), developed by Fries (1945) and Lado (1957), explains L2 difficulties through L1-L2 differences, such as Thai learners' substitution of /θ/ and /ð/ with /t/, /d/, or /s/. Wardhaugh (1970) distinguished strong CAH, which predicts errors, from weak

CAH, which diagnoses them. Despite its limitations, CA remains useful for identifying difficulties and guiding pronunciation instruction.

2. Error Analysis (EA)

Error Analysis (EA) views learner errors as evidence of L2 development, arising from L1 transfer and intralingual processes such as overgeneralisation and simplification (Corder, 1967, 1974; Richards et al., 1985).

3. Interlanguage Theory

Interlanguage Theory (Selinker, 1972) views learner language as an evolving L1-L2 system shaped by transfer and overgeneralisation, with fossilisation explaining persistent non-native forms.

4. Markedness Differential Hypothesis (MDH)

Eckman's (1977) Markedness Differential Hypothesis (MDH) explains L2 difficulties with structures that differ from L1 and are more complex or marked. For example, Thai prohibits final voiced stops /b, d, g/, causing devoicing in words such as “cab” and “dog.”

5. Orthographic Depth Hypothesis (ODH)

The Orthographic Depth Hypothesis (ODH) (Katz & Frost, 1992) explains how irregular spelling–pronunciation relationships affect reading. Thai learners may rely on letter-by-letter decoding, causing mispronunciations of words such as “though,” “colonel,” and “cough.”

6. Perceptual Assimilation Model (PAM)

Best's (1995) Perceptual Assimilation Model (PAM) explains how learners perceive unfamiliar L2 sounds through L1 categories. Thai learners may assimilate /θ, ð/ to /t, d/, making “thin” similar to “tin,” highlighting the role of L1 perceptual filtering in pronunciation difficulties.

7. Speech Learning Model (SLM)

The Speech Learning Model (SLM) (Flege, 1995) explains that learners may create new L2 sound categories or assimilate similar sounds into L1 categories, causing errors such as /ð/ → /d/. Accurate perception supports pronunciation learning.

8. Psycholinguistic Grain-Size Theory

Ziegler and Goswami's (2005) Psycholinguistic Grain-Size Theory explains how learners process orthography from grapheme–phoneme units to larger units. Thai learners may transfer small-grain strategies, causing irregular-word pronunciation errors.

9. Integrated Theoretical Framework for the Analysis of Phonological Errors

This study analyses phonological errors among Thai EFL non-English majors using an integrated framework of CA, EA, Interlanguage Theory, MDH, PAM, SLM, ODH, and PGST, addressing linguistic, developmental, perceptual, and orthographic factors.

Lado's (1957) Contrastive Analysis identifies Thai-English differences causing pronunciation difficulties, while Corder's (1967) Error Analysis and Selinker's (1972) Interlanguage Theory explain systematic L2 errors and fossilisation. Eckman's (1977) MDH addresses marked structures, and Best's (1995) PAM and Flege's (1995) SLM explain perceptual and phonetic substitutions. Katz and Frost's (1992) ODH and Ziegler and Goswami's (2005) PGST explain spelling-pronunciation errors.

Overall, the framework views phonological errors as resulting from four interacting factors: (1) cross-linguistic influence, (2) developmental processes, (3) perceptual and phonetic constraints, and (4) orthographic influences, with MDH explaining differences in the difficulty of specific phonological features. This integrated framework guides the analysis and discussion of findings by providing a comprehensive account of error causes and their implications for English pronunciation instruction among Thai EFL learners.

This integrated framework guides the analysis by examining each phonological error across four dimensions, providing a comprehensive explanation of learner difficulties and implications for Thai EFL pronunciation instruction.

A Contrastive Study of English and Thai Phonology

English and Thai share several consonants, including /p, b, m, n, k, f, s/, which generally cause little difficulty for Thai learners. However, English sounds absent from Thai, such as /θ, ð, z, ʒ, tʃ/, often lead to substitutions with similar Thai sounds, e.g., /θ, ð/ → /t, d/ and /z/ → /s/.

1. English Consonant Phonemes

English has 24 consonant phonemes. Twenty-three can occur initially, with /ŋ/ as the only exception. All 24 can occur medially. Twenty-one can occur finally, except /h/, /w/, and /j/.

Table 1

English Consonant Phonemes

		PLACE OF ARTICULATION							
		Bilabial	Labiodental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Glottal
MANNER OF ARTICULATION	Plosive	p b			t d			k g	
	Fricative		f v	θ ð	s z	ʃ ʒ			h
	Affricate					tʃ dʒ			
	Nasal		m		n			ŋ	
	Lateral approximant				l				
	Approximant	w				r	j		

Source: English Phonetics and Phonology: A Practical Course. (Roch, 2009, p. 52)

2. Thai Consonant Phonemes

Thai has 21 consonant phonemes, all of which can occur initially. However, only nine occur finally: /p, t, k, ʔ, m, n, ŋ, w, j/. Unlike English, Thai has a limited final consonant inventory, with final consonants typically produced unreleased.

Table 2*Thai Consonant Phonemes*

			PLACE OF ARTICULATION					
			Bilabial	Labiodental	Alveolar	Alveolo-palatal	Velar	Glottal
MANNER OF ARTICULATION	Plosive	VI. Unasp.	p	f	t	c t ^h	k	ʔ
		VI. Asp.	ph		th		kh	
		V. Unasp.	b		d			
	Fricative	VI.	s		h			
		Affricate	VI. Unasp.					
			V. Asp.					
	Nasal	V.	m	n		ŋ		
	Lateral	V.		l				
	Trill	V.		r				
	Semi-Vowel	V.	w		i			

Source: Adapted from the chart of Thai consonant phonemes (Sriyaphai, 2013, p. 73)

Research Objectives

1. To analyse the pronunciation errors of English consonant sounds in the three phonological positions-initial, medial, and final-produced by Thai undergraduate students who are non-English majors and study English as a foreign language
2. To investigate the effects of first language (L1) interference on the pronunciation of English consonant sounds in the three phonological positions-initial, medial, and final-among Thai undergraduate students who are non-English majors and study English as a foreign language

Research Questions

1. Which types of English consonant sounds in the three phonological positions-initial, medial, and final-pose difficulties for Thai undergraduate students who are non-English majors and study English as a foreign language?
2. To what extent does first language (L1) interference influence the pronunciation of English consonant sounds among Thai undergraduate students who are non-English majors and study English as a foreign language, and which specific consonant sounds are affected by such interference?

Methodology

1. Research Design

This study used descriptive statistics, with percentage analysis to summarise the frequency and distribution of pronunciation errors. Qualitative analysis applied Thai-English Contrastive Analysis and phonological rules to explain the nature and causes of errors across phonetic environments. Together, these approaches provide both statistical and linguistic interpretations of the error patterns.

2. Population and Samples

The population comprised 443 second-year, non-English-major undergraduates aged 18+ from 15 programmes in the Faculty of Education, Loei Rajabhat University, in 2023. They were purposively selected to represent general English learners and provide an appropriate context for examining pronunciation in teacher education. The sample comprised 142 second-year

students from 15 programmes, selected through cluster sampling. Ten students (five male, five female) were randomly selected per programme, or all students when fewer than ten were enrolled, ensuring balanced representation and reducing selection bias.

3. Instruments

The research instrument was systematically developed by creating an English pronunciation error word list based on six phonetic categories: plosives, fricatives, affricates, nasals, lateral approximants, and approximants, ensuring comprehensive and systematic analysis. The study examined all 24 English consonants in initial, medial, and final positions. One to six words per consonant were selected based on suitability, frequency, and phonological context. Representative words were used when positional or lexical constraints limited options. The vocabulary included common and moderately challenging words to ensure appropriate difficulty and ecological validity. A pronunciation recording form covering 24 target consonants and 68 positional instances was developed, with 4-6 lexical items per consonant across initial, medial, and final positions. Five linguistics experts and native speakers assessed the items using a three-point scale (+1, 0, -1), yielding an IOC of 0.99, indicating excellent content validity. After revisions based on expert feedback, the finalised form was used for data collection.

4. Data Collection Procedures

Data were collected from 142 second-year undergraduates randomly selected from 15 programmes, with 10 students per programme. Where enrolment was below 10, all available students were included to ensure complete and reliable data. Audio and video recordings were conducted in quiet classrooms at Loei Rajabhat University to ensure clear, reliable speech data. Participants read a predetermined vocabulary list clearly and repeated unclear items when necessary. One academic programme was recorded per day to ensure systematic organisation and consistent quality control. Following data collection, recordings were checked for quality and transcribed using Received Pronunciation (RP). The researcher and a native English speaker jointly evaluated consonant production across word positions, focusing on voicing, unreleased final consonants, and place of articulation. Discrepancies were discussed and resolved by consensus, ensuring accurate and consistent identification of pronunciation errors.

5. Data Analysis

Following phonetic transcription, pronunciation errors were organised into analytical tables and interpreted using phonological rules. The analysis examined Thai-English phonological similarities, sound substitutions, and other L1 interference patterns in L2 acquisition. Error patterns across phonetic contexts were analysed using the rule-based framework of Fasold and Connor-Linton (2006, p. 47-49), represented as $X \rightarrow Y / A _ B$, indicating that X changes to Y between A and B. This framework supported systematic interpretation of phonological processes, learner errors, and contextual influences on pronunciation. English consonants were classified by manner of articulation into six categories: plosives, fricatives, affricates, nasals, lateral approximants, and approximants. This classification supported systematic identification of articulatory errors, analysis of English-Thai phonological differences and L1 transfer, and the development of pronunciation teaching recommendations.

Table 3

An Example Table Illustrating the Systematic Analysis of Errors in English Pronunciation (The deviation of /t/)

Positions	Lexicons	RP (Phonemic Transcription)	Phonological Error (Phonetic Transcription)	n = 142	n _{errors}	Sum of errors	Overall proportion of total error
Initial	time	/taɪm/	-	-	-	-	1 / 142 x 100 = 0.70%
	talk	/tɔ:k/	-	-	-	-	
	team	/ti:m/	-	-	-	-	
	tent	/tent/	t → t * [tenə]	1	0.70%	0.70%	
Medial	better	/betə/	t → t * [betə]	55	38.73%	40.13%	223 / 568 x 100 = 39.26%
			t → d * [bedə]	2	1.40%		
	letter	/letə/	t → t * [letə]	41	28.87%	30.98%	
			t → d * [ledə]	3	2.11%		
	matter	/mætə/	t → t * [mætə]	41	28.87%	30.27%	
			t → d * [mædə]	2	1.40%		
	cutter	/kʌtə/	t → t * [kʌtə]	75	52.81%	55.62%	
			t → d * [kʌdə]	4	2.81%		
Final	eat	/i:t/	t → t * [i:t]	119	83.80%	83.80%	490 / 568 x 100 = 86.26%
	night	/naɪt/	t → ø * [najø]	122	85.91%	85.91%	
	rat	/ræt/	t → t * [læt]	121	85.21%	85.21%	
	out	/aʊt/	t → ø * [aʊø]	128	90.14%	90.14%	

6. Statistical Methods for Data Analysis

The statistical procedures employed in this study are outlined as follows.

- *Percentage*: Percentage = (Percentage value × 100) / Total number
- *Formula for Calculating the Number of Errors (n errors)*: n errors = (Number of erroneous sounds × 100) / Number of samples
- *Formula for Total Error*: Total Error = $\sum$ (n errors for each word)
- *Formula for Overall Percentage of Total Errors*: Overall Percentage = ($\sum$ n errors × 100) / (Total number of words × Number of participants (142))
- *Formula for Index of Item-Objective Congruence (IOC)*: IOC = ($\sum$ R) / N

Where:

- *IOC* refers to the Index of Item-Objective Congruence between the research objectives and the test items.

- $\sum$ R denotes the sum of the ratings assigned by subject-matter experts.

- N represents the number of experts involved in the evaluation.

Results

The study analysed English consonant errors among Thai non-English-major EFL undergraduates by classifying target sounds into six manner-of-articulation categories: 1) plosives, 2) fricatives, 3) affricates, 4) nasals, 5) lateral approximant, and 6) approximants. This classification ensured a systematic, theoretically grounded, and coherent analysis of learners' articulatory patterns.

1. An analysis of the pronunciation errors of English consonant sounds in the three phonological positions-initial, medial, and final-produced by Thai undergraduate students who are non-English majors and study English as a foreign language.

1.1 Plosives

1.1.1 Voiceless and Voiced Bilabial Plosives /p/ and /b/

Thai learners have difficulty producing /p/ and /b/, particularly word-finally, despite both existing in Thai. Errors reflect L1 transfer and intralingual overgeneralisation, with Thai's ban on final voiced stops causing voicing neutralisation and modified release.

Initial Position: /p/ was sometimes produced as unaspirated [p], with a 21.30% error rate, as in “paper” /peɪpə/ → *[pepə] (52.81%). Errors mainly resulted from overgeneralisation and Thai transliteration conventions (e.g., “เพปเปอ”), reflecting incomplete acquisition of English aspiration norms (Larsen-Freeman & Long, 1994). Medial Position: The error rate was 24.41%, mainly due to orthographic and transliteration interference. For example, “apple” /æpəl/ → *[æpən] (59.85%) reflects reliance on Thai representations, while “speak” /spi:k/ → *[sp^{hi}:k] shows over-aspiration and hypercorrection, indicating incomplete mastery of English aspiration rules. Final Position: /p/ had a 99.29% error rate, mainly realised as unreleased [p̚], e.g., “keep” → *[ki:p̚]. /b/ showed 98.59% substitution by [p̚], e.g., “tab” → *[tæp̚]. These patterns reflect Thai phonotactic constraints, which permit only voiceless unreleased final stops /p̚, t̚, k̚/, causing final neutralisation and negative L1 transfer.

1.1.2 Voiceless and Voiced Alveolar Plosives /t/ and /d/

Thai learners generally produce /t/ and /d/ accurately medially, but final-position errors increase due to Thai phonotactic constraints, which allow /t/ but prohibit /d/. Common errors include devoicing, final consonant deletion, and unreleased stops.

No errors occurred initially, but the medial error rate was 39.26%, mainly involving /t/ → [t̚] instead of [t^h], e.g., “cutter” /kʌtə/ → *[kʌtə] (52.81%), reflecting L1 transfer and inconsistent application of English aspiration. Flapping /t/ → [d] also occurred in “better” *[bedə] and “letter” *[ledə] (1.40-2.81%), reflecting exposure to American English. Final Position: /t/ had an 86.26% error rate, often being deleted after diphthongs, e.g., “out” → *[aʊø] and “night” → *[najø], or produced as unreleased [t̚] after monophthongs, reflecting Thai phonotactic constraints. /d/ showed a 96.47% error rate, commonly devoiced to unreleased [t̚], e.g., “did” → *[dɪt̚] and “made” → *[met̚]. This pattern reflects the absence of final voiced stops in Thai and supports previous findings (Kanokpermpoon, 2007, p. 60).

1.1.3 Voiceless and Voiced Velar Plosives /k/ and /g/

Thai learners experience considerable difficulty with /k/ and /g/, particularly medially and finally, due to Thai phonological influence. Since Thai has /k/ but lacks /g/, maintaining the voicing contrast is difficult. Final /k/ and /g/ showed error rates of 94.78% and 97.88%, respectively, with aspiration and unreleased stops further contributing to errors.

Initial Position: /k/ had a 21.12% error rate, mainly due to orthographic interference, with “ch” sometimes prompting /k/ → *[tʰ], e.g., “chorus” → *[tʰɔ:lʌt] (21.12%). /g/ showed 100% errors, typically /g/ → *[k], e.g., “gun” → *[kʌn], reflecting L1 transfer because /g/ is absent in Thai. Medial Position: /k/ showed an 88.20% error rate, with forms such as “skip” → *[sʰkʰɪp] (80.98%) and “speaker” → *[sʰpʰi:kə] (96.47%), reflecting difficulty distinguishing aspirated and unaspirated stops. /g/ showed 100% errors, commonly /g/ → *[k], e.g., “forget” → *[fɔ:kət], due to its absence in Thai and assimilation to the closest L1 category. Final Position: /k/ showed a 94.78% error rate, e.g., “take” /teik/ → *[te̚k], while /g/ showed 97.88%, e.g., “dog” /dɒg/ → *[dɔ:k̚]. These errors reflect Thai phonotactic constraints, which favour unreleased final stops and prohibit audible release.

Figure 1

A Graphical Representation Illustrating the Patterns of Pronunciation Errors in the Production of Plosive Consonant Sounds

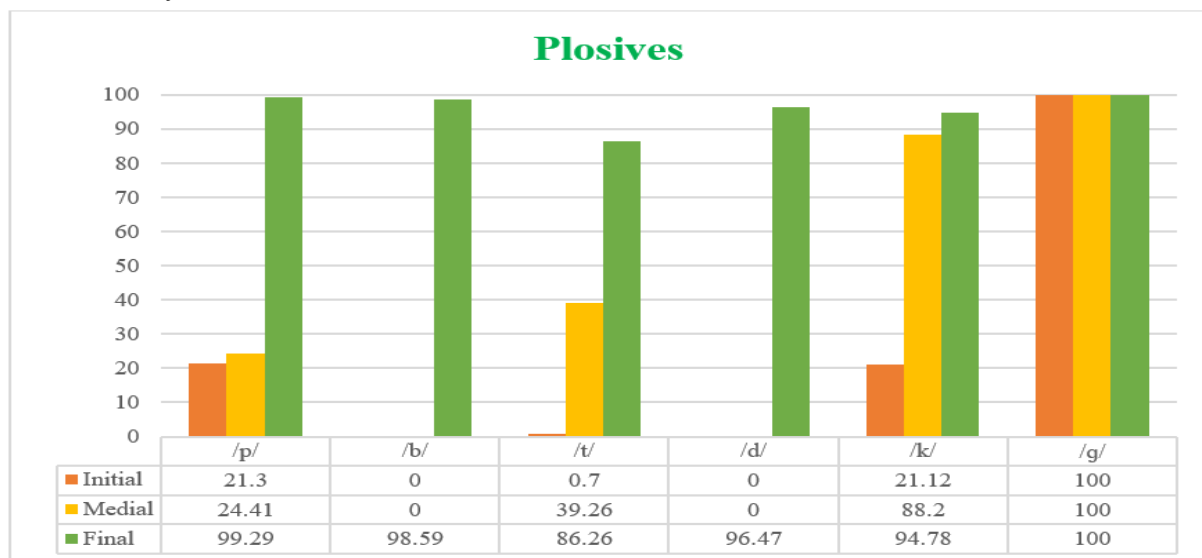


Figure 1 presents the results of the analysis of pronunciation errors in plosive consonants, classified according to their positional occurrence within words, namely initial, medial, and final positions. The findings are detailed as follows.

The syllable-final position was most challenging for English plosives, with 80-100% error rates. /g/ was the most problematic (100% across all positions), followed by /k/ (88.20% medially and high final-position errors). Other plosives were generally more accurate initially and medially, with errors concentrated in final position.

1.2 Fricatives

1.2.1 Voiceless and Voiced Labiodental Fricatives /f/ and /v/

/f/ and /v/ are labiodental fricatives differing in voicing. Both occur in all English positions, but Thai restricts /f/ to initial position and lacks /v/. Thus, /f/ is generally accurate, while /v/ remains highly problematic.

Initial Position: /f/ had a 58.45% error rate, often /f/ → *[p^h] due to misinterpreting “ph” as /p^h/, e.g., “phrase” → *[p^het]. /v/ showed a 98.59% error rate, commonly /v/ → *[w], e.g., “van” → *[wæn] and “view” → *[wju:], reflecting its absence in Thai and substitution by the articulatorily similar /w/. Medial Position: /f/ had a 33.09% error rate, often /f/ → *[p^h] due to “ph” interference, e.g., “dolphin” → *[dolphɪn]. /v/ showed a 98.59% error rate, with 97.18% substituted by [w], e.g., “over” → *[owə], reflecting L1 transfer and difficulty perceiving and producing voiced fricatives. Final Position: /f/ and /v/ showed very high error rates of 93.09% and 98.06%, respectively. Learners often substituted them with unreleased [p̚], e.g., “safe” → *[sep̚] (92.25%) and “love” → *[lɜ:p̚] (87.32%), reflecting Thai phonotactic constraints against final fricatives. Final deletion and orthographic interference also occurred, making the final position most difficult.

1.2.2 Voiceless and Voiced Interdental Fricatives /θ/ and /ð/

/θ/ and /ð/ were the most problematic consonants, with error rates exceeding 98% and reaching 100%, respectively, across all positions. Their absence and lack of voicing contrast in Thai led to frequent substitution and deletion.

Initial Position: /θ/ showed a 98.41% error rate, mainly substituted by [t^h] or [t], e.g., “think” → *[t^hɪŋθ]/[tɪŋθ]. /ð/ showed 100% errors, mostly /ð/ → [d], e.g., “that” → *[dæt]. These substitutions reflect negative L1 transfer, as Thai lacks interdental fricatives, leading learners to use similar alveolar stops. Medial Position: /θ/ showed a 98.76% error rate, mainly /θ/ → [t^h], e.g., “birthday” → *[bɜ:t^hde]. /ð/ showed 100% errors, substituted by [t^h] or [t], e.g., “mother” → *[mɑ:t^hə]/[mɑ:tə]. These patterns reflect systematic substitution with familiar alveolar sounds. Final Position: Both /θ/ and /ð/ showed 100% error rates, mainly substituted by unreleased [t̚], e.g., “faith” → *[fet̚] and “with” → *[wit̚]. These errors reflect Thai coda constraints that prohibit final fricatives, leading to substitution, epenthesis, and syllable restructuring.

1.2.3 Voiceless and Voiced Alveolar Fricatives /s/ and /z/

English /s/–/z/ contrast is problematic because Thai has /s/ but lacks /z/ and restricts final fricatives, resulting in substantial errors, especially for /z/ (99.43% medially and finally), through systematic substitution and restructuring.

No errors occurred initially. However, /z/ showed a 98.59% error rate, mainly substituted by /s/, e.g., “zoo” → *[su:] and “zip” → *[sɪp̚]. Because /z/ is absent in Thai, learners preserve its fricative manner but neutralise voicing, consistent with Flege’s (1995) Speech Learning Model. Medial Position: /s/ showed a 72.53% error rate, mainly from retaining /t/ in words such as “castle” → *[kæst^hən] due to orthographic influence and failure to apply /t/-deletion. /z/

showed a 99.43% error rate, mainly /z/ → [s], e.g., “puzzle” → *[pʊsən̩], reflecting L1 transfer and difficulty maintaining the voicing contrast. Final Position: Both /s/ and /z/ showed 100% error rates, typically replaced by unreleased [̚], e.g., “bus” → *[bʌ̚] and “doze” → *[do:̚]. This reflects Thai coda constraints, which prohibit final fricatives and permit only /p, t, k/. Additional strategies include deletion and epenthesis, indicating restructuring to conform to Thai syllable patterns.

1.2.4 Voiceless and Voiced Postalveolar Fricatives /ʃ/ and /ʒ/

Thai learners struggle with /ʃ/ and /ʒ/ because both are absent in Thai, leading to substitution, orthographic interference, epenthesis, deletion, and overgeneralisation. /ʃ/ is commonly replaced by [tʰ], [s], or [t], while /ʒ/ by [k], [s], or [tʰ], reflecting strong L1 transfer.

1.2.4.1 Analysis of /ʃ/ (Voiceless Postalveolar Fricative)

Initial Position: /ʃ/ showed a 98.16% error rate, mainly substituted by [tʰ], e.g., “shy” → *[tʰai] and “short” → *[tʰɔ:t]. This substitution reflects articulatory and acoustic similarity, L1 transfer, and perceptual assimilation, consistent with the SLM and PAM. Medial Position: /ʃ/ showed a 99.29% error rate, mainly substituted by [tʰ], e.g., “washing” → *[wɔ:tʰɪŋ] and “fishing” → *[fɪtʰɪŋ]. Errors reflect articulatory similarity and orthographic interference. Final Position: /ʃ/ showed an 88.30% error rate, mainly replaced by unreleased [̚], e.g., “dish” → *[dɪ̚] and “push” → *[pʊ̚]. This reflects Thai coda constraints and phonological repair. “Douche” showed high variation (85.20%), indicating strong orthographic influence and pronunciation uncertainty.

1.2.4.2 Analysis of /ʒ/ (Voiced Postalveolar Fricative)

Initial Position: /ʒ/ showed a 98.59% error rate, mainly /ʒ/ → [k], e.g., “genre” → *[kɒnrə] (95.07%), due to its absence in Thai and orthographic interference. Medial Position: Errors reached 100%, mainly /ʒ/ → [tʰ], e.g., “visual” → *[wɪtʰʊə] (88.73%), reflecting perceptual similarity and the absence of voiced fricatives in Thai. Final Position: Errors reached 99.29%, mainly /ʒ/ → [̚], e.g., “beige” → *[bet̚] (92.25%), reflecting Thai phonotactic constraints and repair strategies such as epenthesis.

1.2.5 Voiceless Glottal Fricative: /h/

The voiceless glottal fricative /h/ exists in both Thai and English, differing only in distribution. English allows broader positional occurrence, but this does not significantly affect Thai learners.

Initial and Medial Positions: Learners achieve 100% accuracy in both positions, reflecting positive transfer and equivalence classification.

Therefore, fricatives pose considerable challenges across word positions. Charumanee and Wongkittiporn (2024, p. 127) reported frequent substitutions among Thai university students, including /v/ → [w] initially and medially and [p] finally; /z/ → [s] across all positions; /θ/ → [t] initially and medially or omission finally; /ð/ → [d] initially and [t] medially and finally; /ʃ/

→ [tɛ^h] medially; and /ʒ/ → [tɛ^h] medially and [t] finally. These findings, supported by other studies (Prombut, 2023, p. 624; Piyamat & Deekawong, 2021, p. 70; Plailek & M. Essien, 2021, p. 2026; Sridhanyarat, 2017, p. 15), confirm substantial difficulties with English fricatives and affricates, particularly /θ/, /ð/, /tʃ/, and /dʒ/.

Figure 2

A Graphical Representation Illustrating the Patterns of Pronunciation Errors in the Production of Fricative Consonant Sounds

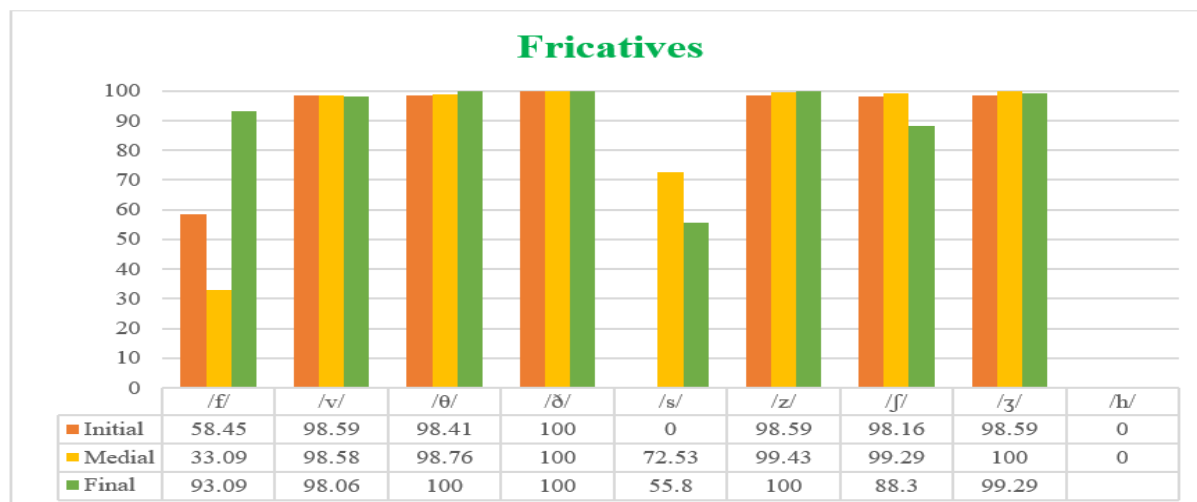


Figure 2 illustrates the patterns of pronunciation errors in the production of fricative consonants, classified according to their positions within words, namely initial, medial, and final positions. The findings are presented as follows.

Fricatives were highly problematic, especially /ð/ (100% errors) and /v, θ, z, ʒ/ (over 98%) across positions. /ʃ/ also exceeded 88%, whereas other fricatives were more accurate. Overall, Thai-absent fricatives caused the greatest difficulty for Thai EFL learners.

1.3 Affricates

1.3.1 Voiceless and Voiced Postalveolar Affricates /tʃ/ and /dʒ/

English /tʃ/ and /dʒ/ occur in all syllable positions, while Thai has comparable /c/ and /tɛ^h/, mainly restricted to initial position. These phonemic and distributional differences cause systematic substitutions due to L1 phonological constraints, articulatory proximity, and L1 transfer (Lado, 1957; Eckman, 1977; Ronakiat, 2002; Kanokpermpoon, 2007; Suntornsawet, 2022; Pathanasin et al., 2026; Naruemon et al., 2024; Peerachachayane, 2022).

Initial Position: /tʃ/ showed 100% errors, mainly /tʃ/ → [tɛ^h], e.g., “chair” → *[tɛ^hə]. /dʒ/ showed 99.29% errors, mainly /dʒ/ → [c] or [k], e.g., “jam” → *[cæm]. These substitutions reflect articulatory similarity, Thai phonemic gaps, and L1 transfer, consistent with Lado (1957) and Eckman (1977). **Medial Position:** /tʃ/ showed 100% errors, mainly /tʃ/ → [tɛ^h], e.g., “teacher” → *[ti:tɛ^hə] (99.29%). /dʒ/ showed 99.29% errors, mainly /dʒ/ → [c], e.g., “object” → *[ɔ:bcekɔ]. These substitutions reflect nearest-sound assimilation and voicing neutralisation, consistent with PAM (Best, 1995). **Final Position:** /tʃ/ showed 76.76-83.80%

errors, mainly /tʃ/ → [t̪], e.g., “touch” → *[t̪ʌt̪], while /dʒ/ showed 92.95–93.66% errors, mainly /dʒ/ → [t̪] or [ke], e.g., “age” → *[eɪt̪]. These substitutions reflect Thai coda constraints and phonotactic repair through unreleased stops or vowel insertion, consistent with previous studies (Kitikanan & Al-tamimi, 2012; Suntornsawet, 2022).

Figure 3

A Graphical Representation Illustrating the Patterns of Pronunciation Errors in the Production of Affricate Consonant Sounds



Figure 3 illustrates the patterns of pronunciation errors in affricate consonants, classified according to their positions within words-initial, medial, and final. The findings are presented as follows.

The results show very high error rates for both affricates. The overall error rate for /dʒ/ was 99.29% in the initial and medial positions and 97.18% in the final position. Similarly, /tʃ/ had a 100% error rate initially and medially, decreasing to 88.55% finally.

1.4 Nasals

1.4.1 Voiced Bilabial, Alveolar, and Velar Nasals: /m/, /n/, and /ŋ/

1.4.1.1 Voiced Bilabial Nasal /m/

The bilabial nasal /m/ occurs in all word positions in both English and Thai and is highly similar phonetically. Thus, Thai learners show minimal difficulty, with only two final-position errors (1.40%) among 142 participants, indicating near-native accuracy.

The bilabial nasal /m/ occurs in all word positions in both English and Thai and is highly similar phonetically. No errors occurred initially or medially, while only 2 of 142 learners (1.40%) erred finally, e.g., “some” /sʌm/ → *[so:me], indicating near-native accuracy. Errors may reflect Thai phonotactic restructuring, epenthesis of [e], orthographic interference from silent “e,” and perceptual disyllabification of “-me” in “some”.

1.4.1.2 Voiced Alveolar Nasal /n/

The alveolar nasal /n/ occurs in both English and Thai and is permitted in all word positions. However, unexpectedly high error rates, especially initially and finally, were found, mainly due to orthographic interference, L1 phonological constraints, and learner repair strategies.

Initial Position: A total error rate of 27.81% was observed. Examples: “knee” /ni:/ → *[kʰi:] (15.49%), “gnu” /nu:/ → *[ku:] (40.14%). The observed influence can be explained as follows; 1) Orthographic interference: Learners rely more heavily on spelling than on acoustic-phonetic cues. 2) L1 constraints: Thai lacks silent letters, leading learners to pronounce initial consonants that are orthographically represented but phonetically silent. 3) Theoretical Explanation: The Orthographic Depth Hypothesis (ODH) explains that English’s deep orthography encourages the misinterpretation of grapheme-phoneme correspondences. The Psycholinguistic Grain-Size Theory (PGST) suggests learners process larger orthographic units, leading to incorrect phonological mapping. **Final Position:** A high total error rate of 45.77% was recorded. Examples: “mine” /main/ → *[maiə] (90.84%), “cone” /kəʊn/ → *[co:ne] (0.70%). 1) Final consonant deletion: Particularly frequent after diphthongs. 2) Epenthesis/syllable restructuring: e.g., “cone” → *[co:ne]. 3) Phonotactic constraints: Thai phonology discourages certain final consonant patterns and silent letters. 4) Communicative impact: These errors may obscure meaning and diminish intelligibility.

1.4.1.3 Voiced Velar Nasal /ŋ/

The velar nasal /ŋ/ occurs in both Thai and English, especially in the final position, where Thai learners generally produce it accurately due to phonetic familiarity. However, substantial errors occur in the medial position despite its presence in Thai.

Medial Position: A total error rate of 58.62% was observed. Examples: “singer” /sɪŋə/ → *[sɪŋkə] (92.95%), “longer” /lɒŋɡə/ → *[lɔ:nkə] (97.88%). The observed influence can be explained as follows: 1) Orthographic interference: Learners misinterpret “ng” as /ŋk/ or /n/. 2) Deletion and epenthesis: Some cases involve the omission of /ŋ/ or the restructuring of syllables. 3) Theoretical support: ODH, Katz and Frost (1992) show deep orthography leads to overreliance on spelling. PGST, Ziegler and Goswami (2005) support that grapheme-based decoding mismatches phonological reality.

Figure 4

A Graphical Representation Illustrating the Patterns of Pronunciation Errors in the Production of Nasal Consonant Sounds

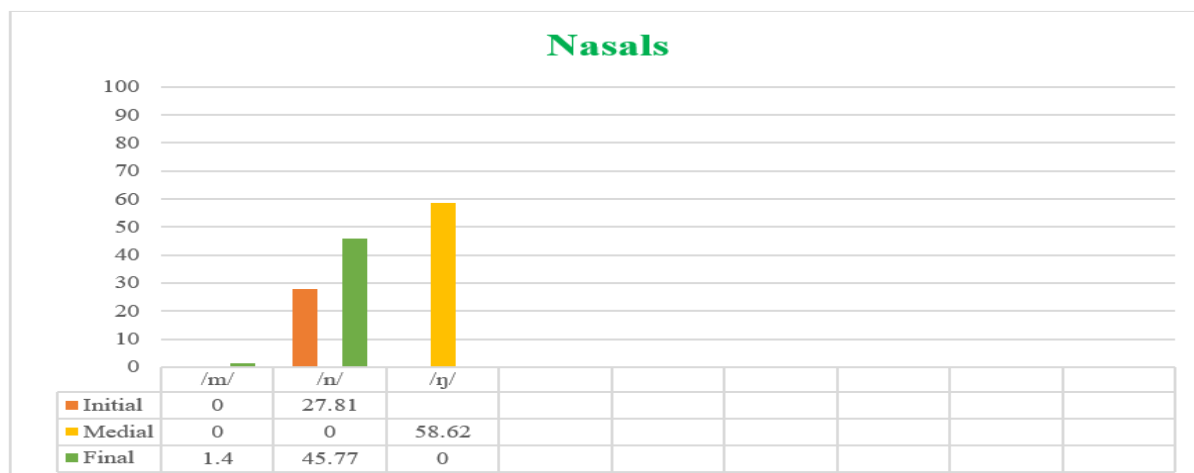


Figure 4 illustrates the patterns of pronunciation errors in nasal consonants, classified according to their positions within word-initial, medial, and final. The findings are presented as follows:

/ŋ/ was the most problematic nasal, with a 58.62% medial error rate but no final errors, while /n/ showed 45.77% final errors and minimal initial and medial errors.

1.5 Lateral Approximant

1.5.1 Voiced Alveolar Lateral Approximant /l/

The alveolar lateral approximant /l/ occurs in both English and Thai and is generally accurate initially and medially. However, final /l/, often realised as dark [ɫ] in English, differs from Thai, causing significant difficulty for Thai learners.

No pronunciation errors were observed in the initial or medial positions. In contrast, the final position had a very high error rate of 98.58%. Error Types and Examples: Errors can be classified into three principal categories: 1) Substitution (/l/ → [n]): “wall” /wɔ:l/ → *[wɔ:n] (1.40%), “ball” /bɔ:l/ → *[bɔ:n] (10.56%). 2) Deletion (/l/ → ø): “wall” /wɔ:l/ → *[wɔ:ø] (97.18%), “tell” /tel/ → *[teuø] (97.88%). 3) Syllable Breaking / Epenthesis (/l/ → [le] / _#): “pole” /pəul/ → *[po:le] (2.81%).

Therefore, these patterns reflect systematic phonological adaptation strategies: 1) Substitution Rule: /l/→[n] / _#. Learners replace /l/ with the alveolar nasal [n], consistent with Thai phonotactic constraints. This reflects L1 transfer. 2) Deletion Rule: /l/→∅ / _#. The coda /l/ is deleted to conform to Thai syllable structure (typically CV(C)), representing a repair strategy to avoid illicit codas. 3) Epenthesis Rule (Syllable Breaking): /l/→[le] / _#. A vowel is inserted to create an additional syllable, thereby restructuring the word to align with Thai phonological patterns. Collectively, these strategies indicate that learners prioritise articulatory ease and conformity to L1 phonotactic constraints over adherence to target-language norms.

Figure 5

A Graphical Representation Illustrating the Patterns of Pronunciation Errors in the Production of the Lateral Approximant Consonant Sounds



Figure 5 illustrates the patterns of pronunciation errors in the lateral approximant, classified according to its positions within word-initial, medial, and final. The findings are presented as follows.

The consonant /l/ showed a 98.58% error rate in the final position but was produced accurately in the initial and medial positions, with no errors recorded.

6.1 Approximants

1.6.1 Voiced Post-alveolar Approximant /r/

English /r/ is a post-alveolar approximant, while Thai /r/ is typically an alveolar trill, causing articulatory and phonological difficulties. Errors are high initially and medially but absent finally.

Initial Position: /r/ showed a 93.30% error rate, mainly replaced by /l/, e.g., “read” → *[li:t] and “rice” → *[laiø]. This reflects L1 transfer and the articulatory similarity of /r/ and /l/, consistent with Urona et al. (2025). Under the MDH, English /r/ is more marked than its Thai counterpart, increasing acquisition difficulty. **Medial Position:** /r/ showed a 94.35% error rate, mainly replaced by /l/, e.g., “hurry” → *[hɜ:li:] and “marry” → *[mæli:]. This reflects L1 interference and learners’ preference for familiar, less complex L1 sounds.

1.6.2 Voiced Bilabial and Palatal Approximants /w/ and /j/

The approximants /w/ and /j/ occur in both Thai and English and are phonetically similar, supporting accurate production through positive L1 transfer. Both occur initially and medially, with some /j/ errors, while /w/ showed no errors in either position.

Initial Position: /j/ had a low error rate (14.08%), e.g., “unit” → *[ʌnit̚]. Errors reflect orthographic interference from “u” and L1-based phonological processing. **Medial Position:** /j/ showed a 100% error rate in specific words, e.g., “onion” → *[ɔ:nø̃m]. Errors involve /j/ deletion due to unclear orthographic representation, reflecting orthographic interference and L1-based processing.

Figure 6

A Graphical Representation Illustrating the Patterns of Pronunciation Errors in the Production of Approximant Consonant Sounds

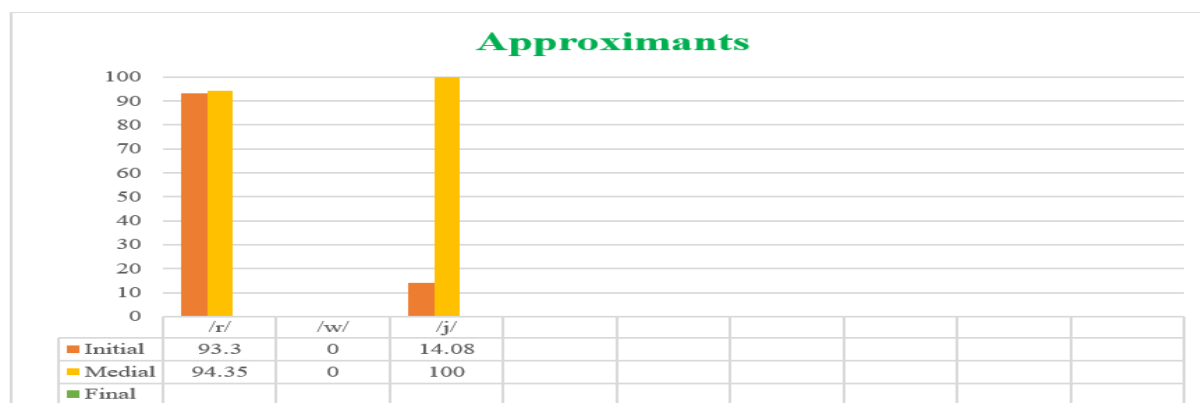


Figure 6 illustrates the patterns of pronunciation errors in approximant consonants, classified according to their positions within word-initial, medial, and final. The findings are presented as follows.

The results show that /r/ remained highly problematic, with error rates of 94.35% medially and 93.30% initially. In contrast, /j/ had a 100% error rate medially, while /w/ was produced without errors.

2. An investigation of the effects of first language (L1) interference on the pronunciation of English consonant sounds in the three phonological positions-initial, medial, and final-among Thai undergraduate students who are non-English majors and study English as a foreign language.

The findings reveal systematic English consonant errors across all positions, mainly caused by L1 transfer as learners substitute unfamiliar English sounds with Thai patterns. This supports Lado's (1957) Contrastive Analysis, which attributes L2 difficulties to cross-linguistic differences.

In the initial position, Thai learners accurately produce shared consonants such as /p/, /t/, /k/, /s/, and /h/ but struggle with Thai-absent sounds, often substituting /v/ → [w] and /z/ → [s], reflecting equivalence classification (Flege, 1995). Orthographic interference also causes errors, such as "ph" → /p^h/ and "ch" → /tʰ/ (Avery & Ehrlich, 1992). Medially, errors increase due to difficulties with aspiration, voicing, and reduction, including over-/under-aspiration of /t/ and /k/ and substitutions of /θ/ → [t]/[t^h] and /ð/ → [d]/[t]. These patterns support the MDH (Eckman, 1977), which predicts greater difficulty with marked L2 sounds absent from L1. The final position shows the greatest difficulty due to Thai phonotactic constraints, which allow only unreleased /p̚, t̚, k̚/. Learners therefore produce final stops unreleased and devoice /b, d, g/ to [p̚, t̚, k̚], causing final neutralisation (Jun, 2010). Other strategies include consonant deletion (e.g., "life" → [laɪjə]) and epenthesis (e.g., "some" → [so:me]) (Broselow, 1992), with orthographic influence also contributing (Hayes-Harb et al., 2010). Previous studies confirm these Thai phonotactic effects (Sridhanyarat, 2017; Wei & Zhou, 2002; Suntornsawet, 2022; Taothong, 2022).

The pronunciation strategies employed by Thai learners can be categorised according to the manner of articulation as follows:

- Plosives: Interlingual transfer, intralingual errors, negative transfer, phonological transfer (L1 transfer), transliteration, aspirated/unaspirated, overgeneralisation, transliterated words, nearest sound, flapping (American accent), deletion, substitution, unreleased plosives, error patterns, and vowel glide sequences.
- Fricatives: Negative transfer, substitution, nearest sound, orthographic interference, phonological constraints, L1 influence/phonemic gap, unreleased plosives (substitution), deletion, epenthesis (syllable breaking), voicing (voiced → voiceless), and phonotactic transfer.

- Affricates: L1 transfer, substitution, nearest sound, palatalised, negative transfer, overgeneralisation, orthographic interference, deletion, voicing (voiced → voiceless), unreleased voiceless plosives, and markedness.
- Nasals: L1 transfer, epenthesis, orthographic interference, silent letters, substitution, and unreleased sounds.
- Lateral Approximant: L1 transfer, substitution, deletion, and epenthesis (syllable breaking).
- Approximants: L1 interference, substitution, orthographic interference, and deletion.

Overall, Thai EFL learners show systematic, position-sensitive consonant errors mainly caused by L1 transfer, phonotactic constraints, phonemic gaps, orthographic interference, and intralingual processes. Initial errors involve phonemic gaps and spelling influence; medial errors involve aspiration, voicing, and phonological rules; and final errors are greatest, involving devoicing, unreleased stops, deletion, and epenthesis. These findings support Flege (1995), Best (1995), and Eckman (1977) and highlight the need for targeted listening and phonetic training with less reliance on orthography.

Discussion

This study examined the nature and distribution of English consonant errors among Thai non-English-major undergraduates, focusing on word position (initial, medial, and final) and L1 interference. The findings show that pronunciation difficulties are systematic, position-sensitive, and strongly influenced by interactions between Thai and English phonological systems.

Overall, accuracy was highest initially, especially for consonants shared by Thai and English (/p/, /t/, /k/, /s/, /h/, /m/, /w/), reflecting positive L1 transfer (Naruemon et al., 2024, p. 9). Thai-absent sounds such as /v, z, ʃ, ʒ, θ, ð/ remained difficult and were often assimilated to similar L1 categories, supporting Flege's (1995) equivalence classification. Medial errors increased due to phonological complexity, L1 transfer, rule overgeneralisation, and orthographic interference, supporting the ODH (Katz & Frost, 1992) and interlanguage development. Final position was most difficult, mainly because Thai permits only unreleased voiceless stops /p̚, t̚, k̚/ in coda position. Learners therefore used devoicing, substitution, deletion, and epenthesis, consistent with Broselow (1992) and Eckman's (1977) MDH and findings by Paisart (2025, p. 2).

A key contribution of this study is showing that pronunciation errors are systematic rather than random across manner-of-articulation categories. Plosives are mainly affected by aspiration and final devoicing; fricatives and affricates by substitution due to phonemic gaps; nasals are generally well acquired but influenced by orthography; and approximants, especially /r/ and final /l/, remain difficult due to articulatory and phonotactic differences. These findings support previous research (Avery & Ehrlich, 1992; Swan & Smith, 2001; Suntornsawet, 2022), highlighting the central role of L1 influence in L2 phonological acquisition.

The findings support complementary frameworks, including the Contrastive Analysis Hypothesis (Lado, 1957), Speech Learning Model (Flege, 1995), and Perceptual Assimilation

Model (Best, 1995), which explain substitution, perceptual assimilation, and difficulty with non-native contrasts. The results also highlight orthography as a mediating factor, as reliance on grapheme-phoneme correspondences may hinder accurate phonological processing (Hayes-Harb et al., 2010).

The findings highlight the need for systematic Thai-English pronunciation training focusing on predictable phonological differences through minimal pairs, listening discrimination, and articulatory practice. Instruction should address sounds across phonological environments, especially word-final consonants, clusters, and coda contrasts, to reduce deletion, substitution, and modification caused by Thai phonotactic constraints.

The findings suggest integrating phonics-based approaches with explicit phonetic training. While phonics develops grapheme-phoneme awareness, excessive reliance on English spelling may cause pronunciation errors. Teachers should therefore encourage the use of phonetic transcription and IPA, together with listening activities linking spoken and written forms. This can strengthen phonological awareness and reduce orthographic errors. Klahan, Nooyod, and Thomma (2026, p. 67) similarly found that phonics develops letter-sound awareness by connecting and blending sounds to form words, such as /c/, /a/, and /t/ in “cat”, thereby supporting word identification, reading fluency, and decoding of unfamiliar words.

Conclusion

In conclusion, this study highlights the strong influence of L1 phonology, phonotactic constraints, and orthographic interference on English consonant acquisition among Thai EFL learners. Its position-sensitive analysis provides a detailed account of how errors vary across initial, medial, and final positions, showing that pronunciation difficulties are shaped by both L1 transfer and phonological and orthographic factors. Pedagogically, the findings support targeted instruction of problematic consonants, particularly those absent from Thai, with emphasis on word-final production. Future research should examine the effectiveness of explicit phonetic, perceptual, and phonics-based instruction, as well as use longitudinal studies to assess changes in pronunciation accuracy and intelligibility over time.

Recommendations

1. Expansion of Pronunciation Research through the Integration of Articulatory Phonetics

Future research should integrate articulatory phonetics and advanced imaging technologies to examine speech-organ movements and better explain the underlying causes of pronunciation errors.

2. Investigation of the Relationship between Speech Perception and Production

Future research should integrate speech perception and production to determine whether pronunciation errors stem mainly from perceptual or production difficulties, thereby clarifying persistent pronunciation problems.

3. Development of Personalised Pronunciation Instruction Based on Learner Error Patterns

Future research should develop tailored pronunciation instruction based on learners' specific errors to improve training efficiency and sustainable pronunciation development in higher education.

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Human Research Ethics Certificate

Since this study involved university students as participants, strict adherence to research ethics was carefully observed. The researcher applied for approval of human research ethics, which was subsequently reviewed and approved by the Human Research Ethics Committee of Loei Rajabhat University. The study was granted an ethical approval certificate number H 001/2567.

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