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Phonetic-Phonological Mapping of Hijaiyah Letters: Integrating Makhārij al-ḥurūf, Articulatory Features, and Phonemic Contrasts

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Abstract

Arabic consonants exhibit distinctive articulatory properties that can be examined through traditional Arabic scholarship and modern linguistic frameworks. This study developed an integrated phonetic-phonological mapping of fourteen selected Arabic letters by connecting *makhārij al-ḥurūf*, *ṣifāt al-ḥurūf*, International Phonetic Alphabet (IPA) representations, and phonemic contrasts. A qualitative library research approach was employed, combining descriptive analysis with comparative and integrative examination. Sources comprised classical Arabic linguistic and *tajwīd* works, modern phonetics and phonology references, and relevant scholarly journal articles. The analysis identified traditional articulation points and letter characteristics, compared them with modern phonetic categories, examined IPA representations, and illustrated meaning-distinguishing functions through Arabic minimal pairs. The findings indicate conceptual correspondences between traditional articulatory classifications and modern phonetic categories, alongside differences that preclude direct equivalence, particularly in descriptions of voicing and secondary articulation. The resulting mapping systematically links articulatory properties, phonetic representations, and phonemic contrasts. This framework contributes to the theoretical description of Arabic consonants and provides a conceptual reference for pronunciation analysis and Arabic language instruction. Its practical applicability requires further empirical investigation.

Keywords: Articulatory Phonetics; Arabic Consonants; *Makhārij al-Ḥurūf*; Phonemic Contrasts; *Ṣifāt al-Ḥurūf*

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INTRODUCTION

Arabic has a distinctive phonological system characterized by consonants that require specific articulatory configurations, including glottal, pharyngeal, uvular, and emphatic sounds. These consonants present particular challenges for non-native learners because their production involves articulatory distinctions that may not exist in the learners' first language (Al-Shidi et al., 2025; Gillon, 2007). Understanding Arabic pronunciation therefore requires more than recognizing individual letters; it also involves examining their places of articulation, manners of articulation, and phonological functions. Watson (2002) explains that Arabic phonology encompasses a complex consonantal system in which articulatory characteristics play an important role in distinguishing speech sounds and meaning.

In the traditional Arabic scholarly framework, the articulation and characteristics of letters are systematically explained through the concepts of *makhārij al-ḥurūf* and ***ṣifāt al-ḥurūf***. *Makhārij al-ḥurūf* refers to the articulation points from which letters originate, while ***ṣifāt al-ḥurūf*** describes the distinctive qualities associated with their production. These concepts constitute fundamental elements of Arabic pronunciation, particularly in the disciplines of tajwīd and Qur'anic recitation (Ibn al-Jazari, 1985). Meanwhile, modern articulatory phonetics classifies speech sounds according to their place of articulation, manner of articulation, voicing, and secondary articulatory features. The International Phonetic Alphabet (IPA) provides a standardized system for representing these sounds and identifying their phonetic distinctions (Ladefoged & Johnson, 2011). The relationship between these two approaches offers an important foundation for examining Arabic letters through both traditional and contemporary linguistic perspectives.

The relevance of integrating these approaches becomes particularly evident in the analysis of Arabic guttural and emphatic consonants. Guttural consonants involve different articulatory locations, including the glottis, pharynx, and uvula, which cannot be treated as a single articulatory category. Embarki (2013) and Owens (2013) explains the importance of examining Arabic phonetic characteristics through the relationship between traditional descriptions and modern experimental phonetics. Empirical evidence is also provided by Ariyaee et al. (2024), whose acoustic investigation of guttural fricatives in Arabic, Kurdish, and Armenian demonstrates that differences in articulatory location are reflected in measurable acoustic characteristics. These findings highlight the importance of

distinguishing Arabic consonants based on their specific articulatory properties rather than relying solely on broad traditional classifications.

Another important aspect of Arabic phonology concerns emphatic consonants and their distinction from non-emphatic counterparts. These contrasts involve secondary articulation, particularly pharyngealization, which contributes to differences in consonant production and the acoustic characteristics of adjacent vowels. Aldamen & Al-Deaibes (2023) investigated the production of Arabic emphatic consonants by English-speaking learners and identified acoustic differences between emphatic and non-emphatic contexts, particularly in vowel formant frequencies. Similarly, Kulikov (2022) demonstrated that voicing and emphasis in Arabic coronal stops involve multiple acoustic cues, including voice onset time (VOT), spectral characteristics, and vowel formant frequencies. These studies indicate that the distinction between Arabic consonants involves more than their primary articulation points, requiring consideration of additional articulatory and phonological features.

Although previous studies have provided substantial explanations of Arabic articulatory characteristics and phonological contrasts, the relationship between traditional classifications and modern phonetic representations still requires systematic examination. Traditional descriptions explain the articulation and characteristics of letters through makhārij and ṣifāt, whereas modern phonetic studies generally employ articulatory categories, IPA transcription, and acoustic measurements. These approaches offer complementary perspectives, but their relationship is not always presented in a form that directly connects the articulation point, articulatory characteristics, phonetic representation, and meaning-distinguishing function of individual Arabic letters. Consequently, an integrated letter-by-letter mapping can provide a useful conceptual contribution to Arabic phonetics and phonology, particularly in explaining the relationship between traditional articulatory knowledge and modern linguistic analysis.

Based on this research gap, the present study proposes an integrated phonetic-phonological mapping of fourteen selected hijaiyah letters by connecting four analytical components: *makhārij al-ḥurūf*, *ṣifāt al-ḥurūf*, IPA symbols, and phonemic contrasts. Its novelty lies in bringing these components together within a single analytical framework and illustrating their phonological functions through Arabic minimal pairs. Rather than assuming that traditional articulatory classifications have exact equivalents in modern phonetic

terminology, this study examines their conceptual correspondence while acknowledging differences in theoretical orientation and variations in the phonetic realization of certain Arabic consonants. This integration is expected to clarify how traditional articulatory descriptions can be interpreted through contemporary phonetic and phonological concepts.

Accordingly, this study aims to examine the articulation points and distinctive characteristics of fourteen selected hijaiyah letters, identify their correspondence with modern phonetic categories, represent their phonetic realizations through IPA symbols, and illustrate their phonemic functions using minimal pairs. The resulting framework is intended to provide a systematic conceptual reference for understanding Arabic consonant distinctions and diagnosing pronunciation differences in Arabic language and tajwīd instruction. Since the research employs a qualitative library-based approach, its contribution is primarily theoretical and conceptual, providing a foundation for subsequent empirical investigations involving acoustic measurements and the pronunciation of Arabic learners.

METHODS

1. Research Type

This study employed a qualitative library research approach to examine the relationship between traditional Arabic phonetic classifications and modern articulatory-phonological concepts. Library research was considered appropriate because the primary data consisted of linguistic concepts, articulatory descriptions, phonetic classifications, and phonological representations obtained from scholarly publications and classical Arabic works rather than direct observations of speech production. The study focused on interpreting and synthesizing existing knowledge to develop an integrated conceptual mapping of selected hijaiyah letters. Document analysis was used to examine the content, relevance, and theoretical contributions of the selected sources (Bowen, 2009). Accordingly, the study did not involve human participants, acoustic experiments, or direct measurements of learners' pronunciation.

2. Research Design

The research employed a descriptive-analytical and comparative-integrative design. The descriptive stage identified the traditional classifications of *makhārij al-ḥurūf* and *ṣifāt al-ḥurūf*, together with their corresponding phonetic descriptions in modern linguistics. The analytical stage examined the articulatory characteristics of individual letters, including their

place of articulation, manner of articulation, voicing, and secondary articulation. Subsequently, the comparative-integrative stage examined the conceptual relationships between the traditional and modern classifications to construct a unified analytical framework. This approach was informed by the integrative perspective of literature-based research, which enables different theoretical perspectives and research findings to be synthesized into a new conceptual understanding (Snyder, 2019). The design was not intended as a systematic literature review or an exhaustive assessment of all publications on Arabic phonology, but rather as a focused conceptual analysis of the selected linguistic phenomena.

3. Data Sources and Selection Technique

The study used primary and secondary literature as its data sources. Primary sources consisted of classical Arabic linguistic and tajwīd works, particularly *Al-Kitāb* by Sibawayh (1988), *Sirr Ṣinā'at al-I'rāb* by (Ibn Jinni, 1954), and *At-Tamhīd fī 'ilm at-tajwīd* by Ibn al-Jazari (1985). These works were selected because they provide foundational descriptions of Arabic articulation points, letter characteristics, and traditional classifications of speech sounds. Secondary sources included modern phonetics and Arabic phonology reference books, particularly Ladefoged & Johnson (2011) and Watson (2002), as well as scholarly journal articles published between 2016 and 2026 addressing Arabic articulatory phonetics, phonological contrasts, acoustic characteristics, and pronunciation difficulties among Arabic learners.

Literature selection followed a purposive approach based on relevance to the research objectives and the verifiability of bibliographic information. The selection criteria included publications that discussed at least one of the following aspects: (1) traditional classifications of *makhārij al-ḥurūf* and *ṣifāt al-ḥurūf*; (2) modern phonetic descriptions of Arabic consonants, including place and manner of articulation, voicing, and secondary articulation; (3) IPA representations and phonemic contrasts in Arabic; and (4) pronunciation errors involving Arabic consonants, particularly among Indonesian learners. Sources with unclear publication identities, insufficient relevance to the research focus, or unverifiable bibliographic information were excluded. Journal article metadata were checked against official journal or publisher records, while classical works and reference books were identified through their publication editions and bibliographic details. The selection process

followed the principles of purposive literature identification rather than systematic screening of all available publications (Snyder, 2019).

The scope of the analysis was limited to fourteen hijaiyah letters selected according to three considerations. First, eleven letters were included because their pronunciation difficulties had been reported in previous studies involving Indonesian learners, namely hamzah (ء), hā' (ه), 'ayn (ع), ḥā' (ح), khā' (خ), ghayn (غ), qāf (ق), fā' (ف), shīn (ش), ṣād (ص), and ḍād (ض). Second, ṭā' (ط) and ẓā' (ظ) were included to complete the emphatic consonant series and facilitate comparison with their non-emphatic counterparts. Third, thā' (ث) was included as a comparative example of a dental fricative that presents a distinction from familiar Indonesian consonants. These criteria resulted in fourteen selected letters for the integrated analysis. Other hijaiyah letters, including jīm (ج), were excluded from the present mapping and remain outside the scope of this study.

4. Instruments and Data Collection

Data were collected through documentation using relevant scholarly publications, academic reference books, and classical Arabic linguistic works. The literature search employed the keywords *makharij al-huruf*, *sifat al-huruf*, Arabic phonology, articulatory phonetics, Arabic consonants, phonemic contrasts, and International Phonetic Alphabet (IPA). The search focused on academic journal databases, official publisher platforms, and catalogues of classical scholarly works. The collected information was organized according to the research objectives and classified into four principal analytical components: traditional articulation points (*makhārij*), traditional articulatory characteristics (*ṣifāt*), modern phonetic representations using IPA symbols, and phonemic contrasts illustrated through Arabic minimal pairs.

A documentation and data-extraction matrix was used to maintain consistency in recording information from different sources. The matrix included the name of the letter and its traditional articulation point, its principal *ṣifāt*, its corresponding IPA symbol, its modern articulatory description, and an illustrative minimal pair with its lexical meaning. Particular attention was given to the distinction between normative descriptions in traditional tajwīd literature and phonetic realizations documented in modern linguistic studies. This

procedure followed the principles of document analysis, in which relevant information is according to the research questions (Bowen, 2009).

5. Validity and Trustworthiness

The trustworthiness of the analysis was maintained through source triangulation by comparing information obtained from classical Arabic works, modern phonetics and phonology references, and empirical journal articles. This comparison was intended to reduce dependence on a single theoretical perspective and identify agreements or differences among the sources. The interpretation of documents also considered their publication context, theoretical orientation, and relevance to the research objectives (Creswell & Poth, 2018).

When traditional and modern descriptions differed, the two perspectives were maintained separately rather than forced into an identical classification. Traditional descriptions were treated as normative references for the articulation of letters in tajwīd, whereas modern phonetic descriptions were used to explain their observed phonetic realizations. This distinction was particularly important for qāf (ق), ṭā' (ط), and ḍād (ض), whose descriptions may differ according to theoretical orientation and dialectal realization. When modern sources presented different realizations, the analysis identified the commonly reported representation and acknowledged relevant variations. The meanings of the selected minimal pairs were also checked against Arabic lexical references to ensure that the examples represented meaningful phonemic distinctions. The analysis further maintained consistency in the use of transliteration, IPA symbols, and phonetic terminology throughout the study.

6. Data Analysis Technique

Data analysis was conducted through a descriptive-analytical and comparative-integrative procedure consisting of five stages. First, the traditional concepts of *makhraj* and *ṣifāt* were identified and classified based on the selected classical Arabic sources. This stage established the traditional articulatory characteristics of each selected letter. Second, the identified characteristics were compared with modern phonetic categories, particularly place of articulation, manner of articulation, voicing, and secondary articulation. The comparison focused on establishing conceptual correspondences while identifying differences between traditional descriptions and contemporary phonetic interpretations.

Third, each selected letter was represented using its corresponding IPA symbol based on modern descriptions of Arabic consonants. Fourth, the phonemic function of each letter

was examined through illustrative Arabic minimal pairs. The examples were selected to demonstrate how differences in consonant articulation could distinguish lexical meanings, with particular attention to contrasts involving guttural, emphatic, and other selected consonant categories. Fifth, the findings from the preceding stages were synthesized into an integrated mapping table connecting the traditional articulation point, distinctive letter characteristics, IPA representation, and phonemic function. This analytical process involved the organization of relevant information, comparison of conceptual categories, interpretation of linguistic relationships, and synthesis of findings into a coherent framework. The procedure was informed by qualitative data analysis principles involving data organization, display, interpretation, and conclusion development (Creswell & Clark, 2017; Krippendorff, 2018; Miles et al., 2014).

7. Ethical Considerations, Research Time, and Location

This study involved no human participants, personal data, or direct field observations because all research materials were obtained from published scholarly sources and classical literature. Therefore, formal ethical clearance involving human participants was not required. Academic integrity was maintained by acknowledging all sources through appropriate in-text citations and reference-list entries. The research was conducted through library-based activities during the preparation of the manuscript in 2026, without a specific geographical field site. The findings were interpreted within the limitations of the selected literature and the fourteen hijaiyah letters examined in this study.

RESULTS

1. Traditional Concepts of *Makhārij al-ḥurūf*

In the traditional Arabic scholarly framework, *makhraj* refers to the specific point or region from which a letter originates during speech production. The classification commonly adopted in tajwīd divides the articulation system into five principal regions: the oral cavity (*al-jawf*), the throat (*al-ḥalq*), the tongue (*al-lisān*), the two lips (*ash-shafatayn*), and the nasal cavity (*al-khayshūm*), which are further differentiated into seventeen articulation points (Ibn al-Jazari, 2001). This classification represents a systematic description of the physical origins of Arabic sounds and provides a foundation for distinguishing letters with similar articulatory locations.

The throat region (*al-ḥalq*) is particularly relevant to the present study because it contains six letters divided into three articulation areas. The deepest part of the throat (*aqṣā al-ḥalq*) produces hamzah (ء) and hā' (ه), the middle part (*wasaṭ al-ḥalq*) produces 'ayn (ع) and ḥā' (ح), while the upper part (*adnā al-ḥalq*) produces ghayn (غ) and khā' (خ). This classification reflects the articulatory distinctions established in classical Arabic linguistic works, particularly those of Sibawayh (1988) and Ibn Jinni (2000). These scholars systematically described Arabic letters according to their articulation points and phonetic characteristics, establishing an important foundation for subsequent developments in Arabic phonetic studies.

The articulation of the tongue (*al-lisān*) involves several regions, including the tongue tip, tongue edges, middle tongue, and back tongue. These regions produce different consonants according to their contact or approximation with the upper teeth, alveolar ridge, hard palate, and soft palate. The selected letters in this study also include labiodental articulation, represented by fā' (ف), and dental articulation, represented by thā' (ث) and ẓā' (ظ). Consequently, the traditional classification provides a detailed articulatory framework for examining the selected letters according to their physical points of production.

2. Traditional Concepts of *Ṣifāt al-ḥurūf*

In addition to articulation points, every Arabic letter possesses distinctive characteristics known as *ṣifāt al-ḥurūf*. These characteristics describe the manner and qualities accompanying the production of each letter. According to Ibn al-Jazari (2001), fulfilling the articulation point and inherent characteristics of a letter constitutes an essential requirement for accurate recitation. Therefore, two letters originating from relatively similar articulatory regions may still be distinguished through their different *ṣifāt*.

In traditional tajwīd classification, the characteristics of Arabic letters are generally divided into two categories: opposing characteristics and non-opposing characteristics. Opposing characteristics include *jahr* and *hams*, *shiddah* and *rakhāwah*, with *tawassuṭ* occupying an intermediate position, as well as *isti'lā'* and *istifāl*, and *iṭbāq* and *infitāḥ*. Non-opposing characteristics include *ṣafīr*, *qalqalah*, *līn*, *inḥirāf*, *takrīr*, *tafashshī*, *istiṭālah*, and *ghunnah*. Each characteristic contributes to the identification and differentiation of Arabic letters.

The selected letters demonstrate how these characteristics distinguish consonants that may share similar articulation points. For example, hamzah (ء) is characterized by *jahr* and *shiddah*, whereas hā' (ه) is characterized by *hams* and *rakhāwah*. Similarly, the emphatic consonants ṣād (ص), ṭā' (ط), ḍād (ض), and ẓā' (ظ) are characterized by *isti'lā'* and *iṭbāq*, distinguishing them from their non-emphatic counterparts. These classifications demonstrate that the articulation point alone is insufficient to explain the complete phonetic identity of an Arabic letter.

3. Correspondence Between Traditional and Modern Phonetic Categories

The comparison between traditional Arabic phonetic terminology and modern articulatory phonetics reveals several conceptual correspondences. First, *makhraj* corresponds broadly to the modern concept of place of articulation, which identifies the location in the vocal tract where constriction or closure occurs during speech production (Ladefoged & Johnson, 2011). Accordingly, the traditional classification of the throat region can be interpreted through three modern articulatory locations: glottal, pharyngeal, and uvular. Hamzah (ء) and hā' (ه) are associated with glottal articulation, 'ayn (ع) and ḥā' (ح) with pharyngeal articulation, while khā' (خ) and ghayn (غ) are commonly associated with uvular articulation, although velar realizations are also reported in certain dialects.

Second, *ṣifāt al-ḥurūf* correspond to several dimensions of modern phonetic description, including voicing, manner of articulation, and secondary articulation. The traditional distinction between *jahr* and *hams* can be related to the distinction between voiced and voiceless sounds, although the correspondence is not universally exact, particularly for certain consonants such as glottal stops. Similarly, *shiddah* and *rakhāwah* broadly correspond to the distinction between stops and continuants, particularly fricatives. The intermediate characteristic *tawassuṭ* describes sounds that are neither fully stopped nor continuously flowing in the traditional classification.

The characteristics of *isti'lā'* and *iṭbāq* are particularly relevant to the analysis of emphatic consonants. These characteristics involve raising and retracting the tongue configuration, producing a secondary articulatory effect commonly associated with pharyngealization in modern phonetics. However, the two traditional characteristics should

not be treated as exact equivalents of pharyngealization. *Iṭbāq* is more closely associated with the emphatic series, whereas *isti'lā'* also characterizes non-emphatic consonants such as khā' (خ), ghayn (غ), and qāf (ق).

Other traditional characteristics also have corresponding descriptive dimensions in modern phonetics. *Ṣafīr* is associated with sibilant sound characteristics, *ghunnah* with nasality, *takrīr* with trilling, and *inḥirāf* with lateral or lateral-like articulation. Meanwhile, *qalqalah* concerns a particular release characteristic of specified stop consonants in tajwīd. These correspondences provide a conceptual bridge between traditional Arabic phonetic knowledge and contemporary linguistic terminology without assuming that both systems employ identical theoretical categories.

4. Supporting Findings: Phonological Concepts and the Arabic Sound System

Phonetics and phonology provide complementary perspectives for understanding the characteristics of Arabic letters. Phonetics examines how speech sounds are physically produced and perceived, whereas phonology examines how sounds function within a linguistic system. A phoneme represents a sound unit capable of distinguishing meaning, while phonetic variations that do not create a change in meaning may be classified as allophonic realizations (Ladefoged & Johnson, 2011). In Arabic, this distinction can be illustrated through minimal pairs, in which two words differ in only one phonemic element.

For example, the words /qalb/ (heart) and /kalb/ (dog) differ in the initial consonants /q/ and /k/. Similarly, /ʕamal/ (work) and /ʔamal/ (hope) demonstrate a contrast between the pharyngeal consonant /ʕ/ and the glottal consonant /ʔ/. These examples illustrate that articulatory differences may carry phonological significance because the substitution of one consonant for another can produce a different lexical meaning. Consequently, the accurate identification of articulation points and distinctive characteristics is relevant not only to phonetic description but also to the preservation of meaning in Arabic communication.

The consonantal system of Standard Arabic comprises twenty-eight consonant phonemes, which can be classified according to their articulatory locations and manners of articulation. The system includes labial, dental, alveolar, palatal, palato-alveolar, velar, uvular, pharyngeal, and glottal consonants. Among these categories, pharyngeal and uvular consonants, dental fricatives, and emphatic consonants represent particularly distinctive

features of Arabic when compared with Indonesian. Their articulatory properties require careful examination because some of these distinctions are not systematically represented in the Indonesian consonant inventory (Watson, 2002).

The vowel system of Standard Arabic consists of three short vowels, /a/, /i/, and /u/, and their corresponding long vowels, /aː/, /iː/, and /uː/. Arabic also contains two diphthongs, /aw/ and /aj/. Unlike a purely phonetic variation in vowel duration, vowel length in Arabic may distinguish lexical meaning. For instance, /ʕālam/ (world) and /ʕalam/ (flag) differ in the length of the initial vowel. Research on Qatari Arabic further indicates that long and short vowels may differ not only in duration but also in vowel quality, as long vowels tend to occupy more peripheral positions in the vowel space than short vowels (Al-Mazrouei et al., 2024). Although vowel length is not the primary focus of the present mapping, its phonemic function illustrates the broader importance of articulatory and phonological distinctions in Arabic.

5. Reported Pronunciation Errors in Previous Studies

Previous studies involving Indonesian learners have reported pronunciation difficulties involving several Arabic consonant categories, particularly guttural and emphatic sounds. Subhi and Mursidin (2026), for example, identified substitution errors involving the pharyngeal consonants ‘ayn (ع) and ḥā’ (ح), which were replaced by glottal sounds in the pronunciation of learners. These findings demonstrate that consonants originating from different regions of the throat may be perceived as similar by learners who have not fully mastered their articulatory distinctions.

Similar patterns have been reported in other educational contexts. Musthofa et al. (2024) identified phonetic changes involving ghayn (غ), khā’ (خ), ‘ayn (ع), and hā’ (ه) among students at an Islamic boarding school in Yogyakarta. Kosim et al. (2024) also documented pronunciation errors involving hamzah (ء), fā’ (ف), and shīn (ش) among Iqra learners, as well as qāf (ق), fā’ (ف), and ‘ayn (ع) among students learning Qur'anic recitation. Furthermore, Kosim et al. (2023) reported 426 pronunciation errors in Arabic conversation among seventh-grade students at an Islamic boarding school in Bandung, with 47.89% occurring in the throat articulation region and 40.14% in the tongue articulation region.

Additional findings were reported by Kamal and Maria (2025), who identified difficulties involving throat and emphatic consonants among Arabic language education students. Their findings included substitutions in which pharyngeal consonants were realized as glottal consonants, dental sounds were replaced by alveolar sounds, and emphatic consonants were pronounced as their non-emphatic counterparts. These findings are consistent with the broader observation that differences between the Indonesian and Arabic phonological systems may influence the pronunciation of Arabic consonants (Nailurrahmi & Marlina, 2025). A systematic literature review by Mohamed et al. (2024) similarly emphasized the importance of introducing accurate articulatory knowledge from the early stages of Arabic pronunciation learning.

Nevertheless, the reported errors should not be interpreted as evidence that all learners experience identical difficulties. The findings originate from different educational settings, learner populations, and pronunciation tasks. Their relevance to the present study lies primarily in identifying consonants and articulatory categories that require further conceptual examination. Accordingly, these studies provide a basis for selecting the fourteen letters examined in the integrated mapping rather than establishing the empirical frequency of errors in the present research.

6. Integrated Mapping of Makhraj, Ṣifāt, IPA, and Phonemic Contrasts

The integrated mapping constitutes the central finding of this study. It connects the traditional articulation points and characteristics of fourteen selected hijaiyah letters with their corresponding IPA representations and illustrative phonemic contrasts. The selection includes eleven letters reported as problematic in previous Indonesian learner studies, two additional letters completing the emphatic consonant series, and one dental fricative used as a comparative example.

Table 2. Integrated Mapping of Makhraj, Ṣifāt, IPA, and Phonemic Contrasts

Letter	Traditional makhraj	Main *ṣifāt*	IPA and modern description	Illustrative minimal pair
ء	*Aqṣā al-ḥalq*	Jahr, shiddah, *istifāl*	[ʔ] Glottal stop	عمل (hope) – أمل (work)
ه	*Aqṣā al-ḥalq*	Hams, *rakhāwah*, *istifāl*	[h] Voiceless glottal fricative	عمّ (anxiety) – همّ (paternal uncle)
ع	*Wasaṭ al-ḥalq*	Jahr, *tawassuṭ*, *istifāl*	[ʕ] Voiced pharyngeal fricative	أمل (work) – عمل (hope)

Letter	Traditional makhraj	Main *ṣifāt*	IPA and modern description	Illustrative minimal pair
ح	*Wasaṭ al-ḥalq*	Hams, *rakhāwah*, *istifāl*	[ħ] Voiceless pharyngeal fricative	حرم (sanctuary) – هرم (pyramid)
خ	*Adnā al-ḥalq*	Hams, *rakhāwah*, *isti'lā'*	[χ] or [x] Voiceless uvular/velar fricative	خلّ (vinegar) – حلّ (solution)
غ	*Adnā al-ḥalq*	Jahr, *rakhāwah*, *isti'lā'*	[ʁ] or [ɣ] Voiced uvular/velar fricative	غالي (expensive) – عالي (high)
ق	Back of the tongue and soft palate	Jahr, shiddah, *isti'lā'*, qalqalah	[q] Voiceless uvular stop	قلب (heart) – كلب (dog)
ف	Upper incisors and inner lower lip	Hams, *rakhāwah*, *istifāl*	[f] Voiceless labiodental fricative	فرّ (fled) – برّ (was dutiful)
ش	Middle of the tongue and hard palate	Hams, *rakhāwah*, *istifāl*, *tafashshī*	[ʃ] Voiceless palato-alveolar fricative	شهر (month) – سهر (staying up at night)
ص	Tongue tip and incisors	Hams, *rakhāwah*, *isti'lā'*, *iṭbāq*, *ṣafīr*	[sˤ] Voiceless emphatic alveolar fricative	صيف (summer) – سيف (sword)
ط	Tongue tip and upper gum ridge	Jahr, shiddah, *isti'lā'*, *iṭbāq*, qalqalah	[tˤ] Emphatic alveolar stop	طين (clay) – تين (fig)
ض	Side of the tongue and molars	Jahr, *rakhāwah*, *isti'lā'*, *iṭbāq*, *istiṭālah*	[dˤ] Voiced emphatic stop	ضلّ (went astray) – دلّ (guided)
ظ	Tongue tip and upper incisors	Jahr, *rakhāwah*, *isti'lā'*, *iṭbāq*	[ðˤ] Voiced emphatic dental fricative	ظلّ (became humiliated) – ذلّ (remained)
ث	Tongue tip and upper incisors	Hams, *rakhāwah*, *istifāl*	[θ] Voiceless dental fricative	ثار (rose up) – سار (walked)

Source: Synthesized from Ibn al-Jazari (2001), Ladefoged and Johnson (2011), Watson (2002), and the phonetic descriptions discussed in this study.

The mapping demonstrates that the articulation point and distinctive characteristics provide complementary information for identifying Arabic consonants. The throat consonants, for example, are differentiated through their specific articulatory locations. Hamzah (ء) and 'ayn (ع) originate from different regions of the throat and have distinct phonetic realizations, namely [ʔ] and [ʕ]. Their contrast is illustrated through the words أمل

and عمل, which demonstrate how replacing one consonant with another can produce a different lexical meaning.

The emphatic consonants also demonstrate the importance of secondary articulation in distinguishing phonological categories. Ṣād (ص), ṭā' (ط), ḍād (ض), and ẓā' (ظ) possess characteristics associated with *isti'lā'* and *iṭbāq*, distinguishing them from their non-emphatic counterparts. Their contrasts can be illustrated through صيف–سيف, طين–تين, ضلّ–دلّ, and ظلّ–ذلّ. These examples demonstrate that the distinction between emphatic and non-emphatic consonants is not merely an articulatory variation but may also function as a meaning-distinguishing contrast.

Other letters demonstrate that phonemic distinctions may depend primarily on their places or manners of articulation. Qāf (ق), for instance, differs from kāf (ك) through its uvular and velar articulation, respectively, while thā' (ث) differs from sīn (س) through dental and alveolar articulation. Meanwhile, fā' (ف) and shīn (ش) illustrate that pronunciation difficulties cannot always be explained solely by the absence of a particular sound in Indonesian. Both sounds have counterparts in Indonesian phonetic inventories, yet pronunciation errors involving these letters have still been documented in previous studies. Thus, the mapping provides a descriptive basis for examining the articulatory and phonological properties of selected letters without assuming that all pronunciation difficulties originate from the same cause.

7. Divergent Findings and Phonetic Anomalies

Several differences between traditional classifications and modern phonetic descriptions require careful interpretation. One important divergence concerns the classification of qāf (ق) and ṭā' (ط) as *jahr* letters in the traditional framework, whereas modern descriptions generally represent their common realizations as voiceless stops [q] and [tˤ]. This distinction indicates that traditional *jahr* and modern phonetic voicing do not always correspond directly. In certain Arabic dialects, the production of these consonants may

involve different laryngeal characteristics, making it necessary to distinguish normative tajwīd classifications from the actual phonetic realization of speakers.

A similar divergence occurs in the description of ḍād (ض). Traditional Arabic phonetic descriptions characterize this letter through *rakhāwah* and *istiṭālah*, emphasizing its distinctive articulation along the side of the tongue. However, modern descriptions frequently represent its common realization as a voiced emphatic stop [dˤ]. This difference reflects historical and dialectal variation in the realization of Arabic consonants and demonstrates why traditional classifications should not automatically be interpreted as direct descriptions of every contemporary dialect.

The emphatic consonant ṭā' (ط) also illustrates the importance of dialectal variation. In Qatari Arabic, [tˤ] is realized as a voiceless unaspirated stop (Kulikov, 2022). In Khuzestani Arabic, the guttural stops /tˤ/ and /q/ are reported to lack voiced counterparts at the same places of articulation, indicating that their laryngeal characteristics require a more nuanced phonological interpretation (Bahrani & Kulikov, 2024). These findings demonstrate that the relationship between traditional articulatory characteristics and modern phonetic categories is not always one-to-one.

For this reason, the integrated mapping presents commonly reported phonetic realizations while acknowledging relevant differences among dialects and theoretical descriptions. The table should therefore be interpreted as a comparative conceptual representation rather than an exhaustive account of all possible Arabic consonant realizations. This distinction is essential to maintaining the analytical accuracy of the study and avoiding the generalization of one dialect's phonetic characteristics to the entire Arabic language.

DISCUSSION

1. Integration of Traditional Arabic Phonetics and Modern Articulatory Phonetics

The integration of traditional Arabic phonetic knowledge and modern articulatory phonetics demonstrates that both approaches provide complementary perspectives for understanding the production of Arabic speech sounds. In the traditional framework, *makhārij al-ḥurūf* identifies the articulation points of individual letters, while *ṣifāt al-ḥurūf*

describes their distinctive articulatory characteristics (Ibn al-Jazari, 1985; Rangkuti et al., 2025; Zainuddin et al., 2026). These concepts share a fundamental concern with the physical production and differentiation of speech sounds with modern articulatory phonetics, which classifies consonants according to their place and manner of articulation, voicing, and secondary articulatory features (Ladefoged & Johnson, 2011). The relationship between these approaches indicates that traditional Arabic phonetic classifications can be interpreted through contemporary linguistic terminology, providing a broader analytical perspective on the Arabic consonantal system. Nevertheless, this integration should be understood as a conceptual correspondence rather than an absolute equivalence between two theoretical traditions.

The correspondence between makhraj and place of articulation illustrates one of the clearest connections between the two frameworks. Traditional descriptions divide the throat region (al-ḥalq) into three articulatory areas: its deepest, middle, and upper sections. Modern phonetics provides more specific anatomical and articulatory descriptions by distinguishing glottal, pharyngeal, and uvular locations. This distinction is particularly relevant to the letters ح ,ع ,ء, and ه. Embarki (2013) explains that classical Arabic phonetic descriptions can be examined alongside modern experimental phonetics to understand the articulation and variation of Arabic consonants. Similarly, Watson (2002) demonstrates that the Arabic consonantal system involves articulatory distinctions that are essential for describing its phonological organization. These perspectives support the interpretation that traditional makhraj classifications provide an important foundation for modern articulatory analysis, although the anatomical precision and terminology employed by contemporary phonetics offer additional descriptive dimensions.

A similar relationship can be identified between ***ṣifāt al-ḥurūf*** and the articulatory features used in modern phonetic analysis. Traditional characteristics such as *jahr, hams, shiddah, rakhāwah, isti'lā',* and *iṭbāq* describe different aspects of consonant production that can be examined through voicing, manner of articulation, and secondary articulation. However, these correspondences require careful interpretation because traditional categories do not always represent the same phonetic properties as their modern counterparts. This distinction is particularly evident in guttural and emphatic consonants. Ariyaee et al. (2024) demonstrated that guttural fricatives in Arabic and related languages exhibit acoustic differences associated with their articulatory locations, supporting the importance of

distinguishing consonants within the throat region. These findings suggest that the traditional classification of letter characteristics can be further understood through modern phonetic analysis, while differences in theoretical orientation and actual sound realization must remain explicitly acknowledged.

Taken together, the findings establish that traditional Arabic phonetic knowledge and modern articulatory phonetics should be treated as complementary analytical frameworks rather than competing systems. The traditional concepts of makhārij and ṣifāt provide a structured account of letter articulation within the Arabic scholarly tradition, whereas modern phonetics offers more explicit descriptions of articulatory mechanisms and phonetic realizations (Rabbaniyah & Halil, 2026; Rizqullah & Ekafitrianda, 2026; Safariah, 2026). Their integration therefore provides a conceptual basis for connecting the articulation point, distinctive sound characteristics, and phonetic representation of individual Arabic letters. In the context of the present study, this relationship is particularly important because the integrated mapping does not merely translate traditional terminology into modern categories; it also identifies the areas in which the two frameworks correspond and those in which their descriptions differ. Consequently, the integration contributes to a more systematic understanding of Arabic consonants and establishes a theoretical foundation for examining their phonemic contrasts in subsequent analysis.

2. Phonemic Contrasts and Articulatory Distinctions in Arabic Consonants

The findings indicate that articulatory distinctions among Arabic consonants are closely related to their phonemic functions, particularly when two sounds differ in their places or manners of articulation. This relationship can be observed in the contrast between the glottal consonant and the pharyngeal consonant, represented by the letters ء and ع, respectively (Aghanimi, 2026; Wilyam et al., 2025). Although both sounds originate from the throat region, they involve different articulatory mechanisms and consequently represent distinct phonemes. This distinction is illustrated by the Arabic words أَمَلٌ (hope) and عَمَلٌ (work), in which replacing one initial consonant with another changes the lexical meaning. Ryding (2014) explains that phonemic contrasts in Arabic can be identified through minimal pair analysis, whereby differences in a single sound establish the distinctive function of individual phonemes. The importance of this distinction is also supported by Nese (2023), who examined the acquisition of Arabic pharyngealized, pharyngeal, and uvular consonants

among Italian learners and identified differences in their perception and production. These findings suggest that understanding Arabic consonants requires attention not only to their general articulatory regions but also to the specific articulatory properties that establish phonemic distinctions.

The distinction between emphatic and non-emphatic consonants provides another significant example of the relationship between articulatory characteristics and phonological contrasts. Arabic emphatic consonants, including /sˤ/, /tˤ/, /dˤ/, and /ðˤ/, involve secondary articulatory gestures that distinguish them from their plain counterparts. Their production requires coordination between the primary coronal articulation and a secondary constriction involving the pharyngeal or uvular region. Aldamen and Al-Deaibes (2023) demonstrated that emphatic consonants produced by English-speaking learners exhibit acoustic characteristics that differ from their non-emphatic counterparts, particularly in vowel formant frequencies and voice onset time. Similarly, Haimeur (2025) reported difficulties among English-speaking learners in perceiving and producing Arabic emphatic and pharyngeal phonemes, with several sounds being replaced by phonetically similar consonants. More recent evidence from Alkhudidi et al. (2026) indicates that the production of plain–emphatic contrasts develops gradually and involves both consonantal and vocalic acoustic cues. These findings demonstrate that emphatic consonants cannot be adequately described merely as thicker or heavier sounds; their phonological identity involves coordinated articulatory and acoustic properties that distinguish them from non-emphatic consonants.

The use of minimal pairs in the present study provides a systematic way to illustrate how articulatory differences contribute to meaning-distinguishing functions. Examples such as صَيْفٌ(summer) and سَيْفٌ(sword), طِينٌ(clay) and تِينٌ(fig), as well as قَلْبٌ(heart) and كَلْبٌ(dog), demonstrate how differences in individual consonants can produce different lexical meanings. These examples also represent distinct articulatory contrasts, including emphatic versus non-emphatic articulation and uvular versus velar articulation. Kfoury et al. (2026) further demonstrated that the perception and production of Arabic pharyngeal fricatives among non-native learners can be improved through targeted training, highlighting the importance of distinguishing sounds that are not present in learners' first-language phonological systems. Taken together, these findings support the argument that Arabic

pronunciation analysis should consider three interconnected dimensions: the precise location of articulation, the distinctive articulatory characteristics of each consonant, and its capacity to preserve phonemic contrasts (Mahendra et al., 2026). Accordingly, the integrated mapping developed in this study provides a conceptual framework for explaining why certain articulatory substitutions may affect lexical meaning. Nevertheless, because the minimal pairs presented here serve as illustrative linguistic examples rather than experimentally tested learner productions, their function is limited to demonstrating phonemic contrasts rather than establishing actual pronunciation error rates.

3. Comparison with Previous Phonetic and Phonological Studies

Previous studies have examined Arabic pronunciation difficulties from different linguistic and educational perspectives, particularly concerning articulatory errors and phonological interference among non-native learners. Nafiah et al. (2024) analyzed phonological errors in Arabic speech videos produced by students at MAPK Solo using content analysis and listening techniques. Their findings identified substitutions involving letters such as ض ,ك ,أ ,ق ,ع, and ظ, indicating that learners frequently experience difficulties distinguishing sounds with different articulatory characteristics. Similarly, Musthofa et al. (2024) investigated phonological errors among students at the Fathul Huda Islamic Boarding School in Yogyakarta through interviews, observations, and documentation. Their study identified phonetic changes involving ع ,خ ,غ, and ه, as well as phoneme deletion and addition in Arabic word production. Both studies demonstrate that pronunciation difficulties involve more than individual articulation mistakes because substitutions and deletions may affect the phonological structure and meaning of words.

Further empirical evidence is provided by Kosim et al. (2023), who investigated mispronunciation of *makhārij al-ḥurūf* during Arabic conversation learning among students at Pondok Pesantren Babussalam in Bandung. Their study identified pronunciation errors associated with insufficient understanding of articulation points, limited awareness of differences between Indonesian and Arabic sounds, inadequate teacher correction, and insufficient pronunciation practice. The findings demonstrate that articulatory accuracy remains a significant challenge even in conversational learning environments. More recently, Rofiq et al. (2026) examined makhraj and tasydid pronunciation errors among fifth-grade students at SDIT As-Sabiquun. Using a descriptive-analytic approach supported by

pronunciation tests, classroom observations, and questionnaires, the researchers identified substitutions involving س and ح ,ش and أ ,خ and ع, as well as ك and ق. Their findings also highlighted the influence of mother-tongue habits, insufficient practice, and limited exposure to Arabic reading activities. These studies collectively demonstrate that articulatory similarities and differences between Indonesian and Arabic phonological systems are important considerations in understanding pronunciation errors.

Table 3. Comparative Review of Previous Studies on Arabic Phonological Errors

Previous study	Research focus and method	Main findings	Relevance to present study
Nafiah et al. (2024)	Phonological errors in Arabic speech videos; content analysis and listening techniques	Identified substitutions involving ض ,ك ,أ ,ق ,ع, and ظ, influenced by first-language habits and limited articulation mastery	Demonstrates the relationship between articulatory substitutions and phonological errors
Musthofa et al. (2024)	Pronunciation errors of hijaiyah letters at an Islamic boarding school; qualitative descriptive research	Identified changes involving ع ,خ ,غ, and ه, as well as phoneme deletion and addition	Supports the importance of examining individual articulation points and distinctive letter characteristics
Kosim et al. (2023)	Mispronunciation of *makhārij al-ḥurūf* in Arabic conversational learning; descriptive research	Identified difficulties associated with insufficient makhraj knowledge, first-language differences, limited teacher correction, and inadequate practice	Provides empirical support for integrating articulatory knowledge into Arabic pronunciation analysis
Rofiq et al. (2026)	Makhraj and tasydid errors among elementary students; descriptive-analytic research	Identified substitutions involving س–ش, ح–خ, أ–ع, and ك–ق, with insufficient practice and mother-tongue influence as contributing factors	Demonstrates the importance of articulatory distinctions between phonetically similar letters

Source: Nafiah et al. (2024), Musthofa et al. (2024), Kosim et al. (2023), and Rofiq et al. (2026).

The synthesis of the four studies reveals three important patterns. First, pronunciation difficulties frequently involve consonants whose articulatory characteristics differ from those familiar to Indonesian learners, particularly pharyngeal, uvular, emphatic, and other consonants requiring specific articulatory control. Second, previous studies primarily focus on identifying pronunciation errors, determining their frequency, and examining the factors influencing learner performance. Third, although these studies provide

empirical evidence concerning Arabic pronunciation difficulties, they generally examine particular learner populations or selected consonant categories rather than integrating traditional *makhārij al-ḥurūf* and *ṣifāt al-ḥurūf* with modern phonetic representations and phonemic contrasts in a single analytical framework. The present study addresses this conceptual gap by developing an integrated mapping of fourteen selected hijaiyah letters through their traditional articulation points, distinctive characteristics, IPA representations, and illustrative minimal pairs. Therefore, its contribution is not to replace previous empirical investigations but to provide a complementary theoretical framework that can explain the articulatory and phonological distinctions underlying the pronunciation patterns identified in those studies.

1. Theoretical and Pedagogical Implications of the Integrated Mapping

The integrated mapping developed in this study offers a theoretical contribution by connecting traditional Arabic phonetic classifications with modern articulatory and phonological descriptions. By combining *makhārij al-ḥurūf*, *ṣifāt al-ḥurūf*, IPA transcription, and minimal pairs, the framework provides a structured representation of the relationship between the physical production of consonants and their meaning-distinguishing functions. This integration is consistent with the broader principles of pronunciation instruction, which emphasize the importance of understanding the relationship between speech production, perception, and linguistic communication (Celce-Murcia et al., 1996). Derwing & Munro (2015) further emphasize that pronunciation research and instruction should be grounded in evidence concerning phonetic learning processes and intelligibility rather than focusing exclusively on the imitation of native-speaker accents. In this context, the present mapping contributes a conceptual framework for examining Arabic consonants through both traditional articulatory knowledge and contemporary phonetic representation. It also provides a basis for future research investigating the relationship between articulatory accuracy, acoustic realization, and phonemic distinctions in Arabic.

From a pedagogical perspective, the mapping can serve as a conceptual reference for organizing Arabic pronunciation instruction according to the specific characteristics of individual letters. Teachers can use the articulation points to explain where a sound should be produced, the distinctive characteristics to describe how it should be articulated, and IPA representations to provide a standardized phonetic reference. Minimal pairs can subsequently illustrate how replacing one consonant with another may change lexical meaning. This

approach is particularly relevant to Indonesian learners when studying distinctions such as ع and ح ,ء and ه, or ص and س. Haryadi & Marlina (2025) highlighted the importance of phonetic and visual strategies in teaching *makhārij al-ḥurūf*, particularly for consonants that do not have direct equivalents in Indonesian phonology. Similarly, Faturohman et al. (2026) examined teachers' perceptions and practices concerning the integration of tajwīd and 'ilm al-aṣwāt in Arabic pronunciation instruction, highlighting the relevance of connecting traditional recitation knowledge with modern phonetic perspectives. These findings support the pedagogical relevance of an integrated approach, although the present study itself does not measure instructional effectiveness or learner improvement.

Furthermore, the integrated mapping provides a conceptual basis for developing a three-stage diagnostic perspective for examining Arabic pronunciation differences. The first stage identifies whether a pronunciation substitution involves a shift in the articulation point (makhraj). The second stage examines whether the substitution involves a change in distinctive articulatory characteristics (ṣifāt), including voicing, manner of articulation, or emphasis. The third stage determines whether the resulting substitution affects a phonemic contrast and potentially changes lexical meaning. This sequence is consistent with the principles of evidence-based pronunciation instruction, which emphasize the importance of identifying relevant pronunciation features and prioritizing those that influence intelligibility (Thomson & Derwing, 2015; Levis, 2018). Accordingly, the proposed framework moves beyond a general classification of pronunciation as correct or incorrect by identifying the specific linguistic dimensions involved in a sound substitution. Nevertheless, the three-stage perspective remains a conceptual proposal rather than a validated diagnostic instrument. Its practical effectiveness requires further investigation through classroom implementation, pronunciation assessments, and acoustic analysis involving Arabic learners.

CONCLUSION

This study examined the relationship between traditional Arabic phonetic classifications and modern articulatory-phonological concepts through an integrated mapping of fourteen selected hijaiyah letters. The findings demonstrate that *makhārij al-ḥurūf* and *ṣifāt al-ḥurūf* provide a systematic foundation for understanding the articulation points and distinctive characteristics of Arabic consonants. Their correspondence with modern

phonetic categories, including place of articulation, manner of articulation, voicing, and secondary articulation, offers a broader perspective for explaining the phonetic properties of individual letters. However, these traditional and modern classifications are not always equivalent, particularly in the interpretation of certain articulatory characteristics and their actual phonetic realizations.

The principal contribution of this study lies in integrating four analytical components: traditional articulation points, distinctive letter characteristics, IPA representations, and phonemic contrasts illustrated through Arabic minimal pairs. This mapping demonstrates that articulatory differences are not merely physical variations but may also function as meaning-distinguishing features in the Arabic consonantal system. Furthermore, the findings provide a conceptual foundation for understanding pronunciation difficulties reported in previous studies, particularly those involving guttural, emphatic, and other consonants that require specific articulatory control. From a pedagogical perspective, the proposed framework may serve as a reference for organizing Arabic pronunciation instruction and identifying potential pronunciation difficulties through articulation points, distinctive characteristics, and their effects on phonemic contrasts.

Nevertheless, this study is limited to a qualitative analysis of selected literature and fourteen hijaiyah letters. It does not involve direct pronunciation experiments, acoustic measurements, or empirical testing of the proposed mapping among Arabic learners. In addition, variations in the phonetic realization of certain consonants across Arabic dialects indicate that the presented representations should not be generalized to every variety of Arabic. Future research should therefore examine the proposed framework through experimental phonetic analysis, acoustic measurements, and classroom-based investigations involving learners from different linguistic backgrounds. Such investigations would help evaluate the accuracy, practical applicability, and pedagogical effectiveness of the integrated mapping in Arabic phonetics and pronunciation instruction.

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