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Sociophonetic Markers in English Majors: How Urban Jordanian Identity Shapes Consonantal Substitutions

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Abstract This study examined English pronunciation errors among 50 Jordanian English majors at the Faculty of Educational Sciences and Arts. Data were collected via a 190-item word-list reading task, focusing on frequency and complexity. Recordings were transcribed using IPA and analyzed via Praat, with inter-rater reliability confirmed at 0.85. The research investigated seven consonants (i.e., /dʒ/, /tʃ/, /θ/, /ð/, /ʃ/, /ʒ/, and /ŋ/) across various positions. Analyzed through Contrastive Analysis, Markedness Theory, and Sociophonetics, findings revealed a systematic hierarchy of phonological complexity. Primary deviations included deaffrication (/dʒ/→/ʒ/), stopping (/ð/→/d/), and nasal epenthesis (/ŋ/→ [ŋg]). Notably, applying Al-Wer's (2004, 2019) framework, substitutions of /z/ for /ð/ and /g/ for /dʒ/ reflect dialectal prestige and urban identity rather than mere mistakes. Results suggest that teaching should prioritize articulatory features and functional intelligibility over native-like accuracy. Educators need to recognize that pronunciation reflects cultural identity and Jordanian dialects, supporting learners by relating linguistic rules to social contexts.

Keywords: *English pronunciation errors, Contrastive analysis, Markedness theory, Nasal epenthesis, Sociophonetics*

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1. Introduction

Globally, many EFL and ESL learners believe that English proficiency is achieved by mastering skills such as listening, speaking, reading, writing, and especially pronunciation to acquire a native-like accent (Alimemaj, 2021). Recently, the tendency has shifted primarily toward a more practical goal of communicative intelligibility at the phonological, grammatical, and pragmatic levels (Abu Manie et al., 2025; Hamdan & Sayyed, 2022; Smadi et al., 2023). That is, to what extent listeners would actually understand a speaker's message (Derwing & Munro, 2015; Levis, 2005). The intelligibility principle, unlike the native-like goal, assumes that Communication is successful when speakers avoid phonological deviations

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that may arise when substituting one word for another, which can lead to a loss of meaning and obstruct comprehension (Jenkins, 2000). Levis (2005) and Derwing and Munro (2015) explain that such approaches prioritise clarity and focus on deviations arising from direct mother tongue (L1) interference (Al-Zoubi, 2019; Kalaldeh, 2016). This is further elaborated by Positional Markedness, which holds that certain sounds are harder than others in specific phonological positions for those who use English for Global Purposes (EGP). Thus, examining the phonological deviations that might hinder clear communication is significant, particularly for learners who need to use English in diverse professional and academic environments (Alshehri et al., 2024).

Recent studies confirm that speakers of Arabic find certain English phonemes absent from their everyday spoken vernacular difficult to produce (Al-Azzam & Al-Zoubi, 2022). In particular, Jordanian speakers often substitute sounds such as dental fricatives (e.g., /θ/ and /ð/) with /s/, /t/, /z/, or /d/ in their native dialect, leading to predictable errors in English (Al-Wer, 2004; Zibin, 2019). Al-Wer (1991) argues that this is rooted in Jordan's dialectal landscape, distinguishing between indigenous varieties and the urban Palestinian norm. While the replaced sounds exist in Standard Arabic (SA), they are absent from the students' prestigious urban dialect; hence, pronunciation is not merely a matter of mastering the L2 but also a marker of urban identity. Al-Khatib (1988) asserts that speech communities differ in particular phonological variables. For instance, producing /θ/ as [s] reflects a socially prestigious substitution found in the Urban Palestinian Arabic (UPA) norm. As Al-Wer (1991) observes, such a choice is frequently adopted by university students who aim not only to master the L2 but also to reflect a metropolitan identity and an elevated social standard that supersedes the phonetic rules of both SA and English. Therefore, any errors observed in their English production do not reflect linguistic failures; rather, they are a regular transfer of ingrained sociophonetic identity markers deeply rooted in urban communities.

While these sociophonetic transfers have been well documented at the dialectal level, their impact on the English pronunciation of advanced Jordanian learners, particularly in relation to word position, remains underexplored. Al-Shalabi (2021) notes that Arab university learners majoring in English and receiving high-quality language training experience communication breakdowns when substituting sounds. Al-Azzam (2020), Al-Azzam and Al-Zoubi (2022), and Hasan (2023) have listed the most common consonantal replacements and deletions among Arabic-speaking learners. A more recent study by Al-Shallakh (2024) shows that sound replacements are clearly affected by the digital learning methods used by Arabic-speaking learners. Despite this, there is still no comprehensive study that examines how sound positions (initial, medial, and final) change the way EFL/ESL learners pronounce sounds. This major gap in the study of consonant positions, grounded in Interlanguage Theory (Selinker, 1972), helps determine whether an error is a context-dependent phonological shift or a case of fossilisation (i.e., a permanent part of the learner's accent). This study helps determine whether these errors stem from first-language (L1) habits, orthography (Bassetti, 2008), or articulatory simplification (Archibald, 2023). Hence, through Error Analysis (EA), this study provides a thorough mapping of how the pronunciation of particular sounds produced by English university-level learners is affected by word-position constraints. This will be done by integrating the Contrastive Analysis (CA) hypothesis (Lado, 1957) with Positional Markedness (Archibald, 2023). While the former identifies errors derived from direct L1 interference (Al-Zoubi, 2019; Kalaldeh, 2016), the latter clarifies why certain sounds are harder than others in certain phonological positions, relating this to universal articulatory pressure (Archibald, 2023; Eckman, 2008).

Put differently, this study aims to examine the impact of word-positional constraints on the production of particular English consonants among Jordanian university-level learners of English and to identify where phonological processes such as substitution and deletion occur most frequently. This study also seeks to clarify the relationship between L1 interference and universal articulatory pressure. Drawing on Al-Wer's (2004, 2019) sociophonetic framework, this study views pronunciation deviations not as simple errors but as expressions of speakers' urban Jordanian identity and social prestige. Recognising how identity influences consonantal choices is crucial for differentiating between actual intelligibility issues and socially meaningful dialectal transfers that learners may intentionally or unintentionally maintain. To do this, this study addresses the following questions:

1. Among the seven targeted English consonants (/ð, θ, ʃ, ʧ, ʤ, ʒ, ŋ/), which sound(s) pose the greatest difficulty for Jordanian English university learners, and how do these difficulties vary across initial, medial, and final word positions?
2. To what extent are these phonological deviations driven by L1 transfer, phonotactic constraints, orthographic interference, or universal articulatory simplification?

2. Theoretical Framework

Recent studies have reported that Arabic speakers frequently struggle to acquire English phonology due to L1 interference and universal articulatory constraints (Alharbi, 2020; Alotaibi et al., 2022; Alshehri et al., 2024; AlKendi, 2020). Lado's (1957) CA hypothesis explains that errors arise from missing phonemes in the L1, such as /p/ and /v/. Flege's (1995) Speech Learning Model, however, posits that learners assimilate sounds to their closest L1 equivalents, such as substituting /p/ for /b/ or /v/ for /f/ (Aldaghri, 2025; Algethami, 2022). Bassetti (2008) adds that irregular English orthography, which shows an arbitrary relationship between letters and sounds, often challenges Arab learners, who expect a one-to-one correspondence between letters and sounds, as in Arabic, leading them to pronounce silent letters, such as the <k> in knight (Aliswed, 2024). Gemination (i.e., shaddah) in Arabic often confuses Arab learners, who tend to produce two sounds instead of one when encountering an English word like 'address', thus affecting consonant production accuracy (Kharma & Bin Hajjaj, 1989; Dhayef & Al-Aassam, 2020).

Al-Wer (2004, 2019) argues that regional Arabic dialects differ markedly from Standard Arabic (SA). This is because Arabic orthography includes certain phonemes that are entirely absent from everyday vernacular speech (Ferguson, 1959). A major contradiction in traditional regional studies (e.g., Al-Saidat, 2010; Hassan, 2014) is the belief that /θ/ and /ð/ errors occur because these phonemes are absent from Arabic; this is inaccurate, since these phonemes clearly exist in Modern Standard Arabic (MSA). Therefore, Al-Wer (2004, 2019) distinguishes between the formal MSA taught in schools and Urban Palestinian Arabic (UPA), the current study participants' daily spoken variety, arguing that UPA speakers often neutralise these dental fricatives in their speech. That is, Arabic speakers often produce /θ/ and /ð/ as alveolar stops [t] and [d], or as sibilants [s] and [z], for social and prestige reasons. This demonstrates that such substitutions do not occur due to speakers' lack of phonetic knowledge (Qudah, 2012) but rather to sociophonetic transfer, in which the deeply rooted habits of their local dialect supersede their formal learning in MSA.

This sociophonetic perspective is further elaborated by Fowler Al-Hawamdeh (2019), who asserts that urban identity shapes phonological choices among Jordanian university students. In particular, Ammani urban identity is linked to modernity and prestige. However, gender and social networks affect performance, as seen in negotiated speech. While urban females maintain the glottal stop [ʔ] and sibilants as signals of softness and superiority, urban males exhibit identity instability, suppressing their urban variants in multilingual university settings, especially when they have rural and Bedouin peers. These peers view non-urban variants as signals of manhood and urban variants as feminine. Therefore, phonological deviations or substitutions in EFL environments are often tools of identity management, in which learners choose between a civilised, urban, and up-to-date identity and a rough, masculine, and traditional identity to ensure social integration. While identity-driven substitutions explain the social motivation behind phonological choices, the question remains why certain sounds, regardless of social context, consistently pose greater articulatory challenges than others across languages.

Eckman's (1977, 2008) analytical framework of the Markedness Differential Hypothesis (MDH) explains why certain phonemes, such as affricates (/ʧ, ʤ/) and the velar nasal (/ŋ/), are challenging even for Arab speakers. These sounds are linguistically complex and less common globally, so speakers often substitute them with simpler, unmarked alternatives. For example, Al-Azzam (2020) emphasised deaffrication (/ʧ/ → /ʃ/), as in 'church' becoming 'shurch' across dialects, and Akbar et al. (2020) noted that /ŋ/ deletion word-finally (e.g., sing as sin) was frequent. This shows that it is not only L1 interference that prompts speakers to shift to simpler sounds, but also universal tendencies towards simplification and minimising physical effort. Al Shalabi (2024) and Altakhaineh et al.

(2024) relate the shortening of final consonants or clusters in Jordanian spoken Arabic (JSA) to specific positional constraints. It is also observed that Arab learners' use of epenthesis in complex clusters such as /spr/ is affected by the cluster's position within the word.

As noted, some previous regional studies (e.g., Al-Saidat, 2010; Hassan, 2014; Qudah, 2012) have compiled descriptive lists of sound substitutions within various frameworks without highlighting how word position affects such substitutions. In addition, studies such as Kharma & Bin Hajjaj (1989), Ruthan (2022), Aliswed (2024), and Dhayef & Al-Aassam (2020) have relied on L1 interference to explain phonological deviations in the speech of Arab learners. Moreover, some studies have shown that the persistent struggles observed among Arabic speakers of English in phonological acquisition go beyond L1 interference, involving a complex interaction between orthographic interference (Bassetti, 2008), sociophonetic dialectal habits (Al-Wer, 2019), and universal markedness (Eckman, 2008). This indicates a gap in the literature on how sound substitutions are triggered by word-position variables (initial, medial, and final). Consequently, this study aims to examine how Jordanian university learners majoring in English substitute seven target consonants (/ð, θ, ʃ, tʃ, dʒ, ʒ, ŋ/) across word-position variables, combining the CA hypothesis with Positional Markedness and sociophonetic identity. This acknowledges that the UPA Jordanian speaker's output is a product of their UPA dialectal identity, universal markedness, and the formal constraints of English phonotactics. That is, this study aims to establish a comprehensive synthesis mapping of second language (L2) production by examining how native UPA dialectal habits and universal articulatory pressures of Arabic university learners affect their pronunciation accuracy when producing certain consonants in word positions.

3. Methodology

3.1. Participants

The study's participants comprised 50 Jordanian university juniors and seniors majoring in English Language and Literature at the Faculty of Educational Sciences and Arts (FESA), affiliated with the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) in Amman, Jordan. There were 25 males and 25 females, aged 19 to 23. Selecting advanced English majors with prior academic phonological training was purposeful. This helped determine whether the observed deviations reflected deeply rooted phonological habits or fossilisation (i.e., patterns that resist change despite academic knowledge of a particular system (Han, 2004; Selinker, 1972)), rather than general L2 proficiency.

A demographic questionnaire was conducted to ensure that the participants' L1 dialect was UPA. The participants confirmed that their background was in Palestinian camps distributed in Amman, and that their UPA was their dominant vernacular. This ensures that the participants have a homogeneous L1 background, allowing examination of how their L1 dialect influences their production and perception of English sounds. This aligns with Al-Wer (2004, 2019), who asserts that people brought up in urban Palestinian camps frequently display UPA characteristics in their speech rather than rural or Bedouin varieties.

3.2. Instrument

This study employed a word-list reading task as the main instrument to record the participants' English pronunciation. The selection of the test lists' words followed two steps. Initially, Lado's (1957) CA hypothesis was adopted to compare the UPA and English sound systems to predict which sounds would be difficult for learners, such as /p/or /v/. Then, the list was modified to include words that highlighted syllable patterns and stress placement. This was done to ensure that the surrounding phonological sounds would not overlap with the production of the target sounds, following Eckman's (1977) standard phonetic sampling methods.

Regarding word choice, the following steps were taken. Initially, the list included words from literary texts and the English Literature curriculum, familiar to the English Literature major participants, to ensure that any errors were due to sound problems related to the UPA dialect rather than unfamiliarity with word meanings. Highly complex multi-syllabic words or those with unpredictable unstressed positions were avoided so that target consonants would not be affected by surrounding word stress or

difficult rhythms; thus, high-frequency target words such as ‘something’ and ‘pleasure’ were included, as seen in Appendix 1. While most target phoneme items utilised high-frequency vocabulary such as ‘mother’, ‘fish’, and ‘chair’, the /ʒ/ items necessitated the use of lower-frequency French loanwords, including ‘triage’, ‘collage’, and ‘deluge’, owing to the rarity of /ʒ/ in the native English lexicon. To satisfy lexical frequency thresholds, the entire corpus was verified using (http://www.wordfrequency. info/free.asp) to ensure that the tokens occur frequently and are familiar to the participants. Furthermore, while the researchers acknowledged that certain morphological suffixes (e.g., -ing, -ion) in certain medial positions might distract the participants from the target consonants, this was controlled by giving the participants clear examples of how to speak during the instructions and by ensuring that the target sounds were in stressed syllables to achieve clear articulation without influences from surrounding word structure.

The researchers also used distractor words to prevent participants from anticipating the target words, keeping the target sounds central to pronunciation elicitation. Furthermore, the participants were not informed of the specific target phonemes being tested prior to or during the task. For example, for dental fricatives /ð/ and /θ/, distractor words lacking these sounds were used to prevent over-monitoring (Burki & Madec, 2023). The final list comprised 210 words (190 target words and 20 distractors (see Appendix 1). To ensure reliable data collection, the researchers conducted a pilot test with five students who were excluded from the final sample. The pilot confirmed that the 210-item list was representative and that the task could be completed efficiently. However, the results indicated that students felt uneasy with low-frequency words. Consequently, the researchers replaced them with higher-frequency equivalents wherever possible (except where phonetically required, as with /ʒ/). Additionally, the pilot test demonstrated that using simple words with the target sounds in stressed positions yielded accurate data, reducing the risk associated with complex words and preventing participant fatigue.

The participants were informed of the study’s main goal and provided informed consent before data collection. Each participant took approximately 15–20 minutes to finish the reading task. For the sake of anonymity, each participant was assigned a unique code (e.g., P01–P50). The researchers stored all digital and audio files on a password-protected device.

3.3. Procedure

The researchers collected the data in the English-language lab at FESA using a smartphone application. They also used the International Phonetic Alphabet (IPA) to transcribe each participant’s pronunciation. Praat was used to carefully listen to and analyse the recordings to identify problematic sounds, such as sibilant substitutions ([z] for /ð/). To ensure inter-rater reliability, a second trained linguist reviewed a 15% sample of the recordings. Agreement between the two raters was calculated using Cohen’s Kappa coefficient, yielding a score of 0.85 (McHugh, 2012). In case of discrepancies, the raters and researchers discussed and resolved them until a final decision was made.

The researchers presented each target consonant with 10 words in each position (initial, medial, and final, where applicable) to ensure balanced and systematic coverage, as shown in Appendix 1. Specifically, /ð/ and /θ/ were elicited in initial, medial, and final positions; /ʃ/, /tʃ/, and /dʒ/ in initial and medial positions, selected for their high contrastive frequency and predicted L1 interference in these contexts; and /ʒ/ and /ŋ/ in medial and final positions. Across 50 participants, this yielded 8,050 tokens. 50 tokens were excluded due to unclear articulation, leaving a final corpus of 8,000 tokens.

This descriptive study adopted EA as the primary analytical framework. The researchers followed Corder (1967) and Richards (1971) in classifying the data. That is, phonological deviations were identified, classified, and explained. For classification, a Phonological Process Taxonomy focusing on five processes was used as follows: substitution (the replacement of an L2 phoneme with a phonetically equivalent L1 sound), deletion (the omission of a target consonant), epenthesis (vowel insertion to simplify consonant clusters), affricate simplification (the reduction of stop–fricative sequences), and voicing/devoicing errors (Celce-Murcia et al., 2010; James, 1998; Kenworthy, 1987). The data analysis then examined systematic patterns of Cross-Linguistic Influence (L1 interference) and Orthographic Dissimilarity to discuss the participants’ L2 phonological system.

The data were analysed both qualitatively and quantitatively. Qualitative data were collected through transcription and pattern identification. Quantitative data were summarised using frequencies and percentages to describe the distribution of each target sound. Statistically, the data were analysed using Chi-square tests in SPSS. The analysis tested whether differences in error rates across word positions were statistically significant ($p < 0.05$). This approach accounts for phonological hurdles, which are statistically significant effects of positional constraints rather than simple observational deviations. The explanation of the statistical results for each target sound is discussed below.

4. Results

This section presents the phonological analysis of the pronunciation errors for the target consonants /ð/, /θ/, /ʃ/, /tʃ/, /ʒ/, /dʒ/, and /ŋ/. This section also presents the quantitative and qualitative findings for each of the target consonants and their word position in order.

4.1. Voiced Dental Fricative /ð/

Table 1 shows that the participants' realizations of /ð/ were [d], [θ], and [z], varying across word positions.

Table 1
Frequency and Patterns of Error for / ð/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Initial	500	Substitution	/ð/ → /d/ (Stop)	210	42
		Substitution	/ð/ → /θ/ (Devoicing)	150	30
		Correct Realization	—	105	21
		Deletion	—	35	7
Medial	500	Substitution	/ð/ → /θ/ (Devoicing)	210	42
		Substitution	/ð/ → /d/ (Stop)	100	20
		Correct Realization	—	160	32
		Other (e.g., vowel error)	—	30	6
Final	500	Substitution	/ð/ → /z/ (Sibilant)	226	45.2
		Substitution	/ð/ → /θ/ (Devoicing)	136	27.2
		Correct Realization	—	58	11.6
		Other (e.g., vowel insertions, hypercorrections, or non-target consonant substitutions)	—	80	16
Total	1,500	Total Errors		1,177	78.5

Table 1 shows that participants' realizations of /ð/ across 1,500 tokens yielded 1,177 errors (78.5%). The voiced /ð/ shows a higher error frequency when compared to its voiceless counterpart /θ/, indicating that maintaining the vibration of the vocal folds in an interdental position increases articulatory load. Analysis across positions revealed systematic substitution patterns. Word-Initially, /ð/ was frequently substituted with [d], as in *that* /ðæt/ [dæt], and with [θ], as in *this* /ðɪs/ [θɪs]. Medially, /ð/ was primarily devoiced to [θ], as in *mother* /mɑːðər/ [mɑːθər], followed by [d], as in *other* [ʌðər]. Word-finally, the most frequent substitution was [z], as in *bathe* /beɪð/ [beɪz], and [θ], as in *smooth* [smuːθ]. Referring to the articulatory-perceptual analysis, the commonest substitution across positions was devoicing to [θ], occurring in 496 instances (33%), and a slight deviation between two dental fricatives. However, the most significant deviations involved a shift to the alveolar place, as shifting to [d] represents a change in both place and manner (from a dental fricative to an alveolar stop), while the shift to [z] represents a move from a [+distributed] dental to a [+strident] alveolar fricative (Ladefoged & Johnson, 2015). The Chi-square test ($p < 0.001$) confirmed that phonological difficulty is significantly influenced by word position. The final position posed the

greatest hurdle (88.4% error rate), a systematic observation across the voiced segments in this study (Flege, 1995). This suggests that participants substitute target sounds with common L1 alveolar sounds to lessen articulatory effort and ease pronunciation (Al-Deaibes & Rosen, 2022; Al-Wer, 2004).

4.2. Voiceless Dental Fricative /θ/

Table 2 shows that the participants' realizations of /θ/ are often substituted with [ð], [t], [s], and [f] across positions.

Table 2
Frequency and Patterns of Error for /θ/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Initial	500	Substitution	/θ/ → /ð/ (Voicing)	176	35.2
		Substitution	/θ/ → /t/ (Stop)	150	30
		Correct Realization	—	100	20
		Deletion	—	74	15
Medial	500	Substitution	/θ/ → /t/ (Stop)	190	38
		Substitution	/θ/ → /ð/ (Voicing)	150	30
		Substitution	/θ/ → /s/ (Sibilant)	50	10
		Correct Realization	—	110	22
Final	500	Substitution	/θ/ → /f/ (Labio-dental fricative)	220	44
		Substitution	/θ/ → /s/ (Sibilant)	120	24
		Correct Realization	—	110	22
		Deletion	—	50	10
Total	1500	Total Errors	—	1180	79

Table 2 shows the participants' realizations of /θ/ across 1,500 tokens, yielding 1,180 errors (79%). When compared to its voiced counterpart /ð/ (78.5%), the error rates are nearly the same, indicating that the interdental place of articulation, aside from voicing, remains the primary articulatory challenge for these learners. The analysis across positions showed four systematic substitution patterns. Word-initially, /θ/ was frequently substituted with [ð], as in *thank* /θæŋk/ [ðæŋk], and with [t], as in thick /θɪk/ [tɪk]. Medially, substitutions included [t] in *wealthy* [wɛlti], [ð] as in *nothing* [ˈnʌðɪŋ], and [s] as in *birthday* [ˈbɜːrsdeɪ]. Word-finally, /θ/ was most often replaced by [f], as in *bath* /bɑːθ/ [bɑːf], and by [s] in mouth [maʊs].

According to the articulatory-perceptual analysis, the most common yet minimal deviation was the voicing of /θ/ to [ð], accounting for 326 instances (21.7%), as both sounds share the same dental and fricative features. More prominent deviations occurred when /θ/ shifted to the alveolar stop [t], the labio-dental fricative [f], and to [s], which shifts from a [+distributed] dental to a [+strident] alveolar fricative (Chomsky & Halle, 1968). The Chi-square test ($p < 0.001$) confirmed that the error rate was significantly affected by word position, with the highest error rates occurring finally. Such patterns, particularly voicing to [ð], likely reflect the influence of UPA variants, in which learners substitute the target with common dialectal equivalents to reduce articulatory effort (Al-Wer, 2019).

4.3. Voiceless Palato-alveolar Fricative /ʃ/

Table 3 shows that /ʃ/ was substituted with [s], [z], or [ʒ], and [k] word-initially and medially. The final position was excluded because these learners generally produce /ʃ/ accurately at the end of words or before a pause (Kalaldeh, 2016).

Table 3
Frequency and Patterns of Error for /ʃ/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Initial	500	Substitution	/ʃ/ → [s] (Place Shift / Alveolarization)	215	43%
		Substitution	/ʃ/ → [z] (Voicing / Place Shift)	60	12%
		Correct Realization	—	175	35%
		Deletion	—	50	10%
Medial	500	Substitution	/ʃ/ → [s] (Place Shift / Alveolarization)	150	30%
		Substitution	/ʃ/ → [z] or /ʃ/ → [ʒ] (Voicing)	126	25.2%
		Substitution	/ʃ/ → [k] (Manner / Place Shift)	24	4.8%
		Correct Realization	—	190	38%
		Deletion	—	10	2%
Total	1000	Total Errors	—	635	64%

Table 3 shows that participants' realizations of /ʃ/ across 1,000 tokens had 635 errors (64%). Regular four-substitution patterns are consistent across positions. Initially, /ʃ/ was frequently substituted with [s], as in shell /ʃel/ [sel], and with [z], as in shadow /ʃædəʊ/ [zædəʊ]. Medially, /ʃ/ was often replaced by [s], as in fashion /ˈfæʃən/ [ˈfæsən]. Substitutions with voiced fricatives ([z] or [ʒ]) represent a voicing deviation, as in station /steɪʃən/ [ˈsteɪzən] and pressure /ˈprɛʃər/ [ˈprɛzər]. A minor deviation involved shifting to the velar stop [k], as in ocean /ˈoʊʃən/ [ˈoʊkən], where both place and manner of articulation changed.

Referring to the articulatory-perceptual analysis, the most noticeable deviation was alveolarization (/ʃ/ → [s]), occurring in 365 instances (36.5%). This shows a shift from a palato-alveolar to an alveolar place of articulation. It is a move to a [+strident] sibilant while keeping a fricative manner (Chomsky & Halle, 1968). Unlike the dental fricatives /ð/ and /θ/, which were highly sensitive to word position, the Chi-square test ($p = 0.358$) showed no statistical significance for /ʃ/ error rates. This points out that phonological difficulty with this target is consistent across initial and medial environments and reflects L1 transfer patterns (Al-Wer, 2004, 2019), in which learners substituted the non-native palato-alveolar target with familiar alveolar segments.

4.4. Voiceless Palato-alveolar Affricate /tʃ/

Unlike other sounds, /tʃ/ is not part of the SA phonetic system, though it occurs in some rural Jordanian and Palestinian dialects (Holes, 2004). Table 4 shows /tʃ/ substituted with several realizations such as [ʃ], [k], [t], [s], and [h] word-initially and medially.

Table 4
Frequency and Patterns of Error for /tʃ/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Initial	500	Substitution	/ʧ/ → [ʃ] (Deaffrication/Fricativization)	250	50%
		Substitution	/ʧ/ → [k] (Velarization/Stop Substitution)	100	20%
		Correct Realization	—	150	30%
Medial	500	Substitution	/ʧ/ → [ʃ] (Deaffrication/Fricativization)	167	33.4%
		Substitution	/ʧ/ → [k] (Velarization/Stop Substitution)	67	13.4%
		Substitution	/ʧ/ → [t] or [s] (Alveolarization)	58	11.6%

		Substitution	/ʃ/ → [h] (Glottalization)	25	5%
		Deletion	/ʃ/ → [Ø]	8	1.6%
		Correct Realization	—	175	35%
Total	1000	Total Errors	—	675	68%

Table 4 shows that participants' realizations of /tʃ/ across 1,000 tokens yielded 675 errors (68%). Positional analysis revealed five main substitutions. Initially, /tʃ/ was frequently deaffricated to [ʃ], as in chair /tʃɛər/ [ʃɛər] and chief /tʃiːf/ [ʃiːf]. Medially, deaffrication occurred in teacher /ˈtiːtʃər/ [ˈtiːʃər]. Velarisation to [k] was observed in cheese /tʃiːz/ [kiːz] and kitchen /ˈkɪtʃən/ [ˈkɪkən]. Alveolarisation to [t] or [s] also occurred medially, as in nature /ˈneɪtʃər/ [ˈneɪtər] or [ˈneɪsər]. Minimal instances of glottalisation and deletion [Ø] were observed, as in coach [kəʊ].

The articulatory-perceptual analysis identified deaffrication (/tʃ/ shifting to [ʃ]) as the primary phonological deviation, occurring in 417 instances (41.7%). This reflects articulatory simplification, in which the [-delayed release] stop component is omitted (Katamba & Stonham, 2006). In other words, although /tʃ/ occurs in certain rural Jordanian and Palestinian dialects (Holes, 2004), participants shift to the existing sound [ʃ] in their SA system to ease pronunciation (Al-Deaibes & Rosen, 2022). Similar to /ʃ/, the Chi-square test ($p = 0.30$) showed no statistically significant difference in /tʃ/ error rates. Unlike the dental fricatives, the difficulty of the target is consistent across positions, driven by its complex structure rather than its word environment (Zuraiq & Sereno, 2021).

4.5. Palato-alveolar Affricate /dʒ/

Like /tʃ/, the palato-alveolar affricate /dʒ/ does not exist as a single phoneme in SA, though its component sounds [d] and [ʒ] exist separately (Roach, 2009). Table 5 illustrates three main realizations: [ʒ], [g], and [d] initially and medially.

Table 5
Frequency and Patterns of Error for /dʒ/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Initial	500	Substitution	/dʒ/ → [ʒ] (Deaffrication/Fricativization)	300	60%
		Substitution	/dʒ/ → [g] (Velarization/Stop Substitution)	175	35%
		Correct Realization	—	25	5%
Medial	500	Substitution	/dʒ/ → [ʒ] (Deaffrication/Fricativization)	240	48%
		Substitution	/dʒ/ → [g] (Velarization/Stop Substitution)	160	32%
		Substitution	/dʒ/ → [d] (Stopping/Alveolarization)	94	18.8%
		Correct Realization	—	6	1.2%
Total	1000	Total Errors	—	969	97%

Table 5 shows that participants' realizations of /dʒ/ across 1,000 tokens yielded 969 errors (97%). Analysis across positions revealed three main substitutions. Across positions, the most common realization was deaffrication, reducing the complex affricate to the fricative [ʒ], as in jog /dʒɒg/ [ʒɒg] word initially and in the major /ˈmeɪdʒər/ [ˈmeɪʒər] word medially. Similarly, velarisation was noted, with /dʒ/ substituted by the velar stop [g] initially, shifting both place and manner, as in general /ˈdʒɛnərəl/ [ˈgɛnərəl] and magic /ˈmædʒɪk/ [ˈmægɪk]. Moreover, alveolarisation occurred when the target was replaced by the voiced alveolar stop [d] word medially, as in legend /ˈlɛdʒənd/ [ˈlɛdənd].

The articulatory-perceptual analysis identified deaffrication (/dʒ/ → [ʒ]) as the primary phonological deviation, occurring in 540 instances (54%). As with the voiceless affricate, this is motivated by the loss of the [-delayed release] feature to reduce articulatory effort (Katamba, 1996). That is, participants attempted to avoid the complexity of /dʒ/ by substituting it with a simpler stop or fricative, as found in certain loanwords or regional variants (Al-Deaibes & Rosen, 2022). The Chi-square test (p = 0.52) showed consistency with the other palato-alveolar segments and indicated no statistically significant difference in /dʒ/ error rates. This suggests that the difficulty of voiced affricates is related to their phonetic complexity and is not significantly affected by word position, unlike the dental fricatives (Altakhaineh et al., 2024).

4.6. Voiced Palato-alveolar Fricative /ʒ/

The voiced palato-alveolar fricative /ʒ/ does not exist as a distinct phoneme in SA, presenting a challenge for English learners (Ladefoged & Johnson, 2015). While it occurs as a dialectal variant of '*jeem'* in some Urban Jordanian and Palestinian dialects (Al-Wer, 2019; Holes, 2004), its absence in the formal SA phonetic system can lead to phonological interference. Table 6 presents these substitutions: [ʃ], [z], [s], and [g] medially and finally, as /ʒ/ is rarely found initially in English.

Table 6

Frequency and Patterns of Error for /ʒ/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Medial	500	Substitution	/ʒ/ → [ʃ] (Devoicing)	100	20%
		Substitution	/ʒ/ → [s] (Alveolarization + Devoicing)	72	14.4%
		Substitution	/ʒ/ → [z] (Alveolarization)	39	7.8%
		Correct Realization	—	290	58%
Final	500	Substitution	/ʒ/ → [ʃ] (Devoicing)	6	1.2%
		Substitution	/ʒ/ → [g] (Velarization/Stopping)	4	1 %
		Correct Realization	—	490	98%
Total	1000	Total Errors	—	221	22.1%

Table 6 shows that participants' realizations of /ʒ/ across 1,000 tokens yielded 221 errors (22.1%). Across positions, the most frequent pattern was devoicing (/ʒ/ shift to [ʃ]), as in *measure* [ˈmɛʃər] medially and *prestige* [ˈprestiːʃ] finally. Other medial substitutions included alveolarization with devoicing (/ʒ/ → [s]) in vision [ˈvɪsən], and alveolarization (/ʒ/ → [z]) in leisure [ˈlɛzər]. An infrequent final deviation was velarization (/ʒ/ → [g]) as in garage [gəˈrɑːg]. Remarkably, final-position accuracy (98%) was significantly higher than medial accuracy (58%).

The articulatory-perceptual analysis identified devoicing (106 instances, 10.6%) as the primary deviation, although it is a minimal shift since both sounds share place and manner. However, substitutions with [s] and [z] indicate a shift to a [+strident] alveolar place. The Chi-square test ($p < 0.0001$) confirmed that error rates were highly significantly influenced by word position. This suggests that /ʒ/ poses moderate difficulty yet is easier than other palato-alveolars due to the frequency of loanwords in the L1 (Al-Wer, 2019; Holes, 2004). The medial confusion with [ʃ] or [s] is driven by the absence of /ʒ/ in SA. This aligns with Flege's (1995) Speech Learning Model, which suggests that L2 learners often substitute new phonemes with the closest available equivalents from their L1 system. This also matches the inter-vocalic devoicing phenomenon, where learners prefer familiar voiceless equivalents to reduce articulatory effort (Knight, 2013).

7. Velar Nasal /ŋ/

Table 7 presents three main realizations for /ŋ/: [ŋg], [ŋk], and [nʒ], occurring medially and finally.

Table 7
Frequency and Patterns of Error for / ŋ/

Position	Total Tokens	Error Type	Alternative Realization (Substitution)	Frequency (Count)	Percentage (%)
Medial	500	Substitution (Nasal epenthesis)	/ŋ/ → [ŋg] (Addition of Voiced Stop)	175	35%
		Substitution (Nasal epenthesis)	/ŋ/ → [ŋk] (Addition of Voiceless Stop)	70	14%
		Substitution (Nasal epenthesis)	/ŋ/ → [ŋʒ] (Addition of Fricative)	35	7%
		Correct Realization	—	220	44%
Final	500	Substitution (Nasal epenthesis)	/ŋ/ → [ŋg] (Addition of Voiced Stop)	250	50%
		Substitution (Nasal epenthesis)	/ŋ/ → [ŋk] (Addition of Voiceless Stop)	165	33%
		Correct Realization	—	85	17%
Total	1000	Total Errors	—	695	69.5%

Table 7 shows that participants' realizations of /ŋ/ across 1,000 tokens yielded 695 errors (69.5%). Analysis revealed that the most common error was the addition of a voiced velar stop (/ŋ/ → [ŋg]), occurring medially in words like hungry /ˈhʌŋgri/ [ˈhʌŋgri] and angry /ˈæŋgri/ [ˈæŋgri], and finally in king /kɪŋ/ [kɪŋg]. The second pattern was the addition of a voiceless velar stop (/ŋ/ → [ŋk]), occurring finally in long /lɒŋ/ [lɒŋk]. The correct realizations were higher medially (44%) than finally (17%).

The articulatory-perceptual analysis showed that the main phonological deviation was the addition of the voiced velar stop [g] (425 instances, 42.5%). Since /ŋ/ does not exist as a distinct phoneme in SA, learners often experience orthographic interference. The Chi-square test ($p < 0.0001$) confirmed that participants struggled significantly more with /ŋ/ in the final position. This prompts learners to pronounce the written letter <g> in words such as hungry or king to satisfy L1 constraints, which require a stop to follow a [+nasal] segment in clusters (Al-Deaibes & Rosen, 2022). By doing so, learners substitute the unfamiliar velar nasal with more familiar (nasal + stop) sequences in their phonetic system.

A comparative evaluation of the affricates shows that voicing increases the total number of errors for the voiced /dʒ/ (97%). This suggests that the voicing feature poses a challenge for learners. Compared with their voiceless counterparts, voicing is not the primary trigger for mistakes. The main difficulty with the affricates is deaffrication, occurring in 41.7% of instances for /tʃ/ and 54% for /dʒ/. These statistically similar rates indicate that learners struggle with the complex [-delayed release] form of the affricate rather than with voicing itself. That is, learners drop the 'stop' part of the target sound to make pronunciation easier, regardless of whether it is voiced or voiceless.

Comparing initial and final positions, the statistical analysis shows that learners handle two consonant groups in two distinct ways, unlike the palato-alveolars. The dental fricatives (/θ, ð/) and the velar nasal (/ŋ/) are sensitive to position differences ($p < 0.001$). That is, the final position consistently poses the greatest challenge. This occurs because these sounds lack a vowel to support the articulatory transition, making them harder to produce. In contrast to the palato-alveolar group (/ʃ, tʃ, dʒ/), there is no statistically significant change between positions ($p > 0.05$), yet their error rate remains very high regardless of where they appear in a word. This indicates that while difficulties with dental sounds derive from word position, those with palato-alveolars stem from their complex articulatory structure. Overall, for Jordanian learners, these target sounds remain a structural hurdle, unaffected by changes in word position.

5. Discussion

The main goal of this study is to examine how Jordanian EFL learners produce seven English consonants (/dʒ, tʃ, θ, ð, ʃ, ʒ, ŋ/) and to identify systematic phonological deviations across word positions. More specifically, this study aims to determine how L1 transfer, articulatory complexity, and orthographic interference shape the interlanguage system of Jordanian university students. In response to research question 1, the findings reveal a clear hierarchy of phonological complexity, with the voiced affricate /dʒ/ the most problematic (97% error rate), followed by the dental fricatives and the velar nasal. These difficulties indicate a clear ranking, in which some sounds are much harder than others. Thus, these mistakes do not occur randomly but follow predictable, regular rules and patterns. The gap between /dʒ/ and /tʃ/ suggests that articulatory difficulty is probably linked to sociolinguistic pressure. That is, Fowler Al-Hawamdeh (2019) clarifies that /dʒ/ is an identity instability marker, in which speakers shift between [g], [j], and [ʒ] in local dialects. Consequently, the 97% error rate is not a simple phonetic failure but a social signal, in which learners favour a prestigious Ammani urban identity over standard English to ensure social integration.

Regarding research question 2, Markedness theory explains the high frequency of deaffrication (/dʒ/ → [ʒ]; /tʃ/ → [ʃ]) and stopping (/ð/ → [d]) among Jordanian learners. Affricates are highly marked due to their complex [-delayed release] structure (Chomsky & Halle, 1968). Hence, learners across languages attempt to simplify them by shifting to a more common, simpler phonological form, or an unmarked equivalent, such as dropping the /d/ part (Eckman, 2008). This study shows that deaffrication occurs at similar rates for both voiced and voiceless affricates. Thus, deaffrication appears to be a universal simplification rather than L1 transfer used to reduce articulatory effort. Similarly, the shift from /ŋ/ to [ŋg] in word-final positions reflects learners' tendency to simplify the syllable coda. This 'nasal epenthesis' (adding the [g]) is not a mere mistake but a universal strategy used as articulatory support to produce the sound clearly when a following vowel is absent. Fowler Al-Hawamdeh (2019), however, argues that errors involving these sounds are triggered by identity-driven substitution rather than by markedness. That is, the choice to simplify /dʒ/ to [ʒ] is a sociolinguistic preference in the Jordanian context, adopted to embrace a prestigious, urban Ammani identity while meeting universal articulation requirements.

Regarding sociophonetic identity, Al-Wer (2004, 2019) describes Jordanian phonology as dynamic, with sibilant substitutions highlighting dialectal prestige rather than mere defaults. For example, replacing interdental fricatives with sibilants, such as [z] for /ð/ and [s] for /θ/, is a feature of (UPA) speech, signalling speakers' urban modernity. Likewise, /dʒ/ realised as [g] reflects a common dialectal variation in the region. Hence, Jordanian EFL learners may prioritise certain alveolar or velar substitutes over Standard English sounds to signal sociolinguistic identity and prestige. This suggests that the 97% error rate for /dʒ/ is a socially driven deviation. Suleiman (2004) argues that linguistic performance among Levantine speakers is an identity marker. In this view, Jordanian learners adopt the [ʒ] variant as a marker of an Ammani urban identity, emphasising their prestigious, modern identity over the phonetic accuracy of English.

The pedagogical implications of these findings for the Jordanian EFL classroom are significant. Instructors should focus on producing affricates rather than on repetitive pronunciation drills. Since dental fricative substitutions are often linked to sociolinguistic identity, instructors should prioritise functional intelligibility over native-like pronunciation and adopt 'sociopragmatic awareness' in the classroom. This involves recognising that while [ʒ] is socially prestigious in Amman, /dʒ/ is the standard target in English. Hence, students should be encouraged to shift between both identities. Additionally, since certain sounds, such as palato-alveolars, are highly sensitive to position, curriculum designers should address positional difficulties.

The study recommends that future research should explore the influence of gender and educational levels on L2 production. Specifically, more studies should investigate whether female learners in urban centres prefer different substitutions to those in rural areas. While this study concentrated on consonants, a detailed analysis of other challenging consonants, vowel shifts, and diphthong realizations would offer a more comprehensive view of the Jordanian interlanguage system.

Furthermore, comparative studies between Jordanian EFL university learners and other Arab learners should be carried out to examine how different nationalities and dialects substitute consonants in various word positions.

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Data Availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Declaration

All procedures performed in studies involving human participants were in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Furthermore, informed consent was obtained and signed from all Jordanian students who participated in the study.

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Appendix 1

Word-List

Consonant: /ð/

- Initial: that, this, then, they, their, them, though, thus, those, these
- Medial: mother, other, father, brother, another, weather, leather, rather, bother, together
- Final: bathe, smooth, breathe, clothe, soothe, loathe, seethe, tithe, lathe, wreathe

Consonant: /θ/

- Initial: thank, thick, think, thin, thought, thorn, theme, thigh, thirty, theft
- Medial: nothing, wealthy, birthday, method, author, healthy, lethal, athlete, anthem, ethical
- Final: bath, mouth, teeth, cloth, myth, path, heath, growth, wreath, filth

Consonant: /ʃ/

- Initial: shell, shadow, she, shoe, show, shout, shock, shine, ship, shape
- Medial: fashion, ocean, station, pressure, usher, tissue, fissure, mission, cushion, bishop
- Final: fish, cash, push, brush, dish, wish, ash, lash, rush, wash

Consonant: /tʃ/

- Initial: chair, chief, cheese, child, choice, cheap, chicken, church, chop, chain
- Medial: teacher, kitchen, nature, picture, future, lecture, culture, reaches, matches, touches
- Final: match, catch, watch, beach, speech, lunch, rich, teach, switch, pitch

Consonant: /dʒ/

- Initial: jog, general, job, jump, juice, joke, giant, giraffe, jacket, jam
- Medial: major, magic, legend, region, agent, budget, gadget, rigid, fragile, ginger
- Final: judge, bridge, age, page, cage, stage, edge, lodge, huge, ridge

Consonant: /ʒ/

- Medial: measure, vision, leisure, pleasure, treasure, usual, casual, seizure, closure, exposure
- Final: prestige, garage, beige, rouge, barrage, massage, montage, deluge, triage, collage

Consonant: /ŋ/

- Medial: hungry, angry, finger, hunger, jungle, single, longer, stronger, younger, mongrel
- Final: king, long, something, sing, ring, wing, song, young, wrong, hung

Distractor Words:

- apple, table, street, window, market, paper, garden, pencil, yellow, bottle, summer, flower, doctor, coffee, silver, rabbit, winter, blanket, basket, pepper