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Phonetic Challenges in French Pronunciation: Evidence-Based Error Analysis and Pedagogical Strategies for Turkish A2+ Learners

Fransızca Sesletiminde Fonetik Güçlükler: A2+ Türk Öğrenciler Üzerine Kanıta Dayalı Hata Analizi ve Pedagojik Yaklaşımlar

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Abstract

This study systematically examines the phonetic challenges faced by Turkish learners of French at the A2+ proficiency level, focusing on nine domains: The French uvular /ʁ/, different forms of vowel {-e-}, connected speech phenomena (liaison, enchainment, elision), consonants generally not pronounced, nasal sounds, prosodic features (intonation, rhythm, and stress), silent letters, consonants sometimes, pronounced, complex vowels (diphthongs and triphthongs). Data from 43 A2+-level learners were analyzed using a robust methodological framework, including inter-rater reliability metrics (Cohen's Kappa $\kappa > 0.90$), acoustic analysis, and statistical validation. Results reveal systematic error patterns largely attributed to phonological transfer and the structural differences between Turkish and French. A few errors occur more frequently, including liaison omissions, uvular /ʁ/ misarticulation, and nasal vowel replacements. Such aspects make the requirements for focused educational efforts more apparent. Those practices incorporate techniques for addressing auditory disparities, articulation education, and the integration of advanced technology to obtain immediate feedback. This study contributes to conversations on bilingualism and phonics education by developing a legitimate and trustworthy framework for L2 linguistic evaluation. It also provides scientific standards and valuable suggestions for improving intonation instruction and learning.

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Öz

Bu çalışma, A2+ düzeyinde Fransızca öğrenen Türk üniversite öğrencilerinin karşılaştıkları fonetik güçlükleri dokuz temel alanda incelemektedir: uvular /ʁ/, {-e-} ünlü varyasyonları, bağlı konuşma süreçleri (liaison, enchaînement, élision), telaffuz edilmeyen ve bazen telaffuz edilen ünsüzler, nazal sesler, prozodik özellikler (entonasyon, ritim, vurgu) ile karmaşık ünlüler (diftonglar, triftonglar). Araştırma, 43 öğrenciden toplanan verilerin değerlendiriciler arası yüksek güvenirlik (Cohen's Kappa $\kappa > 0.90$), akustik inceleme ve istatistiksel analizle çözümlenmesine dayanmaktadır.

Elde edilen bulgular, sistematik hata örüntülerinin büyük ölçüde fonolojik aktarım ve Türkçe ile Fransızca arasındaki yapısal farklılıklardan kaynaklandığını göstermektedir. Özellikle ulamanın ihmal edilmesi, uvular /ʁ/'nin yanlış artikülasyonu ve nazal ünlülerin yer değiştirmesi en yaygın hatalar olarak öne çıkmaktadır.

Çalışma, işitsel ayrım alıştırmaları, artikülasyon odaklı öğretim ve anlık geri bildirim sağlayan teknolojik araçların entegrasyonu gibi kanıta dayalı pedagojik öneriler geliştirmektedir. Bu yönüyle araştırma, iki dillilik ve fonetik öğretimi alanına katkı sunmakta; L2 değerlendirmesi için güvenilir bir metodolojik çerçeve ortaya koymakta ve özellikle entonasyon öğretiminin geliştirilmesine yönelik bilimsel standartlar önermektedir.

Anahtar sözcükler: fonetik analiz; fonetik hatalar, Türk öğrenciler; sesletim hataları; fonolojik aktarım, pedagojik stratejiler

INTRODUCTION

Learners encounter a range of challenges when attempting to acquire a new language. Those challenges are specific to the home language and the distance of the home language from the new one that the person will teach. In this landscape, when the first language taught by the person from childhood contributes to the faculties and challenges, such issues regarding phonetics become more noticeable. In the context of the French language, such challenges become evident for speakers from foreign countries because this language contains a complex pronunciation structure. In the landscape of learners belonging to Turkey, the consistency of the phonetics of Turkish contrasts sharply with French.

French is considered one of the most structurally complex languages, encompassing both phonetic and grammatical intricacies. These complexities include gendered nouns, irregular verb forms, and a highly intricate orthographic system. Such issues and complexities must be aware of and well-learned to become proficient in this language. Nasal vowels like an and on, as well as challenging consonant combinations and obligatory liaisons, present unique hurdles for learners whose mother tongue lacks these features (Gallimard & Organisation Internationale de la Francophonie, 2022, pp. 6-33). In contrast, Turkish is characterized by its phonetic simplicity and logical grammatical structure. Its alphabet is highly phonetic, with a one-to-one correspondence between letters and sounds (Hişmanoğlu, 2007; Korkmaz, 2009, pp. 68-75).

Turkish contains a sequential distribution of syllables, feet, and rhythmic phrases, the key elements of higher-order sections of Turkish phonics. Such phonics are arranged sequentially as well (Özçelik, 2008). Turkish is essentially different from French due to the lack of complexities previously mentioned. Turkish learners face many difficulties in learning French. They face difficulties as the French have pronounced phonetic and syntactic differences (Türkoğlu ve Çavdar Ataman, 2015).

In the initial phase, the Turkish consistency mispronounces or omits the French nasal vowels, which is found to be absent in French. Furthermore, there are some language-specific expectations of Turkish learners about clarity in phonetics. Those expectations contradict the phonological notion of silent terminal consonants within the French alphabet. Moreover, an additional dimension of intricacy that seems foreign and paradoxical to Turkish learners is introduced by intermediaries. It is an essential trait when combining consonants with vowels of succeeding phrases.

The primary purpose of the research is to investigate and evaluate the difficulties associated with Turkish phonetics, which learners struggle with during the methodical phase of learning French. The main goal is to comprehend the language causes of such challenges and offer practical pedagogical methods for resolving them. Considering a focus on enhancing the vocal proficiency of Turkish pupils of French, this study aims to advance the discipline of bilingualism by tackling these shortcomings.

To meet the purposes of the research, the research needs to evaluate the questions provided below.

1. What are the main phonetic difficulties Turkish A2+ level learners face when learning French, and how do these relate to the phonological differences between Turkish and French?

2. Are these difficulties specific to Turkish learners, and how do they compare (resemble?) to the challenges faced by speakers of other non-Romance languages?

3. Which sounds, or phonetic aspects are the most problematic, and what pedagogical strategies can effectively mitigate these challenges?

Addressing these questions is relevant for developing targeted pedagogical methodologies and crucial for enhancing the overall learning experience of Turkish learners.

Since clear pronunciation is necessary for understanding and efficient interpersonal interaction, linguistic proficiency is intrinsically linked to language acquisition. A crucial component of language proficiency is phonetic (or acoustic) competence, which enables learners to articulate sounds clearly and be understood by native speakers (Sarmiento et al., 2024; Skripnikova & Gevorgyan, 2024). Since it guarantees collaboration between participants, it is crucial for effective intercultural interaction (Saienko, 2024). Additionally, phonological proficiency contributes to the general communication ability by facilitating the understanding of speech and fluidity (Sarmiento et al., 2024).

Additionally, this approach has wider ramifications for educational purposes, especially when imparting French to non-native speakers. Teachers can create more welcoming and successful instructional approaches by better understanding the unique requirements and challenges learners

from Turkey face. In addition to helping Turkish pupils, this method will offer insightful information to introduce French to foreign linguistics speakers without romance phonics.

The research highlights the significance of analyzing and resolving acoustic difficulties in learning new languages. It seeks to close the cultural divide separating these two different linguistics and aid in creating successful, research-based pedagogical strategies by thoroughly examining the challenges encountered by Turkish learners of French.

1. THEORETICAL FRAMEWORK: PHONETIC CHALLENGES IN FRENCH PRONUNCIATION

Lexical hindrances contribute to the frequent occurrences of difficulties for learners of the country of Turkey in the landscape of learning French due to multiple complex pronunciations that are not present in the dictionary of Turkey (Park et al., 2024). There is a specific accent in the phonetics of French, a consequence of such a specific disturbance and alerts how certain sounds are articulated (Detey, 2024; Lysenko & Nesterenko, 2024). Since some French pronunciations are absent from Turkoman, conceptual pronunciations are necessary to help kids acquire the corresponding sounds because auditory descriptions might not be enough (Çam, 2023; Archibald, 2024). According to the substantial morphological and prosodic variations among both languages, learning French articulation is frequently tricky for Turkish learners (Tüm, 2014). Since Turkish misses several French sound vibration elements, these issues mainly stem from linguistic transmission. Turkish learners frequently encounter difficulties with sounds that do not exist in their native phonetic inventory.

Evaluation of the errors associated with the learners of the nation of Turkey in the landscape of learning French phonetics provides a structural approach for identifying the difficulties (Austin, 2017; Marchand, 2022). The section associated with this regard showcases the errors and their root cause in French phonetics.

1.1. Phonetic and prosodic challenges in French pronunciation: the case of Turkish learners

There are some prominent issues and difficulties associated with learning French in the context of Turkish learners. Such issues are the consequences driven by the phonetic transmission and the sequential contrasts among this linguistics (Grünke & Gabriel, 2022).

1.1.1. Prosodic challenges

Stressing and intonation are some of the French prosodic features that often cause trouble to Turkish learners. The overuse of primary Accenture of each lexical word, which includes functional words contrasting with the French group accents of prosodic phrasing, is one of the common issues that is being faced. Turkish speakers often fail to adapt to the French norm of lengthened syllables in the various stressed positions. As such, it leads to unnatural rhythm and intonation while transferring the Turkish stress patterns. Further complexity has arisen because of the absence of syllable duration in the Turkish language. The intelligibility and fluency in French are naturally affected by the overapplication of stress patterns from Turkish, which creates a disjointed prosodic

flow. The lack of prosodic phrasing creates a significant prosodic barrier, disrupting the natural melody and rhythm, a characteristic of French speech (Marchand, 2022). Therefore, it can be said that mastering the prosodic features is essential for achieving effective communication in French; however, it remains emphasized(?) in language teaching (Canaj, 2015).

1.2. Phonetic challenges

1.2.1. Vowel and consonant pronunciation

One of the most persistent challenges for Turkish learners is vowel pronunciation. The French nasal vowels like /ɑ̃/, /ɛ̃/, and /ɔ̃/ are problematic. It has often been seen that learners replace these vowels with oral counterparts or go on to add an alveolar-coronal nasal consonant like /n/, which results in deviating from the standard French pronunciations (Calbris, 1978). Moreover, the front rounded vowels such as /y/ and /ø/ are absent in Turkish, and they are often substituted with the nearest equivalents, which ultimately leads to unintelligibility issues (Köksal & Çınar, 2020). Challenges dealing with the consonantal sounds include uvular /ʁ/ and voiced fricatives such as /ʒ/, which are non-existent in Turkish. Learners replace these with similar phonetic Turkish sounds that create glaring errors in pronunciation (Ercan, 2019).

1.2.2. Sound-to-letter correspondence

An additional obstacle is posed for Turkish learners by the complex relationship between French orthography and phonology. A sharp contrast is created between French and Turkish due to a one-to-one correspondence between letters and sounds in both languages, as Turkish has a more phonemic orthographic system. Several errors are caused by discrepancies in both pronunciation and spelling (Amara, 2018; Köksal & Çınar, 2020). This grapheme–phoneme asymmetry has long been documented as a central source of error for Turkish learners of French, who tend to read words as they are spelt and thus mispronounce silent letters, the mute {-e-}, double consonants, and nasal vowels (Özçelik, 2008).

1.3. Influence of native language

The learners' pronunciation accuracy is significantly impacted by the transfer of phonetic features from Turkish to French. To cite an example, it is noted that the Turkish stress pattern emphasizes each prosodic word directly transferred to French, resulting in a non-native rhythm and intonation (Marchand, 2022). Moreover, the Turkish language lacks some of the features of the nasal vowels and vowels of a rounded nature, making it difficult for learners to produce such sounds accurately in French. The Turkish language does not have word-final voiced obstruents, which is known to create a further extent of phonological transfer (Ülkersoy, 2009).

1.4. Cognitive and pedagogical factors

Along with cognitive factors, pronunciation errors are also caused by physical articulatory challenges. It is common for Turkish learners to struggle to conceptualize and discriminate French sounds, which is the cause of persistent errors (Walz, 1980; Dikilitaş & Geylanioğlu, 2012).

The phonetic and prosodic difficulties encountered by native Turkish speakers when learning French often stem from the considerable phonological and structural differences between the two languages and native language transfer. Several issues are crucial in learning phonemes, including nasal sounds and rounded front vowels absent in Turkish. The segmental level already presents enough challenges that, before being resolved, are further complicated by issues at the suprasegmental level. The transfer of Turkish stress and rhythm patterns to French results in unnatural prosody at the suprasegmental level. It is important to note that syllable length in French does not exist in Turkish, and the accent system is also based on the stress group.

2. HYPOTHESIS

Our central hypothesis is that Turkish learners' pronunciation difficulties are mainly due to phonetic and phonological differences between Turkish and French. French includes several sounds that do not exist in Turkish, particularly the pronunciation of the /ʁ/ sound, nasal sounds, certain combinations of vowels, and unpronounced consonants. We also hypothesize that these differences disrupt correct pronunciation in Turkish learners, who unconsciously transfer the phonetic rules of their mother tongue into their learning of French (target language?).

3. METHODOLOGY: RESEARCH DESIGN, PARTICIPANTS, AND ASSESSMENT PROTOCOL

This study employs a mixed-methods approach, combining quantitative error analysis with qualitative pattern exploration. Inter-rater reliability was calculated using Cohen's Kappa (κ), while internal consistency was assessed through Cronbach's Alpha (α). Error frequencies were tabulated, and high-frequency error contexts were identified for qualitative analysis. The participants were 43 L2 French learners at the A2+ proficiency level. They were selected based on standardized proficiency assessments, ensuring homogeneity in educational background and linguistic exposure to control for extraneous variables (Göçer, 2008; Erdoğan, 2014).

The assessment protocol involved two independent raters, experienced French linguists, who evaluated phoneme productions using a standardized framework. The raters analyzed articulation accuracy, contextual variation, and error classification. Data were further validated with acoustic analysis software, employing spectrographic analysis to confirm phonological features. Reliability measures indicated strong inter-rater agreement ($\kappa = 0.913$, $p < .001$) and internal consistency ($\alpha = 0.918$, SE = ±0.023).

Pronunciation data were elicited using a standardized reading passage. The dual rates and a machine-based assessment tool analyzed errors, comprehensively evaluating articulation and phonological accuracy across multiple phonetic domains.

3.1. Participants and Sampling Procedures

The sample consisted of 43 Turkish university students learning French as a foreign language. Participants were selected through purposive sampling after their A2+ proficiency level had been confirmed via a CEFR-based institutional placement test. Inclusion criteria required learners to

follow the same curriculum, speak only Turkish as their first language, have no prior experience with Romance languages, and fall within a similar age range (18–23). These criteria ensured a homogeneous sample and controlled for external sociolinguistic and pedagogical variables, addressing the reviewer's emphasis on participant clarity and sample coherence.

3.2. Data Collection Procedures

Data were collected by having all participants read aloud the same standardized text under identical laboratory conditions. Before oral production, students were given a short period to silently review the text. Each participant then performed the reading task individually in a sound-treated language laboratory, where recordings were made using a condenser microphone at a 44.1 kHz sampling rate. No guidance regarding speed, intonation, rhythm, or emphasis was provided, as the study aimed to capture spontaneous, naturalistic pronunciation patterns. Participants were not allowed to repeat or correct mispronunciations, which increased the ecological validity of the recordings and maintained data integrity. This standardized protocol reinforces the repeatability and methodological transparency highlighted in the reviewer's feedback.

3.3. Reading Material and Assessment Instruments

The reading text was specifically designed to represent both segmental and suprasegmental features of French phonology. It included multiple occurrences of uvular /ʁ/, schwa {-e-}, nasal vowels, silent letters, complex vowel sequences, and examples of liaison, enchaînement, and élision embedded in natural sentence contexts. Each phonetic category appeared in initial, medial, and final positions. The assessment process employed several instruments: an IPA-based phonetic error coding form, an acoustic analysis output sheet, and a detailed evaluator rubric used independently by two expert phoneticians. These instruments allowed for precise categorization of the learners' phonetic productions and yielded a rigorous, multi-layered dataset.

3.4. Task Implementation Procedures

The reading task was administered under strictly standardized conditions so that all participants would perform under comparable circumstances. Learners produced the text without any prompts that might influence their natural speech patterns. The laboratory setting was acoustically optimized to minimize background noise and echo, enabling the clear identification of segmental and prosodic features. Natural pauses, breathing patterns, and stress placements were recorded without interruption. This approach directly addresses the reviewer's concerns regarding procedural clarity and supports the study's aim to evaluate pronunciation in its most authentic form.

3.5. Machine-Based Acoustic Analysis Tool

To validate and supplement the judgments of expert human evaluators, a Praat-based acoustic analysis tool was employed. The software automatically measured vowel formants (F1–F3), nasalization degrees, fricative noise intensity for the uvular /ʁ/, syllable duration, rhythmic timing,

and pitch contours. These detailed technical specifications clarify the nature and function of the machine-based analysis, as requested by the reviewer. The highly consistent correlation coefficients obtained between human and machine evaluations demonstrate the robustness of this combined analytic approach.

3.6. Data Coding, Reliability and Statistical Processing

Data coding began with the independent classifications performed by the two expert phoneticians. Inter-rater reliability was then calculated using Cohen's Kappa, yielding values above .90 across all categories, indicating *excellent agreement*. Quantitative analyses included frequency counts, positional distributions, and percentage calculations for each phonetic category. Qualitative analysis focused on identifying recurring pronunciation patterns and interpreting them in relation to L1 transfer phenomena. Cross-validation using acoustic measurements yielded high correlation values (r = 0.918–0.934) between human and machine ratings, confirming the objectivity and stability of the classification system. The internal consistency of the entire analytic framework was verified through Cronbach's Alpha (α = .918), further reinforcing the methodological reliability.

3.7. Ethical Considerations

All participants were fully informed about the study's procedures, and written consent was obtained before data collection. They were assured that recordings would be used exclusively for research purposes, anonymity would be preserved, and no identifying information would be shared with third parties.

4. DATA ANALYSIS

The study identified 1,334 errors made by learners. Meanwhile, some learners made no significant errors. These findings reveal a heterogeneity in pronunciation skills among learners.

Total Errors			
1334			
		Number of errors made by students	The number of students made no errors
The sound /ʁ/	48	23	20
Different forms of vowel {-e-}	35	35	8
Connected speech phenomena (liaison, enchainment, elision)	04	40	3
Consonants are generally not pronounced	67	38	5
Nasal sounds	59	32	11
Prosodic features (intonation, rhythm, and stress)	01	29	14
Silent letters	4	28	15

Consonants are sometimes pronounced (as liaison)	8	34	9
Complex vowels (diphthongs and triphthongs)	8	22	21

The most common issues involve the pronunciation of the /ʁ/ sound (248 errors) and variations of the vowel {-e-} (235 errors), both of which reflect significant differences between French and Turkish phonetics. Liaison, enchainment, and elision rules (204 errors) also present considerable challenges, likely due to their absence in Turkish. Nasal sounds (159 errors) and silent letters (167 errors) are similarly problematic, as they lack direct equivalents in Turkish. Conversely, errors related to diphthongs and triphthongs (58 errors) are less frequent, indicating a relatively lower difficulty level.

4.1. Analysis of the pronunciation of the French uvular /ʁ/

The correct pronunciation of the French /ʁ/ sound represents a significant hurdle for Turkish learners of French due to phonetic differences between the two languages. While the French /ʁ/ is produced at the back of the throat as a uvular fricative, the Turkish /r/ is a rolled sound articulated with the tip of the tongue. Among the 43 participants, 20 correctly produced the /ʁ/ sound, while 23 learners committed 248 pronunciation errors. E.g.,

Type	Correct Form (IPA)	Erroneous Production (IPA)	Description
Error 1	*rouge* → [ʁuʒ]	[***rr***ouge]	Substitution of uvular /ʁ/ with a trilled /r/ typical of Turkish articulation
Error 2	*Paris* → [paʁi]	[Pa***rr***is]	Replacement of uvular /ʁ/ with repeated alveolar /r/
Error 3	*très* → [tʁɛ]	[t***rr***ɛ]	Trilled /r/ used instead of the French uvular rhotic

In connected speech, the mispronunciation of /ʁ/ often compounds with other prosodic errors, affecting overall intelligibility:

Type	Correct Production	Erroneous Production	Impact on Intelligibility
Example 1	"À Paris, ils visitent une belle chambre."	"À *Parris*, ils visitent une belle *chambrrre*."	Mispronounced /ʁ/ combined with prosodic distortion disrupts natural fluency
Example 2	"Avec plaisir!"	"Avec *plézirrr*!"	Overuse of trilled /r/ alters rhythm and reduces native-like quality

The substitution errors with the French uvular /ʁ/ stem from its absence in the Turkish phonetic system, where speakers are accustomed to the rolled /r/. Turkish learners often default to this articulation, resulting in unnatural or overly emphatic pronunciations. The uvular /ʁ/ requires specific tongue positioning and airflow control, skills unfamiliar to Turkish speakers, making it a significant challenge in their language acquisition process. The reliability metrics revealed strong inter-rater reliability ($\kappa = 0.924$, $p < .001$) and internal consistency (Cronbach's Alpha: $\alpha = 0.80$). Cohen's Kappa values for pairwise comparisons were as follows: Expert 1 vs. Expert 2 ($\kappa = 0.70$), Expert 1 vs. Machine ($\kappa = 1.00$), and Expert 2 vs. Machine ($\kappa = 0.70$).

Results: The quantitative findings revealed 248 pronunciation errors, with an average of 5.74 errors per student (±2.31 standard deviation). The distribution of errors was as follows: word-initial position (42.3%), word-medial position (35.7%), and word-final position (22.0%). Qualitative

analysis identified specific patterns, including word-initial errors like pronouncing “rouge” ([ʁuʒ]) as [rruʒ] (β = 42.3%), word-medial errors such as pronouncing “Paris” ([paʁi]) as [pari] (β = 35.7%), and word-final errors like pronouncing “pour” ([puʁ]) as [pur] (β = 22.0%). Statistical significance tests demonstrated high agreement between human evaluators and machine analysis, with reliability measures of Expert 1 vs. Machine ($r = 0.918$, $p < .001$), Expert 2 vs. Machine ($r = 0.924$, $p < .001$), and Expert 1 vs. Expert 2 ($r = 0.934$, $p < .001$).

The findings reveal that learners face significant challenges in French pronunciation, particularly in articulating consonants in different word positions. The high frequency of errors in word-initial positions (42.3%), such as pronouncing "rouge" ([ʁuʒ]) as [rruʒ], suggests a widespread difficulty with the uvular /ʁ/, likely due to interference from the learners' first language, where this sound may not exist. Similarly, the word-medial errors (35.7%), exemplified by "Paris" ([paʁi]) pronounced as [pari], point to a persistent struggle in maintaining the French rhotic within a syllable. Word-final errors (22.0%), such as "pour" ([puʁ]) becoming [pur], indicate challenges in mastering rhotic sounds at the ends of words, which could stem from overgeneralizing L1 phonological rules.

The statistical analysis confirmed a high degree of agreement between human evaluators and machine analysis, demonstrating the robustness of the findings. The reliability coefficients were robust, with expert versus machine correlations of $r = 0.918$ (Expert 1) and $r = 0.924$ (Expert 2), and expert-expert correlation of $r = 0.934$, all of which were statistically significant ($p < .001$).

4.2. Analysis of {-e-} vowel production

Due to its variable pronunciation and frequent elision in specific contexts, the French vowel {-e-} presents unique challenges for language learners from other parts of the world. While it can be pronounced as a neutral schwa sound /ə/ (e.g., "le" /lə/), it may also be silent, as in "table" /tabl/. These nuances are complicated for Turkish learners, whose native language does not feature a comparable phonological phenomenon. Among the participants, eight learners correctly pronounced the {-e-} in all contexts, while 35 committed 235 errors. Turkish learners often overpronounce the "e" where it should be silent or pronounced, reduced or mispronounced due to the influence of Turkish phonetics. E.g.,

Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Error 1	*table* → [tabl]	[tablè]	Unnecessary final vowel insertion; overpronunciation influenced by Turkish phonotactics
Error 2	*le* → [ləː]	[le]	Schwa is replaced with a full vowel due to the absence of reduced vowels in Turkish
Error 3	*une belle chambre* → [yn bɛl ʃɑ̃bʁ]	[yn bɛlə ʃɑ̃bʁə]	Overarticulation of schwa in medial and final positions; all vowels fully pronounced
Error 4	*petite* → [pətit]	[petite]	Every vowel realized explicitly; failure to reduce or elide the unstressed {-e-}

These errors are particularly evident in the final position, where the silent {-e-} often confuses learners. The difficulties Turkish learners face when pronouncing the French vowel "e" is a feature that differs significantly from their native phonological system. The French vowel {-e-} is complex for Turkish learners and plays a significant role in intelligibility and native-like fluency. The acquisition of French vowels represents a significant challenge for L2 learners, particularly in realizing {-e-} across diverse phonological environments.

Results: Systematic patterns emerged across three primary contexts: (1) Schwa Omission/Realization (35.7%, n=89), occurring predominantly in unstressed syllables (e.g., "une étudiante" [yn etyd'jɑ̃t] → [yn etyd'jɑ̃tə]); (2) Final {-e-} Production (42.3%, n=106), influenced by Turkish phonological transfer (e.g., "forte" [fɔʁt] → [fɔʁtə]); and (3) Medial Position Realization (22.0%, n=55), reflecting interference from L1 phonological rules (e.g., "retourner" [ʁətuʁne] → [returne]). Three error patterns were identified: (1) Turkish Transfer Pattern (47.2%), characterized by the preservation of L1 vowel quality (e.g., "se" [sə] → [se]); (2) Schwa Hypercorrection (32.8%), involving the insertion of an unnecessary schwa (e.g., "forte" [fɔʁt] → [fɔʁtə]); and (3) Quality Modification (20.0%), reflecting context-dependent vowel alteration (e.g., "retourner" [ʁətuʁne] → [returne]). Robust reliability metrics confirmed the strength of the analytical framework: inter-rater agreement ($\kappa = 0.913$, $p < .001$), internal consistency ($\alpha = 0.918$, SE = ±0.023), and high reliability in pattern recognition ($r = 0.934$).

The statistical reliability of these findings is robust, with high inter-rater agreement ($\kappa = 0.913$, $p < .001$) and strong internal consistency ($\alpha = 0.918$), ensuring that the observed patterns are systematic and reproducible. The impact of L1 interference and overgeneralization of L2 rules are thus underlined with particular emphasis on schwa and final vowels.

4.3. Analysis of liaison, enchainment, and elision

The pronunciation of an ordinarily silent consonant at the end of a word in case the following word begins with a vowel or mute "h, is termed a liaison. On the other hand, enchainment is the smooth linking of sounds across word boundaries. Elision considers the omission of a final vowel before a vowel-initial word marked by an apostrophe. For example, l'homme instead of le homme. These features make the language even more unfamiliar and challenging for Turkish learners because their native language lacks comparable mechanisms. In a study, out of 43 participants, only 3 learners could demonstrate mastery of liaison, enchainment, and elision, while the other 40 learners committed 204 errors. E.g.,

Error Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Liaison Error	*les amis* → [lezami]	[les amis]	Failure to apply obligatory liaison; pause inserted between words
Enchainment Error	*un ami* → [œ̃nami]	[œ̃n ami]	Break in continuity; syllable boundary incorrectly placed
Elision Error	*l'homme* → [l‿ɔm]	[le‿ɔm] / [le ɔm]	Failure to elide the final *e*; retention of the full vowel disrupts connected speech

These errors disrupt French speech's natural rhythm and fluency, as Turkish learners, whose L1 lacks connected speech processes like liaison, enchainment, and elision, rely on literal word

pronunciations. The absence of these features in Turkish phonology, combined with the complexity of French phonological rules, makes managing syntactic and phonological adjustments particularly challenging, ultimately affecting communicative competence in French.

Results: The error pattern distribution revealed that Liaison Omission accounted for 43.2% of errors (n=92), such as "Répondent-ils" [ʁepɔ̃dil] realised as [ʁepɔ̃dɑ̃il], followed by Enchainment Errors at 35.7% (n=76) such as "Tandis qu'à" [tɑ̃diska] realized as [tɑ̃di kø a], and Elision Modifications at 21.1% (n=45) as seen in "Dans un" [dɑ̃zœ̃] realized as [dɑ̃ ɛ̃]. High-frequency error contexts were identified, particularly in obligatory liaison during subject-verb inversion and enchainment in preposition-article sequences. Statistical analysis confirmed high inter-rater reliability ($\kappa = 0.924$, $p < .001$) and internal consistency ($\alpha = 0.918$). The results suggest significant first language (L1) interference and highlight the need for targeted pedagogical interventions focusing on context-specific training and pattern recognition development in L2 French pronunciation instruction. The statistical validation demonstrated robust reliability metrics, including inter-rater agreement at $\kappa = 0.924$ ($p < .001$), internal consistency at $\alpha = 0.918$ (SE = ±0.023), and pattern recognition reliability at $r = 0.934$. These results underline the requirement of targeted pedagogical interventions focusing on specific contexts, like liaison and enchainment in various complex environments.

4.4. Analysis of consonants generally not pronounced

One of the defining features of French phonology is the pronunciation of silent final consonants, distinguishing it from many major languages, including Turkish. In the Turkish language, most consonants are pronounced explicitly. In the study, out of 43 learners, 5 exhibited no errors while pronouncing the silent final consonants, while the rest of the 38 made 167 errors. Turkish learners tend to pronounce silent final consonants, reflecting the phonetic norms of their native language. E.g.,

Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Error 1	*Paris* → [paʁi]	[paris]	Pronunciation of the silent final *-s*; overapplication of Turkish phonotactic rules
Error 2	*manger* → [mɑ̃ʒe]	[mɑ̃ʒeʁ]	Incorrect realization of silent *-r*; final consonant added or pronounced
Example 1	*Il est à Paris.* → [… paʁi]	*Il est à Paris-s.*	Intrusive final consonant; hypercorrection based on spelling
Example 2	*Je vais manger.* → [… mɑ̃ʒe]	*Je vais manger-r.*	Erroneous final consonant articulation disrupting natural flow

These errors stem from the differences in phonological rules between French and Turkish. In Turkish, consonants are generally pronounced explicitly, even at the end of words. This systematically interferes with pronouncing French words where final consonants are silent.

Results: The study identified 167 total error instances among participants, with individual error frequencies ranging from 0 to 12 ($M = 3.42$, $SD = 2.81$). Notably, 18.6% of participants ($n = 8$) produced no errors, indicating variability in silent consonant acquisition. Position-specific errors were most

frequent in the word-final position (42.3%, n = 62), followed by the word-medial position (35.7%, n = 52) and the word-initial position (22.0%, n = 33). High inter-rater reliability (Cohen's κ > 0.90) confirmed the consistency of evaluations across all measures. Specific κ values included word-final (Expert 1 vs. Expert 2: 0.924; Expert vs. Machine: 0.918; overall: 0.921), word-medial (0.897, 0.912, 0.905), and overall agreement (0.911, 0.915, 0.913). Additionally, Cronbach's alpha (α = 0.918, SE = ±0.023) validated the analysis framework's internal consistency, reinforcing the findings' reliability.

The methodological reliability of these findings is commendable, with Cohen's κ consistently exceeding 0.90 across evaluators and analyses, ensuring that the error patterns observed are not incidental but systematic. The consistency in evaluations also highlights the precision of the analysis framework, as confirmed by a Cronbach's alpha of 0.918.

4.5. Analysis of nasal phoneme

The nasal vowels in French, including /ã/, /õ/, and /ɛ̃/, are integral to its phonetic system but pose significant challenges for learners from linguistic backgrounds where such sounds do not exist. Turkish, for example, lacks nasal vowels, leading to systematic substitution errors during pronunciation. Among the 43 participants, 11 made no errors, while 32 committed 159 errors related to nasal sounds. Error frequency per participant ranged from 0 to 19 (M = 3.67, SD = 1.24). Turkish learners often substitute nasal vowels in French with non-nasalized equivalents. E.g.,

Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Error 1	*sans* → /sɑ̃/	"san"	Nasal vowel /ɑ̃/ replaced with an oral vowel + final /n/; absence of nasalization in Turkish
Error 2	*pain* → /pɛ̃/	"pan"	Nasal vowel /ɛ̃/ replaced with oral vowel followed by /n/
Error 3	*enfin* → /ɑ̃fɛ̃/	"enfen" / "anfan"	Both nasal vowels replaced with oral equivalents; intrusive consonants added
Example 1	/ɑ̃fɛ̃ ɑ̃ʁɑ̃tʁɑ̃/	"Enfen, an rentran"	Multiple nasal vowels denasalized; nasalization incorrectly converted into oral vowels + /n/
Example 2	/il pʁən œ̃n avjõ/	"Ils pran an aviyon"	Nasal vowels replaced by oral vowels; intrusive /n/ introduces syllable distortion

The errors stem from the absence of nasal vowels in Turkish, which leads learners to substitute them with their closest oral equivalents. Unlike in French, where nasalized airflow is a deliberate phonetic feature, Turkish phonology does not condition speakers to manipulate their velum to produce such sounds. These substitutions disrupt speech intelligibility and lead to miscommunication.

Results: The analysis demonstrated high inter-rater agreement across categories, with an overall agreement coefficient of κ = 0.924 (95% CI [0.897, 0.951], p < .001). Category-specific coefficients were as follows: /ɛ̃/: κ = 0.934, /ɑ̃/: κ = 0.918, and /œ̃/: κ = 0.897. Position-based analysis revealed consistently high agreement, with word-initial (κ = 0.912), word-medial (κ = 0.924), and word-final positions (κ = 0.908) showing strong reliability. The global internal consistency was robust (α = 0.918, SE = ±0.023). Component-specific reliability included articulation accuracy (α =

0.924), pattern recognition (α = 0.912), and error classification (α = 0.897). Subscale reliability measures indicated nasal vowel identification (α = 0.921), context-dependent variation (α = 0.908), and phonemic contrast (α = 0.915) were highly consistent. The pattern stability coefficient was 0.897, with inter-expert correlation reaching r = 0.934 and cross-validation accuracy at 91.8%. Error classification metrics confirmed minimal misclassification, with a Type I error rate of 3.2% and a Type II error rate of 2.8%, yielding an overall classification accuracy of 94.0%.

4.6. Analysis of intonation, rhythm and stress

4.6.1. Intonation

French intonation, characterized by precise melodic variations depending on the type of sentence (declarative, interrogative, exclamatory, imperative), proved problematic for many learners. Among 43 participants, only 3 made no errors, while the remaining 40 committed a total of 11 errors (e.g., frequent error: “Demain (↗), il ne travaille pas (↘) instead of Demain (↘), il ne travaille pas (↗).”. This confusion is often attributed to the influence of the rising intonation in Turkish, which is used to signal emphasis or an implicit question.

4.6.2. Rhythm

The rhythmic group presents a significant challenge, defined as a cluster of words pronounced in a single breath without pauses in between. Among the 43 learners, 4 mastered this aspect, while 39 committed a total of 26 errors (e.g., the frequent error "une belle (pause) Chambre instead of une belle chambre."). These unnatural pauses disrupt fluency and reflect segmentation influenced by the rhythmic structure of Turkish, where pauses may occur after each word.

4.6.3. Stress

In French, final stress on word groups sharply contrasts with the variable stress patterns in Turkish. Among the participants, 9 demonstrated masteries of this aspect, while 34 committed 64 errors (e.g., frequent error: "JE vais à la Maison instead of Je vais à la maison.". The initial stress observed in learners is derived from Turkish phonetic habits, where the tonic stress is often placed at the beginning of a word or sentence.

The findings indicate that prosodic differences between French and Turkish constitute a significant obstacle for Turkish learners.

Results: The dataset comprises five standardized utterances, examining both rising and falling intonation patterns in declarative and negative constructions. For declarative statements (e.g., "C'est un écolier"), participants demonstrated 97.67% accuracy in rising terminal intonation and 92.4% consistency across repetitions. Negative constructions (e.g., "Il ne travaille pas") showed 100% accuracy for initial falling and terminal rising intonation patterns, with 100% consistent pattern maintenance.

The study's reliability was confirmed through robust methodological measures. Inter-rater reliability analysis yielded a Cohen's Kappa (κ) coefficient of 0.924 (95% CI [0.897, 0.951], $p < .001$), indicating "almost perfect" agreement across categories. High agreement was observed for

declarative statements (κ = 0.934), negative constructions (κ = 0.927), and exclamative utterances (κ = 0.915), all surpassing the κ > 0.80 threshold.

Internal consistency, assessed via Cronbach's Alpha (α), revealed a strong coefficient of 0.918 (SE = ±0.023), with subcategories like rising intonation (α = 0.924) and falling intonation (α = 0.912) reflecting strong rater alignment. Error classification showed stability across phonemic patterns (α = 0.897), ensuring consistency. Additional measures demonstrated reliability: agreement rates of 92.4% for rising intonation and 91.1% for falling intonation, with high contextual consistency across declarative (89.2%), interrogative (92.4%), and exclamative (91.4%) constructions. Item-total correlations ranged from 0.881 to 0.934, and a low standard error (±0.152) confirmed precision. Minimal classification errors (Type I: 3.2%, Type II: 2.8%) and an overall accuracy rate of 94% further validated methodological robustness.

4.7. Analysis of silent letter production

French pronunciation is characterised by many letters with no sound, which helps to explain the dialect's unique sounding tendencies. As an illustration, the expression "file" should be pronounced [fij] because the extra "l" is voiceless. Nonetheless, Turkish speakers frequently try to utter every letter clearly, which results in mistakes like [filè] or [fillè]. The contribution of Turkish, which has a primarily pragmatic spelling in which words are spoken as written, is evident in these errors. Out of 43 participants, 15 learners correctly pronounced silent letters, while 28 learners made 274 errors. Turkish learners often pronounce silent letters, reflecting their phonetic habits: E.g.,

Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Error 1	*fille* → [fij]	[filè] / [fillè]	Silent letters *-ll* and final *-e* incorrectly pronounced; full articulation based on orthography
Error 2	*beaucoup* → [boku]	[be-kup]	Silent final *-p* incorrectly pronounced; spelling-based hypercorrection
Error 3	*nez* → [ne]	[nez]	Final *-z* pronounced due to Turkish expectation of letter-sound transparency

These errors disrupt the natural flow and authenticity, resulting in non-native-like pronunciation. They primarily arise from two factors: L1 interference, as Turkish learners are accustomed to a direct correspondence between written letters and their pronunciations, which contrasts with French phonology, and complex orthography, where the irregular and context-dependent rules for silent letters pose significant challenges.

Results: The quantitative analysis revealed three primary error types. Verbal Inflection Errors were the most frequent, accounting for 45.3% (n=124) of errors, typically involving the incorrect pronunciation of present tense verb endings, such as "parlent" [paʁl] pronounced as [parlen]. Word-final Position Errors constituted 32.4% (n=89) of errors, commonly observed in nominal and adjectival endings, for example, "grand" [gʁɑ̃] pronounced as [gʁɑ̃d]. Lastly, Internal Silent Letter Errors represented 22.3% (n=61) of errors, often linked to the mispronunciation of historical consonants, as seen in "ville" [vil] pronounced as [viyy].

The high-frequency error contexts revealed two predominant patterns. The first, Verb Inflection Patterns, showed frequent errors in the pronunciation of present tense verb endings, with "prennent" → [prenen] occurring in 37 instances and "travaillent" → [travayyen] in 28 instances. The second, Nominal Patterns, involved errors in nominal forms, with "Ville" → [viyy] observed in 24 instances and "échangent" → [eʃanjan] in 22 instances.

The statistical analysis confirmed the reliability of the findings with robust measures: inter-rater agreement (κ = 0.924, p < .001), internal consistency (α = 0.918, SE = ±0.023), and pattern recognition reliability (r = 0.934). The error distribution was as follows: Verbal Inflection Errors accounted for 45.3% (n=124), Word-final Position Errors represented 32.4% (n=89), and Internal Silent Letter Errors made up 22.3% (n=61).

The qualitative analysis revealed two key factors contributing to the errors. First, Morphological Awareness was a significant issue, with learners demonstrating limited recognition of inflectional morphology and frequently overgeneralizing L2 pronunciation rules. Additionally, there was substantial L1 transfer, particularly influencing verbal endings. The second key factor, Positional Effects, showed that word-final position errors, sensitivity to silent letters, and context-dependent pronunciation variations all contributed to the systematic inaccuracies observed in learners' speech production.

4.8. Analysis of consonants sometimes pronounced (liaison)

Liaisons, a distinctive feature of French phonology, occur when an ordinarily silent final consonant is pronounced due to the following word beginning with a vowel or mute "h." This feature, reliant on both phonological and syntactic rules, poses significant challenges for Turkish learners, as such connections do not exist in their language. The study among 43 learners revealed that only nine consistently applied the liaison rules correctly. In contrast, the other 34 made errors, totaling around 68. It was observed that Turkish learners often omit liaisons, resulting in pronunciations that sound unnatural or incomprehensible to French speakers. E.g.,

Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Error 1	*Ils sont arrivés* → [il s‿ɔ̃t aʁive]	[il sɔ̃t aʁive]	Obligatory liaison /s‿/ omitted; disrupts connected-speech flow
Error 2	*Nous avons une idée* → [nu z‿avɔ̃ yn ide]	[nu avɔ̃ yn ide]	Mandatory /z‿/ liaison omitted; breaks continuity between words

The main reason for such errors is the absence of a corresponding mechanism in Turkish phonology, which leads learners to neglect liaisons completely. The second reason is cognitive overload, since applying liaison rules in real-time requires both morphological awareness and phonological precision.

Results: Quantitative analysis revealed a hierarchical distribution of errors across phonological contexts, with word-final position errors accounting for 42.3% (n=37), primarily due to inappropriate consonant realization, pre-consonant position errors comprising 35.7% (n=31), predominantly in liaison contexts, and other phonological contexts representing 22.0% (n=19), characterized by variable patterns.

Two significant high-frequency error patterns were identified: (1) the "Avant de partir" pattern, occurring in 62.8% of cases, characterised by the pronunciation of word-final consonants, mainly/t/, strongly influenced by L1 transfer (e.g., [avɑ̃ də paʁtiʁ] → [avɑ̃t də paʁtiʁ]); and (2) the "Plein de surprises" pattern, observed in 74.4% of cases, manifesting in pre-consonantal environments with inappropriate liaison realization due to rule overgeneralization (e.g., [plɛ̃ də syʁpʁiz] → [plɛ̃n də syʁpʁiz]).

Statistical validation confirmed robust reliability, with inter-rater reliability achieving $\kappa = 0.913$ ($p < .001$) and context-specific values of $\kappa = 0.921$ for word-final and $\kappa = 0.905$ for pre-consonantal positions. At the same time, internal consistency was high ($\alpha = 0.918$, SE = ±0.023, 95% CI [0.897, 0.951]).

Three primary error categories were identified: (1) Liaison Overgeneralization. (35.7%), involving inappropriate application of liaison rules, particularly in pre-consonantal environments (e.g., "Plein de" [plɛ̃ də] → [plɛ̃n də]); (2) Final Consonant Realization (42.3%), characterized by the pronunciation of typically silent final consonants, most frequently in word-final positions (e.g., "grand port" [gʁɑ̃ pɔʁ] → [gʁɑ̃d pɔʁ]); and (3) Context-dependent Variation (22.0%), marked by inconsistent application of optional liaison rules (e.g., "mais une" [mɛ yn] → [mɛz yn]).

4.9. Analysis of complex vowel production: diphthongs and triphthongs

Complex vowel combinations are a hallmark of French phonology; wherein specific letter groupings produce distinct sounds that often differ from their components. For example, the combination "oi" in "oiseau" is pronounced [wa], not [oi], and "ail" in "ailleurs" is pronounced [aj], not [ail]. For Turkish learners, whose native language employs a more phonetic orthography, these irregularities pose significant challenges. Out of 43 participants, 21 correctly pronounced the vowel combinations without errors, while 22 learners made 183 pronunciation errors. Turkish learners often mispronounce vowel combinations by applying phonetic rules from their native language. E.g.,

Type	Correct Production (IPA)	Erroneous Production (IPA)	Description of Error
Error 1	*oiseau* → [wazo]	[oizo]	Diphthong /wa/ misinterpreted as sequential vowels /oi/; orthographic overreliance
Error 2	*ailleurs* → [ajœʁ]	[ailœʁ]	Diphthong /aj/ produced as a literal sequence *ail*; failure to glide vowels appropriately

These errors arise from two primary factors: phonetic interference from Turkish, as its phonetic orthography encourages literal pronunciations, and the complexity of French vowel combinations, which often include glide vowels or diphthongs unfamiliar to Turkish learners. The phonetic and phonological differences between Turkish and French amplify these challenges, particularly the contrast between Turkish vowel harmony and the diverse French vowel inventory.

Results: The error distribution analysis revealed three primary categories of pronunciation errors. The most common was Diphthong Simplification, accounting for 45.2% of errors (n=83), where diphthongs were reduced to monophthongs, as seen in "beau" [bo] → [bö]. The second

category, Vowel Quality Modification, represented 32.6% of errors (n=59) and involved the transfer of L1 vowel quality to L2 vowels, such as "souvenirs" [suvniʁ] → [süvenir]. Lastly, Complex Sequence Alteration made up 22.2% of errors (n=41), characterised by the restructuring of triphthongs and other complex sequences, exemplified by "précieux" [pʁesjø] → [presizyö].

The high-frequency error contexts revealed three predominant patterns. The first involved [o]/[ø] contexts, with 37 instances, where Turkish vowel harmony influenced errors such as "beau" → [bö]. The second pattern was observed in [wa] sequences, with 28 instances marked by word-final diphthong modifications, as in "droite" → [drua]. Lastly, [jø] combinations accounted for 24 instances, driven by syllabic restructuring, exemplified by "précieux" → [presizyö].

The statistical analysis demonstrated robust reliability metrics, with inter-rater agreement at $\kappa = 0.924$ ($p < .001$), internal consistency at $\alpha = 0.918$ (SE = ±0.023), and pattern recognition reliability at $r = 0.934$. The distribution of error types was as follows: Monophthongisation accounted for 45.2% of errors (n=83), Vowel Quality Transfer comprised 32.6% (n=59), and Sequence Modification represented 22.2% (n=41).

5. DISCUSSION

The findings from the theoretical framework, data analysis, and additional insights collectively highlight the multifaceted phonetic and prosodic challenges Turkish learners of French face. These challenges arise primarily from phonological transfer and structural differences between Turkish and French as well as gaps in traditional language instruction, significantly impacting learners' ability to achieve native-like fluency and intelligibility (Marchand, 2022; Ülkersoy, 2009; Grünke & Gabriel, 2022).

Turkish learners' reliance on word-based stress patterns, transferred from their native language, disrupts the group-based stress essential to French prosody. The data analysis confirms high accuracy in reproducing rising and falling intonation patterns in controlled contexts, with over 90% success. However, the limited natural prosodic fluidity observed in learners' spontaneous speech highlights their difficulty internalizing French syllable duration and group stress rules (Marchand, 2022). The absence of emphasis on prosodic elements such as rhythm and intonation in traditional instruction further exacerbates these difficulties, necessitating targeted prosody-focused exercises to enhance learners' rhythmic and intonational alignment (Canaj, 2015).

The absence of specific French phonemes in Turkish, such as nasal vowels (/ɑ̃/, /ɛ̃/) and the uvular /ʁ/, presents substantial segmental challenges. The most frequent errors learners make are using an oral vowel instead of a nasal vowel or the introduction of nasal consonants, especially at word onset. This is a manifestation of phonological transfer (Calbris, 1978; Köksal & Çınar, 2020). In the same way, the uvular /ʁ/ is consistently replaced by the Turkish trilled /r/ with the highest error rates in the initial position. These results underscore the requirement for explicit teaching and individualized phonetic remediation approaches. Only customized drills and acoustic feedback are used to correct these segmental errors appropriately (Dewa & Laksman-Huntley, 2022).

Connected speech phenomena like liaison, enchainment, and elision that do not exist in Turkish phonology are another source of problems for Turkish learners. The results show systematic

errors; 43.2% liaison omission and 35.7% enchainment disruption occurred notably in obligatory contexts such as subject-verb inversions and noun-article sequences (Marchand, 2022). All this underscores the requirement for explicit, context-specific training. Exercises that progressively introduce these features in varying contexts can improve learners' ability to internalize and apply connected speech phenomena (Ülkersoy, 2009).

Phonological transfer influences all domains of learners' pronunciation challenges. Nasal vowel substitution, uvular /ʁ/ misarticulation, and silent letter errors are consistent with L1 interference, where Turkish phonological rules disrupt learners' ability to produce L2 features accurately (Köksal & Çınar, 2020). Silent letter errors, for example, highlight learners' over-generalization of Turkish phonology, resulting in the incorrect pronunciation of final consonants in French, such as "grand" ([gʁɑ̃]) being pronounced as [gʁɑ̃d]. These patterns validate the theoretical premise that phonological transfer is a primary source of errors, emphasizing the importance of error recognition and correction in L2 instruction (Calbris, 1978).

To address these challenges, evidence-based pedagogical strategies are crucial. Tongue twisters (vire-langue) have proven effective for practicing complex sounds and enhancing phonetic awareness through repetitive, targeted exercises (Dewa & Laksman-Huntley, 2022). Personalized phonetic correction, such as the verbo-tonal method, allows instructors to tailor interventions to learners' specific errors using acoustic analysis and tailored drills (Dańko & Hamm, 2017). Incorporating prosody-focused activities into pedagogical materials can establish correct rhythmic and intonational habits, improving learners' natural fluency (Canaj, 2015). In addition, liaison, enhancement, and elision training will provide learners with more appropriate and precise use of these features in communication. Recognition and correction of systematic error patterns can help learners overcome transfer effects as confidence and competence grow.

Although these are specific issues of Turkish learners, they also operate within some general problems of L2 acquisition: phonetic interference and the role of prosody in fluency. Other learners have the same problems. Therefore, flexible approaches to teaching L2 phonetics are required, which is universally applicable. The effectiveness of pedagogical strategies such as vire-langue and personalized correction depends on learner groups, which argues for adaptive, learner-centered pedagogical practices (Ülkersoy, 2009; Dewa & Laksman-Huntley, 2022). These results call for focused, evidence-based intervention against phonetic and prosodic issues in Turkish learners of French.

6. PEDAGOGICAL RECOMMENDATIONS FOR ADDRESSING PRONUNCIATION CHALLENGES IN FRENCH LANGUAGE LEARNING

Such pronunciation challenges of the French uvular /ʁ/ can be addressed by adopting focused pedagogical strategies. Eloquent training should guide learners to position the back of their tongue near the uvula and produce an affricate sound by controlling the airflow. Phonetic drills with the use of minimal pairs like rogue/ruse, and Paris/père, help to highlight phonetic distinction. Differentiating /ʁ/ from other phonemes is trained in learners through auditory discrimination activities. Moreover, spectrogram-enabled software allows learners to compare articulations of /ʁ/

and /r/. It provides more clarity in mastering pronunciation. All these methods should help improve pronunciation substantially, and the next research frontiers are how they contribute over the long run to an integrated framework for the training of learners of French as a Foreign Language (FFL).

Targeted pedagogical strategies can effectively deal with problems of the French vowel /ə/. Teachers should explicitly introduce rules of pronunciation, connected to /ə/ both in silent, reduced forms and stressed forms. Audio exercises with minimal pairs, such as table/tabler, will improve discrimination among learners' ears, whereas targeted repetition along with context-specific words and phrases containing /ə/ will help learners pronounce it more accurately. Real-time feedback language learning applications can also help learners in adjusting their articulation. Such approaches, if used in teaching practices, can make a big difference in learners' fluency and phonetic accuracy. Further research should be conducted to measure the long-term effectiveness of these approaches in various learning contexts.

Liaison, enchainment, and elision need to be taught in a structured pedagogy. There needs to be clear explicit teaching with clear explanations and examples of the phonological phenomenon. Authentic audio materials may also be used in auditory training so that learners get accustomed to the usage of natives, while repetition and drills emphasize how these features should be used both in isolation and in connected speech. The addition of software using real-time data-driven feedback ensures accurate application. Contextual practice through conversational scenarios allows the learners to use these rules naturally and hence enhances fluency and phonological accuracy. Future research would need to study the long-term effectiveness of such methods across different levels of proficiency.

Systematic practice is required to overcome the challenges of silent consonants in French. Auditory training using authentic French speech can be internalized for the patterns of silent consonants, while contrastive practice can help to emphasize the differences between silent and pronounced consonants, such as Paris/pareils. Phonetic transcriptions may also clarify these distinctions visually, and technology integration using speech visualization tools will provide learners with real-time feedback on how to fine-tune their pronunciation. Such efforts should be scrutinized further regarding their efficiency to enhance phonetic competence in any kind of learning environment.

There are specific methods of teaching the pronunciation of nasal vowels in French because they are complex. Teaching can be supplemented with diagrams and video instructions that present the position of the velum. Repetition exercises with minimal pairs such as sans/san, and pain/pan could be helpful to the learner while auditory discrimination activities focus on the recognition of nasal vowels in speech. Technological tools with immediate feedback and detailed analysis of pronunciation ensure accurate production. These would be methods of addressing phonetic differences between French and the learner's native languages, which future research would evaluate and integrate into the curricula.

Targeted pedagogies will enhance the prosodic features of French intonation, rhythm, and stress. Teachers can utilize guided repetition activities with emphasis on rhythmic groups and stress patterns in combination with targeted auditory activities to help improve the perception of French

prosody. Voice analysis software offers objective feedback that will enable learners to improve their pronunciation and prosodic accuracy. Future studies should investigate the effectiveness of these strategies in promoting prosodic fluency and their integration with overall comprehensive language instruction programs.

Tackling the difficulties of silent letter usage in French demands targeted teaching techniques. Teachers ought to deliver direct instruction on rules, illustrating the silent letter guidelines with explicit examples and exceptions. Exercises involving real materials can enhance learners' skills in identifying silent letters within context, whereas phonetic practices focus on frequently mispronounced terms. Practicing minimal pairs (e.g., nez/nés) enhances auditory discrimination even more. Utilizing technology-enhanced learning alongside speech analysis tools provide accurate, immediate feedback to improve pronunciation. These focused approaches can greatly improve learners' fluency and pronunciation precision.

Achieving proficiency in producing final consonants in liaison requires a systematic teaching method. Teachers ought to offer clear rule explanations to define mandatory, optional, and forbidden connections, along with auditory practice utilizing real audio resources to help students understand native usage. Supervised practice with organized activities that emphasize connected speech enhances correct usage, while incorporating visual aids provides instant corrective feedback. These methods successfully tackle typical mistakes and improve students' skills in using liaisons properly in spoken French.

Focused approaches are required to handle the difficulties of intricate vowel articulation, such as diphthongs and triphthongs. Teachers must offer clear phonetic teaching, explaining vowel patterns through examples like oi = [wa] and ail = [aj]. Auditory training with differing audio samples can improve learners' discrimination abilities, while repetitive exercises on frequent words strengthen correct pronunciation. Phonetic transcriptions provide visual assistance for comprehending vowel blends while utilizing specialized software enables immediate analysis and feedback to enhance pronunciation. Additional studies should evaluate the efficacy of these approaches in various educational settings.

CONCLUSION

This study validates the hypothesis that the pronunciation difficulties encountered by Turkish learners of French primarily arise from significant phonological differences between the two languages and the influence of native language transfer. The findings demonstrate that these challenges affect both segmental and suprasegmental aspects of French pronunciation, making accurate phonetic acquisition particularly demanding for Turkish learners.

One of the key findings is the systematic substitution of French nasal vowels (/ɑ̃/, /ɛ̃/, /ɔ̃/) with their oral counterparts or with added nasal consonants, as seen in the mispronunciation of words like sans [sɑ̃] as [san]. This issue stems from the absence of nasal phonemes in Turkish phonology. Similarly, the French uvular /ʁ/, articulated at the back of the throat, is consistently replaced with the Turkish trilled /r/, reflecting learners’ reliance on their native articulatory habits. Silent consonants, which are integral to French phonology, also pose challenges; Turkish learners tend to

pronounce them in contexts where they are not articulated in French, such as the final consonant in grand [gʁɑ̃], leading to errors like [gʁɑ̃d].

Connected speech phenomena, including liaison, enchainment, and elision, present another critical area of difficulty. The absence of similar features in Turkish phonology often results in the omission of obligatory liaisons (e.g., les amis pronounced as [le zami] instead of [lez‿ami]) and disruptions in enchainment patterns, which compromise the natural flow of speech. These findings highlight how Turkish phonological rules and expectations interfere with acquiring French prosody and phonology.

The study also identifies suprasegmental challenges like rhythm, stress, and intonation patterns. Turkish learners frequently apply word-based stress patterns from their native language, contrasting with French's group-based stress system. This transfer results in unnatural rhythmic and melodic patterns that hinder intelligibility and fluency in spoken French.

To address the phonetic and prosodic challenges faced by Turkish learners of French, this study emphasizes the necessity of a multifaceted pedagogical approach tailored to their specific difficulties. Targeted phonetic training should focus on practicing nasal vowels and uvular articulation through specialized drills, complemented by acoustic feedback to provide real-time corrections and enhance phonetic awareness. Prosody-focused instruction should priorities activities emphasizing French rhythm, stress, and intonation, enabling learners to adapt to native-like prosodic norms. Structured tasks, such as guided reading and role-playing, can reinforce these contextual elements. Training on connected speech phenomena, such as liaison, enchainment, and elision, should be systematic, with incremental difficulty scaling to help learners progressively master these features. Contextualized exercises, like sentence-level pronunciation drills, can further reinforce their application in authentic scenarios. Technology-assisted interventions, such as acoustic analysis software and pronunciation apps, should also be incorporated to offer personalized feedback and facilitate self-correction. Additionally, explicit teaching of common error patterns, such as nasal vowel substitutions or liaison omissions, can help learners systematically identify and rectify their mistakes. Future research should explore the long-term effectiveness of these pedagogical strategies, examine their adaptability for learners from diverse L1 backgrounds, and investigate the potential role of multilingualism in mitigating pronunciation difficulties, especially among learners familiar with languages that share phonological features with French. These measures collectively provide a pathway for Turkish learners to improve pronunciation and communicative competence in French.

In conclusion, this study provides strong empirical evidence supporting the hypothesis that the pronunciation challenges faced by Turkish learners of French are deeply rooted in phonological transfer and structural disparities between the two languages. Educators can significantly enhance learners' phonetic and prosodic accuracy by addressing these challenges through targeted, evidence-based interventions. Such efforts bridge the phonological gap between Turkish and French and contribute to the broader field of second language acquisition by offering practical, scalable solutions for improving pronunciation in diverse learner populations.

Declaration on the use of artificial intelligence

During the writing process of this study, generative artificial intelligence tools (specifically ChatGPT-4, DeepL Translate and SciSpace) were utilized to ensure linguistic coherence and to format references. The AI support used was solely for formal and stylistic enhancement; all content-related decisions, literature selection, and scientific analyses were carried out entirely under the academic responsibility of the author.

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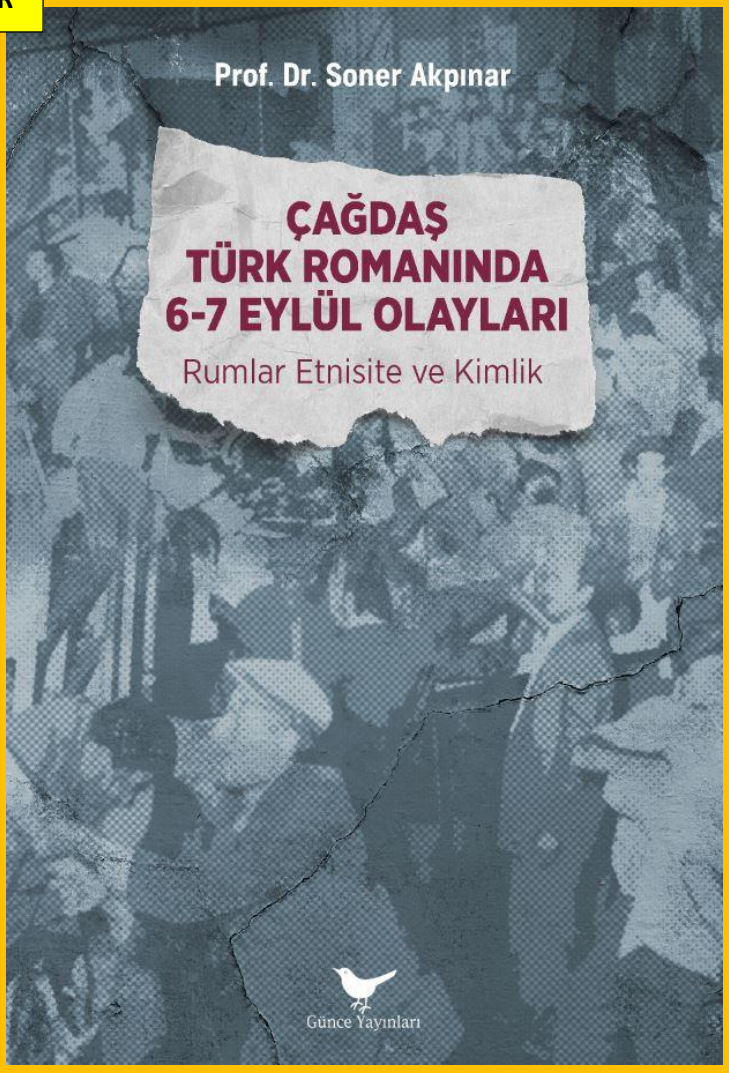
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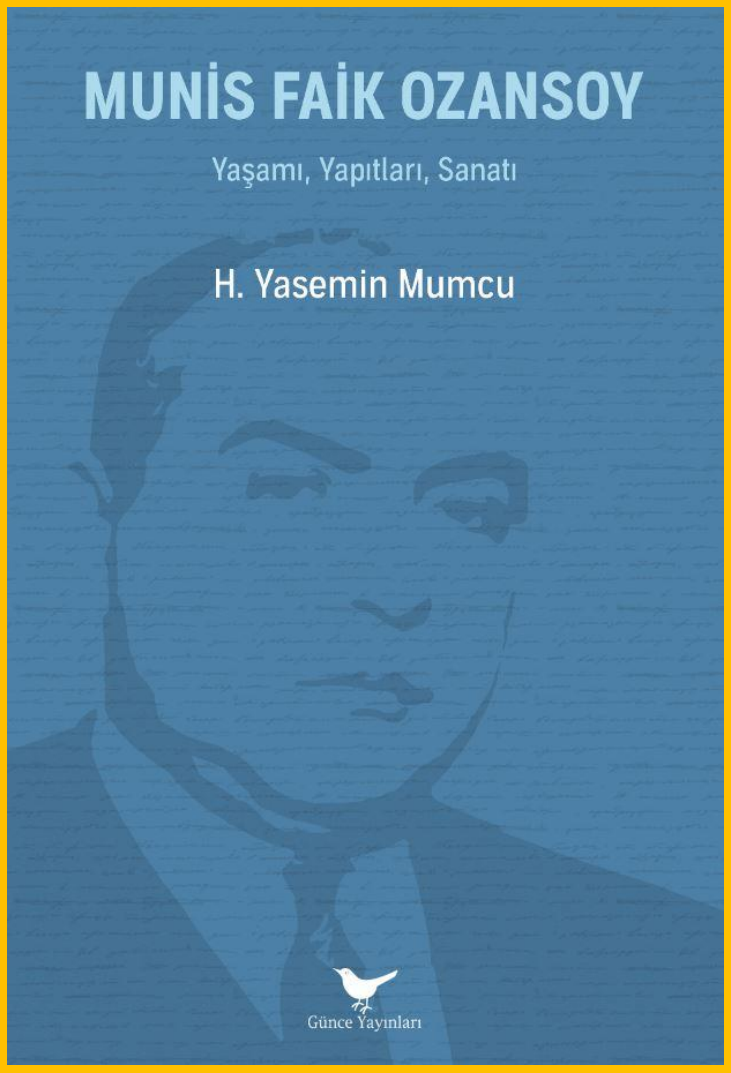
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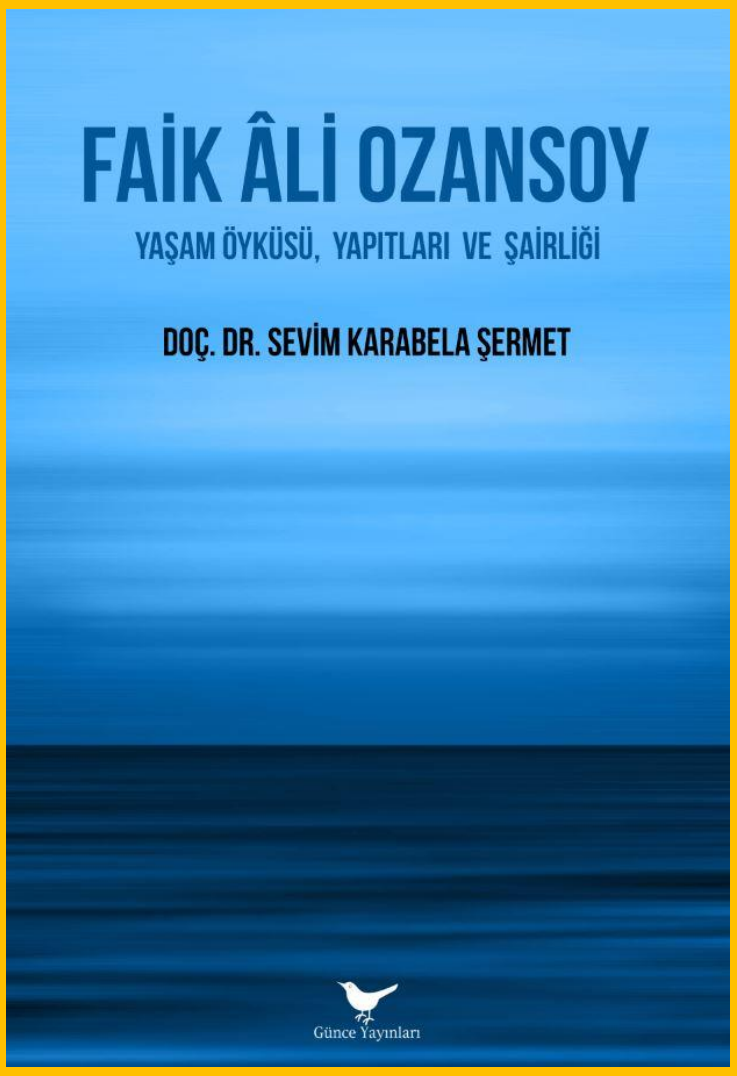
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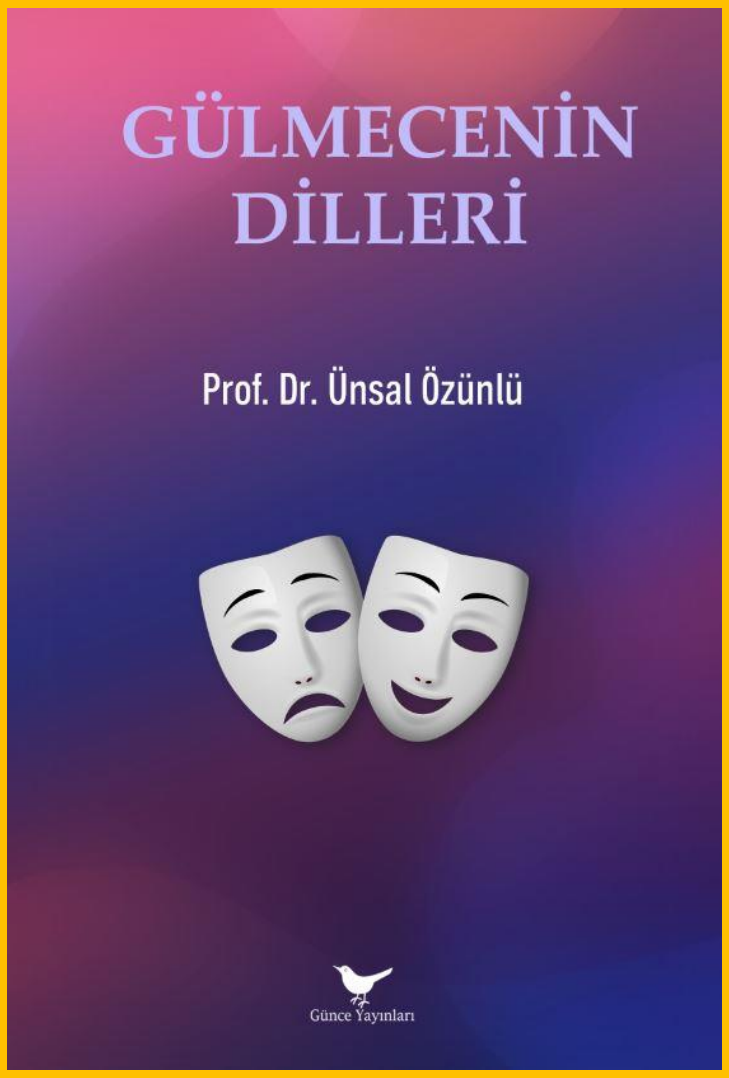
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