International Journal of Evaluation and Research in Education (IJERE)
Vol. 13, No. 6, December 2024, pp. 4212~4224
ISSN: 2252-8822, DOI: 10.11591/ijere.v13i6.27467

Pronunciation therapy for deaf students in coping with Arabic letter difficulties

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Article Info

Article history:

Received May 12, 2023
Revised Jul 16, 2024
Accepted Jul 24, 2024

Keywords:

Arabic letter
Arabic difficulties
Deaf students
Pronunciation
Therapy

ABSTRACT

Pronunciation therapy for deaf students is a very important context within the sphere of the Quran learning. Previous investigations in this domain predominantly focused on media and visual approaches, neglecting the discussion of Arabic letter pronunciation therapy (phonetically). Therefore, this research aimed to elucidate various forms of pronunciation therapy designed for deaf students and the underlying factors motivating the use of the therapeutic techniques. This descriptive qualitative research relied on the primary data collected through an investigation conducted at Qotrunnada Islamic Special School (SLB) in Bantul, Yogyakarta, Indonesia. The primary data comprised the diverse methods applied in Arabic letter pronunciation therapy and the determinant factors of articulation disorders. The research subjects were limited to pure deaf students, categorized by age and the length of therapy. Each student exhibited different results of assessment and response to pronunciation therapy. Moreover, data validation was performed through interaction with the school principal as the research team. The results showed that the forms of pronunciation therapy included articulation therapy (phonetically) exercises addressing sound production, as well as interventions targeting attention and behavior for deaf students in coping with Arabic letter difficulties. This contribution would serve as a basic guide in the development of instruments for Arabic letter pronunciation therapy designed for students with special needs.

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1. INTRODUCTION

Previously, the pronunciation of deaf speakers has been perceived as silent, unclear, and difficult to understand [1]. This is because deaf students, who communicate using sign language, are unable to hear and produce sounds accurately due to impairments in articulation and sound production organs [2]. As a result of these articulation difficulties, deaf speakers encounter challenges in language [3], particularly when it comes to pronouncing Arabic letter. The velum (soft palate) in their mouth is unable to close the gap between the nose and the throat, which causes problems with sounds related to the throat [4]. Furthermore, the short

velum in deaf students causes air to always flow into the nasal cavity [5], which produces the "hidden tongue" phenomenon, where the upper part of the glottis encounters no obstacles [6]. This makes it challenging to control the position of the tongue vertically or horizontally. Deaf students require regular and repetitive medical and oral therapy due to hearing impairment, hidden tongue, and throat issues [6], [7]. They learn to redirect their reliance on auditory senses towards their visual faculties to obtain more information, knowledge, and experiences, which are gained predominantly through vision.

Until present, the learning process of deaf students has centered primarily on the Indonesian sign language system (SIBI) and Indonesian sign language (BISINDO). The research on pronunciation of deaf students can be classified into three categories. The first involves the use of media to improve their pronunciation skills, with the understanding that deaf students are primarily visual learners. Therefore, learning media such as authentic objects, replicas, and pictures, as well as the use of picture cards, Arabic letter cards, and Iqra book, is crucial in order to enhance their speaking, pronunciation, communication, and reading abilities [8]–[10]. Pronunciation learning in this context demands increased visual and visuospatial processing from the early visual and parietal cortex. Deaf students acquire auditory language skills through visual motion perception [11] and the use of card-based media to comprehend meaning and read the Quran [12]. The second category involves Quranic learning strategies, such as the visual motion approach of sign language and the vocal sound approach [12], [13]. Teaching through the sign language system has shown considerable efficacy in helping people with disabilities in mastering *makhārijul ḥurūf* (the place where the letters come out when they are pronounced) and reading the Quran correctly [14], [15]. Third, vocal and consonant exercises are utilized to focus on pronunciation of Arabic letter sounds for deaf students, without the need for attention-focused therapy [16], [17].

Fourth, learning with media technology devices that capture sentences (audio) spoken by the general public to be converted into text through speech recognition [18], [19]. Additionally, mobile media and mobile learning focusing on language phonics have been employed [19]. Existing research in this field predominantly focused on media and visual approaches to sign language animation, as well as vocal and consonant processing exercises, ignoring the discussion of Arabic letter pronunciation therapy rooted in the articulation disorders experienced by deaf students. Consequently, a comprehensive exploration of Arabic letter pronunciation therapy based on articulation disorders is limited.

This research aims to elucidate the various forms of Arabic letter pronunciation therapy for deaf students and the factors motivating the use of the therapeutic techniques. The argument presented in this article is that deaf students redirect the function of hearing senses to visual, enabling them to acquire information, knowledge, and experiences, through vision. The oral exercises, articulation therapy and articulation massage can improve the speech of deaf students [20]. The articulation massage starts with the facial muscles, lip muscles, tongue muscles, neck and shoulder girdle muscles [21].

2. METHOD

This article focused on the use of Arabic letter sound pronunciation therapy to improve the auditory and sound control skills of deaf students. There were three main reasons for selecting this topic: i) it had not received much attention in previous research; ii) it could help to solve the problems faced by deaf students; and iii) the therapy, which involved kinesthetic control and body movements, could assist in improving their pronunciation. This research was conducted at the Qotrunnada Islamic Special School (SLB) situated in Bantul, Yogyakarta, Indonesia. Additionally, this location was selected due to its diverse population of deaf students with various age groups, geographical origins, and degrees of hearing impairment. The major focus was specifically provided on pure deaf students categorized by age and length of therapy.

The sample selection was taken based on the number of students whose ages ranged from 15 to 19 years and had received therapy for more than 2 years, totaling 18 students. This sample determination is in accordance with Creswell's opinion [22] that respondents in qualitative research can range from 5 to 22 people [23]. The selected students, aged between 15 and 19 years, originated from various regions, including Yogyakarta, Pati, Bekasi, Mojokerto, Tangerang, Rembang, Gresik, and Bogor. Each exhibited different assessment results and responses to pronunciation therapy, which were validated by the school principal as a pronunciation therapy consultant, in conjunction with the research team.

To improve their pronunciation, deaf students go through therapy, and the AMABA book media is used to help them articulate the sounds of Arabic letters [24]. This learning resource incorporates auditory input, kinesthetic control, and body movements. It introduces Arabic letter sounds in a specific sequence, starting with *Alif*, *Mim*, and *Ba*, which are read from the right side as shown in Figure 1.

This research employed a qualitative method, relying on primary and secondary data. The primary data was collected from the investigation conducted at the Qotrunnada SLB in Bantul, Yogyakarta. The data collected included the forms of learning, Arabic letter sound pronunciation therapy, and the factors that necessitated the therapy. These three therapies were based on the initial assessment of students, who tended

to experience three difficulties, namely: attention deficit, difficulty in pronouncing fricative sounds, and difficulty in regulating breathing during pronunciation. Secondary data were obtained through a comprehensive review of literature, comprising books and journal articles related to Arabic letter learning for deaf students, as well as the use of the achievement indicator book to assess pronunciation.

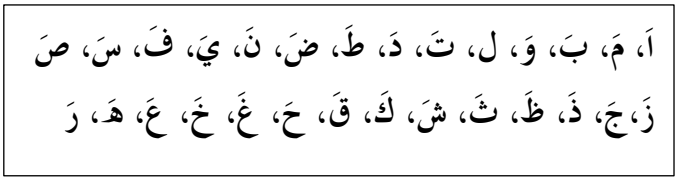

Figure 1. Arabic letter

The instruments used in this research were observation, interviews and group discussions. The validity used in this research is content validity where the instrument will determine the extent to which the instrument items represent the content of the object and reflect the behavioral characteristics that will be measured. Reliability in this instrument is used to determine the consistency or consistency of the instrument which can be used in different research with almost or close to the same results. To ensure validity and reliability, an assessment from experts is needed to ensure that the contents of the instrument are appropriate and appropriate for measuring the data that will be measured [25].

This research involved two parties for data collection, namely: i) informants, consisting of pure deaf students; and ii) class teachers and Arabic letter pronunciation instructors. The research process began with a desk review, field observations, interviews, and focus group discussions (FGDs). Before the investigation, a review was conducted on changes in Arabic letter sound pronunciation among deaf students. Observations were made on pure deaf students with varying disorders and pronunciation therapy, allowing for direct comparison. Interviews were conducted with three teachers (TP, RA, and GL) involved in Arabic letter pronunciation sessions at the research location. TP, the school principal and co-author of this research, served as a validator of Arabic letter sound acquisition data of students. Furthermore, FGDs were held to confirm initial findings regarding pronunciation abilities and therapy of students. The AMABA book served as a central medium for pronunciation therapy, and it offered a comprehensive approach to learning Arabic letter sounds, accompanied by kinesthetic control and body movements [26]. The introduction section for Arabic letter sounds commenced with *Alif*, *Mim*, and *Ba*.

Data collection started with observing and recording pure deaf students while reading the AMABA book, and their reading results were listened to and repeated. In case of any mistakes or difficulties, therapy was provided. Data analysis was conducted in two forms, the first was data reduction from observations and interviews, followed by data presented in the form of summaries and synopses based on data classification results, and data verification for the conclusion process. The second was the technique of understanding, which started with the restatement of the data found from observations and interviews, followed by a description to identify patterns or trends in the data, and concluded with interpretation to reveal the meaning of the collected data.

3. RESULTS

3.1. Pronunciation therapy for deaf students

The ability to develop language is closely related to the hearing capacity of an individual [27]. For deaf students, their speaking abilities differed from those who had normal hearing [7]. During the tactile phase of language and speech development, no obstacles were encountered by students [28]. The moment the speech abilities were developed, their imitation was limited to physical gestures and movements [29]. It was widely believed that reading (writing) was not suitable for the early stages of language development [30]. Additionally, the use of sign language had been criticized for isolating deaf students from the general community [31]. Verbal language was considered the highest and most distinctive form of human language, hence, it needed to be developed and utilized. Deaf students had to learn vocabulary and articulate words with proper and clear pronunciation to acquire language effectively. One essential lesson that required real-life experience was practicing oral articulation and going through the stages of therapy, such as learning Arabic letter sounds.

3.2. Arabic vowels and consonants pronunciation

The human speech organs produced different sounds that were classified into vowels, semivowels, and consonants. Vowels were produced by the vibration of the vocal cords without any constriction in the upper part of the vocal tract [32], making the airflow smooth without any obstacles or difficulties [33]. Arabic vowels consisted of *fatha*, *kasra*, and *damma*, and were characterized by the buzzing created by the pressure on the vocal cords [34]. On the other, consonants were produced by obstructing the airflow at a specific location in the vocal tract above the glottis [35]. This sound was created by the airflow passing through the mouth and being obstructed at various articulation points [34]. Consonants could be explosive, fricative, voiced, or voiceless, and often encountered some form of obstruction in the airflow, whether strong or weak. Some linguists suggested that Arabic letters had 28 consonants [36]. While there was a difference between semivowels and consonants in the scientific realm, they were considered the same in practice. It is important to note that semivowels had both consonant and vowel properties [37].

3.3. Deaf

A person is considered deaf if they have a disorder or damage in one or more of the outer, middle, and inner ear organs, which hinders proper hearing due to disease, accident, or other unknown causes [38], [39]. Deaf individuals can be categorized into two, namely deaf and hard of hearing. It can be further classified into conductive [40], sensorineural [41], conducive [42], [43], perceptual [44], and mixed deafness [45], [46]. Each of the 18 deaf students had unique differences in their initial assessment and the results of pronunciation therapy development. The following entailed a description of the ability of the respondents to pronounce Arabic letters based on their initial pronunciation ability during the assessment before therapy, age, and duration of therapy.

Table 1 provides an overview of the initial Arabic letter sound pronunciation abilities. Six students showed an inability to pronounce any Arabic letter sounds, while eight students could correctly pronounce the [a] sound. Additionally, 2 successfully pronounced the [*wa*] sound, and only 1 (AF) pronounced up to 7 sounds. During the initial assessment, some students exhibited emotional instability, necessitating focused attention and behavior therapy before commencing the pronunciation therapy of Arabic letter sounds. These emotional states comprised a range of behaviors, including tantrums resulting in damage to property and excessive cellphone use (DU), depression (YES), sulking with silence (SA), low self-confidence and prolonged episodes of withdrawn behavior featuring arm folding while sitting (IQ), silence (DI, NA), as well as anger and selfishness (JE, AN, RA, IL, NA, EN, HA).

Table 1. Pronunciation ability of students aged 9-16 years with a therapy length of 80-90 months

No	Length of therapy (months)	Initial and age	Initial pronunciation ability	Letter that is difficult to pronounce/unable to be pronounced well
1	90	EN, 15th	2 sounds (أ, ل)	حَ، غَ
2	88	YA, 16th	1 sound a (أ)	سَ ، شَ ، صَ، فَ، خَ ،غَ، هَ، يَ
3	80	HA, 13th	1 sound a (أ)	كَ، قَ، حَ، غَ، خَ، عَ
4	80	NA, 12th	3 sounds (أ, مَ, بَ)	رَ، قَ
5	80	NA, 9th	0	حَ، خَ، ذَ، زَ، ضَ، ظَ، عَ، غَ
6	54	DI, 12th	0	حَ، خَ
7	32	AF, 17th	7 sounds ظَ زَ، رَ، دَ، تَ، بَ، أَ،	ذَ، زَ، ظَ
8	32	WI, 15th	1 sound (أ)	جَ، دَ، ذَ، زَ، ظَ
9	32	AN, 12th	1 sound (أ)	مَ، يَ
10	15	IL, 12th	0	ثَ، جَ، حَ، خَ، سَ، شَ، صَ، عَ، غَ، قَ، كَ، هَ
11	14	AR, 11th	2 sounds (أ, وَ)	حَ، خَ، عَ، غَ، قَ، كَ، يَ
12	8	CA, 19th	1 sound (أ)	ثَ، جَ، حَ ، خَ، ذَ، رَ، زَ، سَ، شَ، صَ، ظَ، عَ، غَ، فَ، قَ، كَ، يَ
13	8	SA, 16th	1 sound (أ)	ثَ، خَ، ذَ، رَ، زَ، سَ، شَ، صَ، ظَ، عَ، غَ، قَ، كَ
14	8	IQ, 16th	2 sounds (أ, وَ)	جَ ، ذَ
15	8	RO, 13th	1 sound (أ)	ذَ، زَ
16	8	AS, 6th	0	فَ
17	5	RA, 12th	0	ثَ، ذَ، سَ، شَ، صَ، ضَ، طَ، ظَ، عَ، غَ، فَ، قَ، كَ
18	5	JE, 9th	0	ثَ،جَ، حَ، خَ، ذَ، رَ، زَ، شَ، صَ، ضَ، عَ، غَ، فَ، قَ، كَ ، هَ

The initial assessment results concerning the articulation skills of 18 students indicated various challenges: lack of oral skills development (NA, JE, AN, RAIF, IL, EN, AS), chaotic articulation speech

(AY, YES, SA, CA, RO, WI), frequent mumbling (RO, AN, RAIF, EN), imperfect vowel pronunciation and persistent pronunciation through the nasal cavity (DU), and predominant appearance of high tones in pronunciation ending in /u/ and /i/ (AF, SAlSA, CA). Other conditions included stiffness in the speech organs (CA, IQ, HA, DIH, NA, JE, AN, IL, AR, NA, EN, AS), tight closing of the lips (NA), uncoordinated tongue movement (AN, RAIF, NAJ, EN), soft voice and respiratory problems (IL), and entry of sounds into the nose (AR). These showed the necessity for articulation therapy and muscle or nerve flexibility massage. The subsequent sections present a detailed description of the pronunciation therapy for each Arabic letter sound based on pronunciation and articulation points defined by the International Phonetic Alphabet (IPA). Based on Table 1, the students' difficulties in pronunciation of plosive-velar sounds of كَ [*ka*], uvular of قَ [*qa*], fricative – dental of ذَ [*ða*], ثَ [*θa*], fricative-alveolar of سَ [*sa*], زَ [*za*], post alveolar of شَ [*ʃa*], fricative - velar of خَ [*xa*], غَ [*ɣa*], pharyngeal of حَ [*ħa*], glottal هَ [*ha*], trill-alveolar of رَ [*ro*], fricative-pharyngeal of عَ [*ʕa*].

3.3.1. Sound pronunciation therapy of كَ [*ka*]

The كَ [*ka*] sound is produced by closing off the airflow with the soft palate and then releasing it. Deaf students struggled with closing off the airflow or inhibiting the soft palate without the tongue lifting. The pronunciation therapy included the initial opening of the mouth naturally without producing sound. This was followed by gently tapping the palm side of the hand on the middle of the neck and opening the mouth to sound the letter كَ [*ka*] with a stomp. The following sounds of كَ [*ka*] that are difficult to pronounce are explained in Table 2.

Table 2. Pronunciation therapy of كَ [*ka*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	كَ	[*ka*], plosive-velar	HA, IL, AR, CA, SA, RA, JE	7

3.3.2. Sound pronunciation therapy of قَ [*qa*]

The قَ [*qa*] sound is produced by closing off the airflow or inhibiting the pharynx/area behind the tongue. Deaf students had difficulty moving the base of the tongue connected to the soft palate, without breath flow and making the center of the tongue form a concave surface to hold air for subsequent release. The pronunciation therapy included the initial opening of the mouth naturally without sound and gently tapping the palm side of the hand on the middle of the neck, followed by rounding or puffing the lips while sounding قَ [*qa*] with a stomp. The sounds of قَ [*qa*] that are difficult to pronounce are explained in Table 3.

Table 3. Pronunciation therapy of قَ [*qa*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	قَ	[*qa*], plosive-uvular	NA12, IL, AR, CA, SA, RA, JE	7

3.3.3. Sound pronunciation therapy of ذَ [*ða*] and ثَ [*θa*]

The ذَ [*ða*] sound is produced by narrowing and shifting the tongue to reach the teeth, with the tip of the upper surface of the tongue touching the upper incisors, without raising the tongue base. The deaf students struggled with these tongue movements, hence the therapy involved placing the tongue tip behind the incisors, pressing forward until a slight fold formed. This was followed by narrowing the incisors while muttering the sound "*Dzzz*" and releasing air from the edge of the folded tongue. The sounds of ذَ [*ða*] and ثَ [*θa*] that are difficult to pronounce are explained in Table 4.

The ثَ [*θa*] sound is also produced through constriction by sliding the tongue with the teeth. Deaf students encountered difficulty in shifting the base of the tongue away from the teeth and allowing breath flow. The pronunciation therapy involved slightly protruding the tongue tip to touch the upper incisors, narrowing two of the incisors, and blowing air to make the sound "*tssss*". This was followed by pulling the tongue back into the [a] sound along with widening of the upper and lower incisors.

Table 4. Pronunciation therapy of ذ [*ða*] and ث [*θa*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	ذ	[*ða*], fricative-dental	NA9, AF, WI, CA, SA, IQ, RO, RA, JE	9
2.	ث	[*θa*], fricative dental	IL, CA, SA, RA, JE	5

3.3.4. Sound pronunciation therapy of س [*sa*] and ز [*za*]

The س [*sa*] sound is produced by constriction, leading to a shift in the position of the tongue and teeth. The tongue tip is placed against the inner surface (wall) of the lower incisors, maintaining a flat tongue position without raising it backward. Deaf students only produced a hissing sound of air, often accompanied by murmurs. The pronunciation therapy included closing and flattening the upper and lower incisors with the tongue tip positioned behind the lower incisors. This was followed by hissing and air release to generate the spoken sound "*ssssa*". The sounds س [*sa*] and ز [*za*] that are difficult to pronounce are explained in Table 5.

The ز [*za*] sound is created through a narrowing process, including a shift of the tongue tip towards the articulation point by placing it on the inner surface of the lower incisors. The base of the tongue remains unraised, and a hissing sound is concurrently produced. Deaf students struggled with hissing air while shifting the tongue to the articulation point of the lower incisors. The pronunciation therapy required moving the lower jaw forward, positioning the tongue tip behind the lower incisors, and blowing air smoothly while muttering slightly.

Table 5. Pronunciation therapy of س [*sa*] and ز [*za*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	س	[*sa*], fricative-alveolar	YA, IL, CA, SA, RA	5
2.	ز	[*za*], fricative-alveolar	NA9, AF, CA, SA, RO, JE	6

3.3.5. Sound pronunciation therapy of ش [*ʃa*]

The ش [*ʃa*] sound is generated by pressing the middle of the tongue against the palate, causing the airflow to hit the inner walls of the teeth. This sound requires a narrowing process, with the middle of the tongue sliding towards the palate. Deaf students faced challenges in directing the airflow to hit the inner walls of the teeth and closing off the airflow or inhibiting it by the soft palate. The therapy included closing and flattening the upper and lower incisors along with pursing the lips. The tongue tip was positioned behind the lower incisors and the air was blown while hissing the "*shyyy*" sound and releasing the air during pronunciation of the "a" sound by parting the teeth and lips. The ش [*ʃa*] sounds that are difficult to pronounce are explained in Table 6.

Table 6. Pronunciation therapy of ش [*ʃa*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	ش	[*ʃa*], fricative- postalveolar	YA, HA, IL, CA, SA, RA, JE	7

3.3.6. Sound pronunciation therapy of خ [*xa*] and غ [*ɣa*]

The خ [*xa*] sound originates from the tip of the throat (upper throat), where the root of the tongue touches the soft palate. Furthermore, it is produced through narrowing, resulting in a shift of the soft palate. Deaf students experienced challenges in moving the root of the tongue to contact the soft palate, and their ability to visualize this process would be very low. The formation of the rough trill sound [*xa*] could not be achieved through extensive speech development. The sounds of خ [*xa*] and غ [*ɣa*] that are difficult to pronounce are explained in Table 7. The pronunciation therapy involved using a hand gesture resembling the letter 'K in SIBI'. The hand was placed under the chin and moved outward, as shown in Figure 2.

The غ [*ɣa*] sound is produced similarly from the upper throat, with the tongue root touching the soft palate. This is created through constriction, leading to the occurrence of a shift. Deaf students struggled with

the upper throat movement and the formation of the rough trill sound [*ɣa*] required a long process of speech development. The pronunciation therapy consisted of using a hand gesture resembling the letter 'G in SIBI'. The hand was attached to the end of the neck and swiped as shown in Figure 3.

Table 7. Sound pronunciation therapy of خ [*xa*] and غ [*ɣa*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	خ	[*xa*], fricative- velar	YA, HA, NA9, DI, IL, AR, CA, SA, JE	9
2.	غ	[*ɣa*], fricative-velar	YA, HA, NA9, IL, AR, CA, SA, RA, JE	9

Figure 2. 'K'-shaped hand in SIBI movement

Figure 3. 'G'-shaped hand in SIBI movement

3.3.7. Sound pronunciation therapy of غ [*ʕa*] and ح [*ħa*]

The غ [*ʕa*] sound is produced through constriction, involving a shift of the throat from the epiglottis valve and the throat wall. The deaf students had difficulty perceiving the movements within the throat, and the closure of the throat was not easily palpable. The pronunciation therapy was achieved by closing one nostril while making the '*nga*' sound.

The ح [*ħa*] sound is often pronounced from the middle of the throat, with a slight narrowing process but without direct contact, leading to a throat shift. The deaf students experienced challenges in discerning the movement of the middle throat and its interaction with the throat wall. However, a clean friction sound is difficult to visualize and feel, resulting in a long practice duration. The غ [*ʕa*] and ح [*ħa*] sounds that are difficult to pronounce are explained in Table 8. The pronunciation therapy involved using a hand gesture resembling the letter 'K' in the SIBI movement, placed in front of the mouth while producing the ح [*ħa*] sound. The hand was moved outwards, with the air sensation being felt on the thumb side, as depicted in Figure 4.

Table 8. Sound pronunciation therapy of غ [*ʕa*] and ح [*ħa*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	غ	[*ʕa*], fricative pharyngeal	EN, HA, NA9, IL, AR, CA, SA, RA, JE	9
2.	ح	[*ħa*], fricative pharyngeal	EN, HA, NA9, DI, IL, AR, CA, JE	8

Figure 4. 'K'-shaped hand in SIBI movement

3.3.8. Sound pronunciation therapy of هَ [*ha*]

The هَ [*ha*] sound is pronounced from the base of the throat (a position on the vocal cords), around the Adam's apple region. Furthermore, it is produced through a narrowing process, causing a shift in the vocal cords or glottal gap. Deaf students experienced shortness of breath when producing the ‘h’ sound, which required precise narrowing at the base of the neck, leading to the need for extensive breathing practice. The هَ [*ha*] sounds that are difficult to pronounce are explained in Table 9. According to Figure 5, the pronunciation therapy included placing a hand gesture resembling the letter ‘H’ in SIBI at the base of the neck. The sound was initially formed from the chest and gradually learned to be produced from the base of the tongue after mastering proper breathing.

Table 9. Sound pronunciation therapy of هَ [*ha*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	هَ	[*ha*], fricative-glottal	YA, HA, IL, JE	4

Figure 5. The ‘H’ shaped hand in the SIBI movement

3.3.9. Sound pronunciation therapy of رَ [*ro*]

The رَ [*ro*] sound is often created by raising the tip of the tongue to touch the gums of two upper incisors, with pressure applied, without excessive vibration. However, most of deaf students encountered challenges in coordinating the airflow, vibration, and tongue pressure simultaneously. This coordination would be very difficult when breath control and tongue flexibility had not been adequately developed. The رَ [*ro*] sounds that are difficult to pronounce are explained in Table 10. The pronunciation therapy included placing the tongue tip behind the incisors, pressing and pronouncing ‘r’, with a hand gesture resembling the letter ‘R in SIBI’. The hand was positioned under the chin and applied with light pressure, as shown in Figure 6.

Table 10. Sound pronunciation therapy of رَ [*ro*]

No.	Sounds that are difficult to pronounce	Sounds with IPA symbols and articulation	Name of students experiencing difficulty	Total students
1.	رَ	[*ro*], trill-alveolar	NA12, CA, SA, JE	4

Figure 6. ‘R’ shaped hand in SIBI movement

4. DISCUSSION

The initial therapy for deaf students in this research focused on attention using behavior techniques (attention-focused, involving behavior techniques). The articulation therapy began with pronunciation of vowel and front consonant sounds. These interventions effectively improved the behavior and knowledge of students [47]. In this paper, five typologies of speech therapy for deaf students were identified, namely: i) sound pronunciation therapy of velar of كَ [*ka*] and uvular of قَ [*qa*]; ii) sound pronunciation therapy of dental of ذَ [*ða*] and ثَ [*θa*]; iii) sound pronunciation therapy of fricative-alveolar of سَ [*sa*], زَ [*za*] and post alveolar of شَ [*ʃa*]; iv) sound pronunciation therapy of fricative velar of خَ [*xa*] and غَ [*ɣa*], pharyngeal of حَ [*ħa*], glottal of هَ [*ha*] and trill-alveolar of رَ [*ro*]; and v) sound pronunciation therapy of fricative-pharyngeal of عَ [*ʕa*] by changing it into a nasal sound of [*ŋa*]. Figure 7 shows a clear representation of these therapies.

The pronunciation of the plosive sound-velar كَ [*ka*] and uvular sound of قَ [*qa*] were treated as shown in Tables 1 and 2, as well as the pronunciation of the pharyngeal fricative sound of عَ [*ʕa*] is treated by changing the pronunciation from the fricative sound to the nasal sound [*ŋ*]. as a result of the velum (soft palate) in their mouth is unable to close the gap between the nose and the throat, which causes problems with sounds related to the throat. Furthermore, the short velum in deaf students causes air to always flow into the nasal cavity, which produces the "hidden tongue" phenomenon, where the upper part of the glottis encounters no obstacles. The pronunciation of fricative sounds was treated as shown in the Tables 3-8 (except عَ [*ʕa*]) and the trill *ra* sound resulting from tongue stiffness and challenging to control the position of the tongue vertically or horizontally. According to the findings of this research, two Arabic letter pronunciation therapies were successful in improving pronunciation skills of deaf students at Qotrunnada SLB. The need for these therapies arose from three common challenges experienced by students. Firstly, they struggled with maintaining attention focus. Secondly, they encountered greater difficulty pronouncing fricative sounds compared to plosive, nasal, trill, and lateral sounds. Plosive sounds were targeted through exercises such as releasing sounds with bursts, swallowing exercises (for velar sounds), and controlling throat opening and lip flexibility. Fricative sounds were addressed through exercises were employed to develop smooth breath control through jaw movements, breathing exercises using candles and other blowing tools, and throat vibration. Trill sounds were addressed through exercises that focused on tongue placement and repetitive vibration of the tongue and vocal cords.

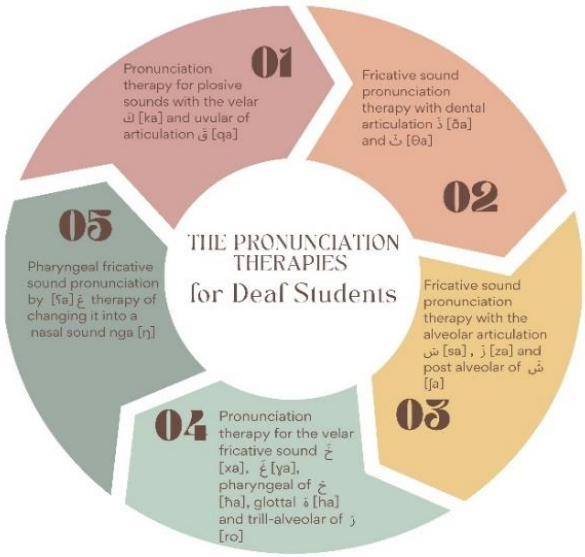

Figure 7. Speech therapy for deaf students

This added to previous findings that pronunciation difficulties in deaf students were caused by two factors, namely organic and functional [48]. Organic factors included hearing loss (deafness), abnormal or incomplete physical structures of the mouth and face [49]–[51], malfunctioning of tongue-lip-teeth-palate interactions, incorrect jaw, lip, and tongue movements, and respiratory mechanisms [52], [53]. Functional factors included contradictory language stimulation methods used by parents.

Contrary to previous investigations that mainly focused on speech problems in deaf students and employed repeated oral therapy [7], reading lips or facial expressions [3], the use of visual learning media, such as objects and pictures, as well as the use of animated sign language. The problem with lip reading therapy is that it cannot solve the problem of pronunciation of similar sounds, such as the sounds ح [*ħa*] and of هـ [*ha*]. The current research proposed a more active role for teachers as facilitators of collaborative learning. Pronunciation therapy by practicing directly with students which consists of showing how to pronounce based on the point of articulation (phonetically), namely by the teacher and student standing in front of the mirror, touching when pronouncing sounds, finger movements, gestures can improve pronunciation.

Based on the various forms of therapies for improving pronunciation of Arabic letters among deaf students, this research recommends several measures to enhance their pronunciation skills. Firstly, it is imperative to provide public education to raise awareness about speech therapy for deaf students. This is because public knowledge greatly influences attitudes and actions toward addressing their needs. Secondly, there is a need for standardization of speech therapy to ensure consistency in the approach used. Finally, various institutions, such as the Ministry of Education and Religious Affairs, are expected to be actively involved in standardizing speech therapy for deaf students in the learning of Arabic letters and Quran recitation. By implementing these three recommendations, it is hoped that speech therapy can provide a solution to the needs of deaf students.

5. CONCLUSION

Arabic letter pronunciation therapy for deaf students is influenced by three impairments, namely: i) attention deficit disorder; ii) difficulties in pronouncing fricative sounds; and iii) difficulties in regulating breath control during pronunciation. This therapy has led to the discovery of three important aspects. First, it begins with attention-focused exercise, followed by behavioral therapy. Second, it includes phonetic therapy, which focuses on articulation, breath control, and sound production. This research provides a new perspective concerning pronunciation of deaf students. Traditionally, this topic has only been approached from the perspective of learning media, but the current research offers a different approach by combining therapies focused on attention and behavior, phonetics.

The strength of this research is embodied in the pronunciation therapy model/alternative that serves as an effective approach to aid the learning of Arabic letter sounds and vocabulary pronunciation among students with special needs. However, it is important to note that the scope of this research is limited to one school and students within the special school 1 level. This means that the findings cannot be used as a reference to explain the efficacy of various types of therapies for deaf students on a larger scale, such as those with ADHD, intellectual disability, autism, cerebral palsy, slow learners, and behavioral disorders. To address these limitations, further research is needed, taking into account comparative aspects between schools and regions, and including a more diverse range of hearing-impaired data. This approach will allow for the formulation of more appropriate therapies for addressing pronunciation needs of deaf students.

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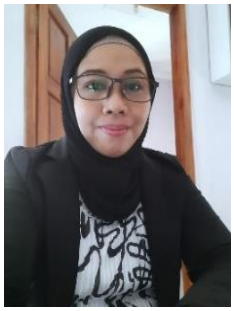

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