Lire Journal (Journal of Linguistics and Literature)
https://lirejournal.ubb.ac.id/index.php/LRJ/index
P-ISSN: 2598-1803 E-ISSN: 2581-2130
Volume 7 Number 1 2023

SPEECH PRODUCTION IN ENGLISH BY STUDENTS WITH HEARING IMPAIRMENT: AN ACOUSTIC PHONETIC APPROACH

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ARTICLE INFO

Received: 06-12-2022
Accepted: 09-05-2023
Published: 17-05-2023
Volume: 7
Issue: 1
DOI:
https://doi.org/10.33019/lire.v6i2.182

KEYWORDS

Acoustic phonetics, hearing impairment, speech, experimental

ABSTRACT

Children with special needs have taken wider attentions in research, especially in finding solutions of how to improve their abilities in communication. The purpose of this research is to identify the challenges and barriers in speech production in English by students with hearing impairments in Pangkalpinang City. Investigation and documentation were the main stages in collecting data. The data were studied using a descriptive method with a qualitative approach. Based on the foundation of phonetic theory by Collins and Mess (2019) regarding speech production and the character of children with hearing impairment by Dennis Fry, this research is aimed at analyzing the sounds produced by children with special needs. Experimental observation using Praat voice analyzer was carried out on students with three types of disabilities: students with vision impairment, with hearing impaired, and with mental or intellectual disability. The observation results showed that students with hearing impairments (partial and total deafness) were the main concern as their abilities in perceiving and producing speech gave them opportunities to communicate in English despite the barriers, they had to face in pronouncing the words. As conclusion, students with hearing impairment both partial and total deafness produced their speech based on other vocal tracts due to their disability, and certain treatment in speech production should be suggested especially the phonemes involving internal articulators, including alveolar, velar, post-alveolar and nasal sounds. Proximities made in speech showed possibilities to refine their pronunciation.

1. INTRODUCTION

Children with disabilities in Indonesia have been facilitated nowadays in many ways in order to help them conduct communication. The one that has been developed by Indonesian government is through sign language. Sign language is a language used by using body movements and facial expressions, especially for the deaf. There are 2 types of Sign Language that are widely used in Indonesia, namely SIBI (Indonesian Sign Language System) and BISINDO (Indonesian Sign Language) (Mursita, 2015). Communication however can be transmitted in several ways: verbal, non-verbal, written, visual, and other types of communication in regard to the development of technology nowadays. For instance, mass-personal communication was introduced as a concept at the intersections of mass and interpersonal communication (O'Sullivan & Carr, 2018). In the scope

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of children with special needs in Indonesia, the signal system had actually started in Indonesia since 1978 when SLB (school for students with special needs) Zinnia in Jakarta and since 1981 by SLB-B Karya Mulya pioneered this approach (Kurnia & Slamet, 2016). Possibilities in acquiring English by students with hearing impairment is the concern in this article and therefore it is necessary to figure out, firstly, the barriers in communication. The formulation of the problem that will be studied in this article is (1) how the character of the sound produced by children with hearing impairment is assessed through an acoustic phonetics approach and (2) what phonemic features should be raised in dealing with the speech impediment. Phonetics is considered as the tool to find out to what extent the children with hearing impairment produce their speech as it is the speech sound that we work with. Phonetics consists of three fields of studies: articulatory, acoustic and auditory. In examination of speech production, the properties of sound produced by the children with special needs would be the main analysis to be brought up as the parameter in measuring their ability in building communication, in this case is in English language. Therefore, acoustic phonetics takes important role in analysis, besides the articulatory phonetics for it is also necessary to view how the speech sounds are produced by the organ of articulations. With hindsight, Indonesian sign language has made a great breakthrough in enabling students or children with special needs to communicate by using certain signs or gestures to convey certain messages, letters, words, or in short to improve their vocabularies in Indonesian language. It is a high opportunity when there is a certain way to enable those "disabled" in communicating in English when difficulties or barriers in speech production are revealed.

2. LITERATURE REVIEW

Speech production deals a lot with the mechanism of how organs of speech produce the sounds. The production of speech sound is viewed from how the lungs, larynx, and vocal tract are engaged in certain mechanism to produce the intended sounds (Quatieri, 2002). The process is drawn as the following figure.

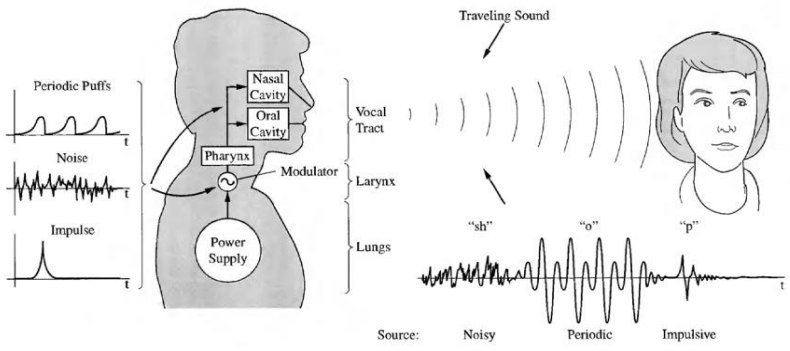

Figure 1. Simple view of speech production (Quatieri, 2002)

The figure above draws that the larynx gets its power from the air pumped by the lungs as initial impulse, where the larynx modulates airflow provides either a periodic puff-like or a noisy airflow source to the third organ group, the vocal tract. The sound produced by the vocal tract then is transmitted through the air, as in the figure above the word '*shop*', into the listener's ear. The sound /ʃɑp/ is identified to have properties in each phoneme, where the fricative /ʃ/ is realized as noisy, vowel /ɑ/ is drawn as periodic, and the stop consonant /p/ represents impulsive. The process continues to the auditory system of the listener where the sound is processed and perceived as 'speech'. Speech production by human involves egressive pulmonic airstream (Collins and Mess, 2013) that is an outgoing stream of air produced by the lungs contracting and thus pushing the air contained within them outwards. Those processes occur beyond our consciousness and are influenced by condition of human's physiology. In some cases of disability, articulation by vocal tracts might be the most problems faced by the students with hearing impairment. Hearing impaired children are also often reported to have difficulty coordinating the respiratory and laryngeal muscles which may result in inappropriate pausing and the absence of a gradual decline of fundamental frequency (F0) across a sentence (Osberger and McGarr, 1982 in O'Halpin, 2021). As in English, speech is identical with co-articulation where clause is uttered in a series of articulation, not in word boundaries. For Indonesian students, English is learnt as the second language and certain treatments in shaping speech, especially for students with special needs, are needed in order to enable them in constructing communication.

Kadek (2019) in Yusuf (2003) stated that children with disabilities are those who in certain respects differ from other children in general. Differences might occur in physical condition, health, intellectual ability, emotional, social, perceptual, motoric and/or neurological disorders and others. Abnormalities can be conditions below average or above average. If this disorder results in disturbances in daily functioning, especially in learning, so that the child requires special services. The sufferer is referred to as a child with learning problems. This includes children with special educational needs. There are several classifications of children with learning problems. Data from the United States Department of Education, for example, classify Children with Special Needs into children with learning difficulties, speech disorders, mental retardation, emotional, physical, hearing, visual, and multiple disorders (Lewis, 2003). Meanwhile Ashman and Elkins (1994 in Yusuf, 2003) divided the types of children with special needs into gifted children, children with communication disorders, children with learning difficulties, children with emotional and behavioral disorders, children with visual impairments, children with hearing impairments, children with visual impairments, children with intellectual and barrier, and children with physical impairments. In Indonesia, among those with special needs, there are "extraordinary children", whose position is clear in Indonesian Constitution No. 2/1989 and Government Regulation No. 72/1991, who is called physically and/or mentally and/or behaviorally disabled, consisting of blind, deaf, mental retardation, quadriplegic or paralysis, mentally retarded, and double disability.

Hearing impairment is a condition where someone is not able to perceive (completely or partially) the sounds by his auditory sense and causes him unable to receive the spoken messages well, or might lead to misinterpretation of messages. There are varying definitions regarding the degrees of hearing impairment, with the World Health Organization (WHO) grading hearing impairment as mild (26–40 dB HL), moderate (41–60 dB HL), severe (61–80 dB HL) or profound (81 dB HL or greater) in the better ear. Hearing levels of 35 dB HL (for children) and 40 dB HL or more (for adults) in the better ear are regarded as disabling, although even a mild and unilateral hearing impairment can cause significant difficulties for an individual. This condition becomes the barrier in constructing speech where, in this case, children would not be able to construct the intended sounds especially for non-native language. As mentioned previously, sign language is the tool to transfer the ideas or perhaps in some light cases of deafness, hearing-aid might be equipped as their assistance.

Besides those physical barriers, psychological state of these children was also considered became the obstacles in developing their ability in communication. Firstly the continuous use of sign language has turned them to be dependable in that method that, for these children, was considered the most comfortable way in conveying message. It was found that the children with the least sign language exposure outperformed the other groups in speech recognition, spoken language, reading, and speech intelligibility (Howerton-Fox, & Falk, 2019). This proved that verbal communication is urgently needed as an important character builder in their personality. This is not simply the institutional concern where the children learn, but is necessary to begin from family where parental assistance would give big impact to their progress. Secondly, the environment where these children interact takes important role, accordingly to the psycholinguistic approaches in which the linguistic input influenced by learners' differences and processes would determine the linguistic output. We cannot deny that deafness is sometimes not the only barrier they have, but cognitive style, intelligence, aptitude, personality and other conditions might become the causal factors for the children in improving their communication ability. It is an opportunity for researcher to figure out to what extent these children have improved their speaking ability, especially in English, and giving further opportunities for the coming research dealing with speech production by children with hearing impairment.

In viewing those conditions, phonetics takes major roles to supply insights to help us understand those aspects of speech and pronunciation that most people seem to find interesting (Collins and Mess, 2013). It is the phonetics and semantics that language molds and structures where the two ends between which language forms the bridge (Bybee, 2001). Communication held by the students with certain disabilities show particular phenomena where speech is realized in certain ways, both in acquiring and producing it, and by the same time to mean it. How they produce the sounds becomes the arena of articulatory phonetics, and the sounds that they produce is the part of acoustic phonetics to analyze. While the way they interpret the message by verbal or

non-verbal means, or perhaps visually, would be the arena of semantics. Therefore, the properties of sound produced in English by the students with certain disabilities could be measured in order to figure out in which aspects barriers hamper the communication.

3. METHODOLOGY

This research applied descriptive method using a qualitative approach. Qualitative described an understanding of the meaning of phenomena, events, or those related to the people or society studied in the context of life in actual situations (Subroto, 1992). Qualitative research uses an inductive approach, which is moving from specific interactions or observations to broad ideas and theories (Altson and Bowles, 2003). All data were collected through experimental phonetics with the following stages: observation, recordings, note taking, and analysis, and then the data were identified and analyzed qualitatively. The primary data was collected from the initial observation to the school and by recording the students' pronunciation in English imitating the tester in saying the words taken from Swadesh list (Swadesh, 2017). Initial recording involved students with vision impairment, hearing impaired (partial and total deafness), and mental or intellectual disability, and therefore the general analysis covered these groups of students. Having decided the scope of this study, the next recording focused on students with hearing impairment. Of a hundred words in the list, twenty words were chosen including nouns, pronouns, adjectives and adverbs with the consideration that these word classes are the most common word used in speaking and to be assembled into clauses. The audio recording files were then processed through voice analyzer PRAAT, version 5.3.56 in order to view the proximity between the tester and the student observed. The output result would display the degree of frequencies, spectrogram, pitch, and intonation of the recorded sounds of the tester and the students. This would be the basis of data interpretation that would be evaluated and justified according to the problems and objectives of the research, namely speech production in English by students with hearing impairment who attend the school of special educational needs in Pangkalpinang City, the province of Bangka Belitung Islands, Indonesia.

4. RESULTS AND DISCUSSION

Based on the method described, initial analysis held in this research covered three groups of students with different disabilities since we have seen several classifications of "children with special needs" in the school and to examine the barriers in speech production in English.

a. Experimental Research on Students with Various Disabilities.

In its implementation, research focuses on children's ability to produce speech, so that a separate method is determined in finding what conditions occur in speech production process in English. The data collected in this phonetic-based research involved a number of students with three types

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https://lirejournal.ubb.ac.id/index.php/LRJ/index
P-ISSN: 2598-1803 E-ISSN: 2581-2130
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of disabilities, students with vision impairment, students with hearing impairment (partial and total deafness), and mental or intellectual disability.

The data shown firstly here were taken from the students with sight impairment. Here, the recorded data showed that there were no obstacles in pronouncing the twenty words through imitation by imitating what the examiner says. This was proved by the spectrogram display which also showed pitch and intonation. Praat analysis displayed that students with visual impairments were able to pronounce and develop their verbal abilities without much difficulty.

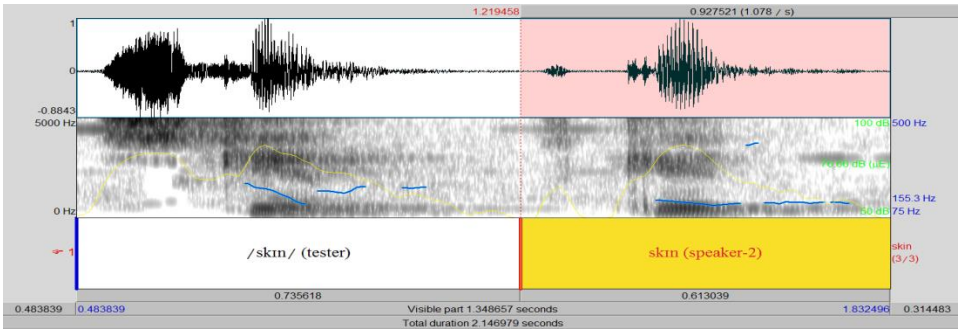

Figure 2: Spectrogram display of "skin" by student with visual impairment

In the spectrogram display, the intensity of the students' voices (as shown in yellow lines) was close to that of the examiner, but in a few words, there were some gaps where the students felt that the intensity was not necessary. Control on the pitch (tone of voice, as shown in blue line) can be trained but in some pronunciations the pitch of some words deviates from that tested. In pronouncing /skɪn/, the density of frequency in phoneme /s/ was contrasted as the speaker-2 turned it with less energy (lenis), while the pitch tended to be flat. This would be the concern in treating students with visual impairment, besides object identification, since it needs more efforts to describe physical objects and situation. One thing to consider though, speaking app for students with visual impairment should emphasize the audio quality and design any possibilities in object recognition.

In phonetic observation on partial hearing-impaired students, it was found that there was a tendency for students to imitate articulatory movements. The student's gaze that was focused on mouth movements (including lips and tongue), compared to the proximity of the sound produced, led to a conclusion that the student was capable, or at least tried to imitate the sound given to him. Obstacles in imitating consonant sounds, such as the phoneme /m/ which tended to result in the phoneme /p/ or /b/, as well as the phoneme /t/ with the comparison to the phoneme /n/, showed that consonants with close articulation position tend to be difficult to distinguish by students with hearing impairments. Likewise dental and alveolar phonemes tended to experience misperception. For instance, the word "leaf" was pronounced as /ni:f/. It could be assumed that the phoneme /l/

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was perceived as /n/ since the student's attention was into the tester's articulator, while the auditory receiver perceived only a part of the sound (most likely the final parts of the utterances).

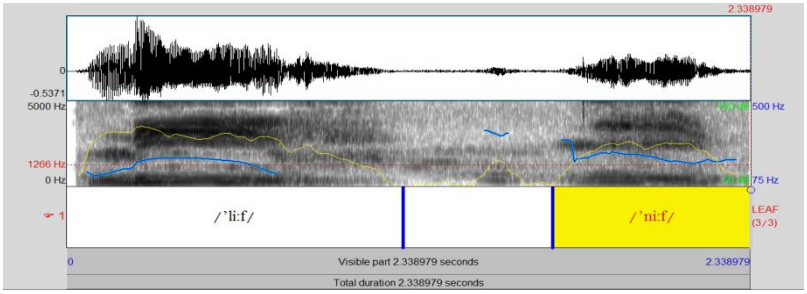

Figure 3: Deviation of the sound "leaf" by student with partial hearing-impairment

Furthermore, in some cases of hearing impairment, the consonants in final position tended to be lost, especially the ones occurred in the internal articulators (oral cavity). This was reckoned due to the invisibility of the articulatory motion on the inside of the oral cavity. These cases were taken from the pronunciation "all" that resulted in /ɔ:/, and also "not" resulted in / ŋo/. The absence of consonant /l/ and /t/ in final position showed that alveolar sounds (and probably other phonemes occurred in internal position of articulator) should be considered as the challenge in designing the speaking app.

The next observation aimed at students with total hearing impairment disability. The results of observations from the sound processing of several students with total deafness showed a tendency for the sounds produced to be creaky voices (squeaky, hoarse, sharp) with sound intensity that was always high, and misperceptions that occurred repeatedly.

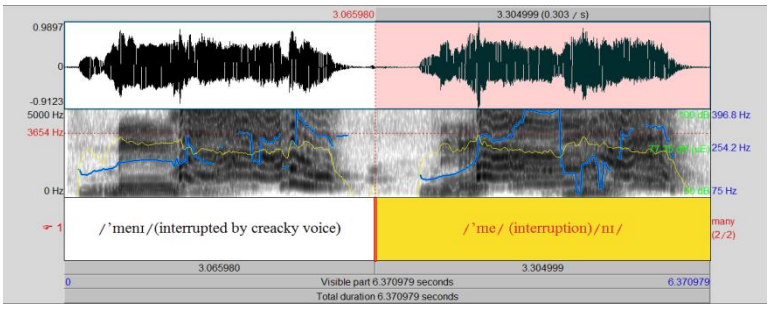

Figure 4: Spectrogram display of students with total deafness saying /me/ in "many" /meni/. The blue line showed the pitch at the upper level, and the yellow line shows the sound intensity at the high level.

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From the results of the spectrogram shown in Figure 3, students were able to pronounce one of the two syllables given in the word *many*. Meanwhile, the next syllable becomes a challenge for the student. Of the twenty words tested for students with total hearing impairments, temporary test results showed 90% of the spectrogram were similar in the following ways: (1) Articulation properties for vowel sounds were easier to imitate, but limited to only one syllable; (2) Consonant sounds were challenges for total deafness cases, especially those involving internal articulators; (3) students showed their efforts to imitate the examiner by high sound intensity.

In the last observation, the pronunciation test was given to students with mental and intellectual disabilities. Previously, the observer team had received information that students with mental retardation actually had other impairments. With the same procedure, the results of observations could be concluded in the following ways: (1) the difficulty in imitating sounds was relatively high; (2) almost all of the sounds produced are babbling and static; (3) the movements of the external articulators could be imitated, but the resulting phonemes were faulty.

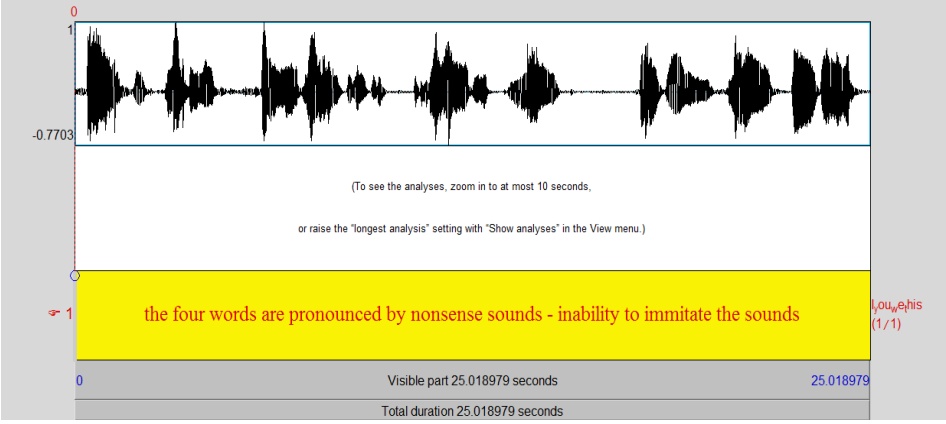

Figure 5: Spectrogram display of students with mental disability

From the results of the observations which were still considered not optimal, the team again tried to give a few words spoken slowly, in syllables, accompanied by maximal articulatory movements. The test results were not far from the original results. In the spectrogram display in Figure 4, the conditions described were how the four words tested to students could not be repeated, even at a proximate level. These were caused by several factors that were owned by students, especially those related to the ability to communicate and process information in the nervous system that exists in the human brain. Therefore, the recommendation to continue using sign language remains a prior and reinforcement using visual-based applications can be an option for these students.

b. Speech Production of Hearing-Impaired Students

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Applying experimental phonetics is expected not only to figure out the characteristics of speech, but also to give opportunities for further research to set up possible treatments in the cases of disabilities. This will begin with the various ranges of intensities made out by the tester to the students with partial hearing impairment, which vary from 85,00 dB up to 88,30 dB in maximum intensities, with distance between tester and students about half meter, separated by a table. From four students' responses in imitating the words, some identical conditions occurred in all of the students. Based on the condition, students' responses to the words mentioned were quite quick by using relatively similar intensity to the tester. Levels of loudness varied but still around the rates pronounced by the tester. However, when students were given two-syllable word, as in *woman*, distinct pronunciation was gained unless the word was pronounced per syllable. When analysis came to segment of sounds, proximity in vowels occurred repeatedly despite the divergence and absence in several consonants. The following table draws two samples in experiment.

Table 1: Phonemic transcriptions of two partial hearing-impaired students

words	tester	Partial hearing-impaired	
		Student 1	Student 2
all	/ɔl/	/ɔɯ/	/ɔː/
bird	/bɜːd/	/eː/	/bəː/
dog	/dɔg/	/ta/	/tɔː/
fish	/fiʃ/	/feiʃ/	/fiw/
I	/aɪ/	/aːɪ/	/aɪ/
leaf	/liːf/	/niːf/	/liːf/
man	/mæn/	/men/	/mæ/
many	/meni/	/bɜn/	/paiː/
not	/nɑt/	/nɑh/	/ŋo/
root	/ruːt/	/ju/	/u/
seed	/siːd/	/siː/	/siːd/
skin	/skɯn/	/tʃɪ/	/sɯ/
that	/ðæt/	/ðɑn/	/ðan/
this	/ðɪs/	/diːs/	/ɲiɲi/
tree	/triː/	/tiː/	/tiː/
we	/wiː/	/wiː/	/wiː/
what	/wʌt/	/wʌ/	/wʌn/
who	/huː/	/uː/	/uː/
woman	/wʊmən/	/ieh/	/wʊm/
you	/juː/	/tʃuː/	/uː/

From the table 1, it can be assumed that proximity in perceiving vowels sounds is higher in the condition in which vowels take medial position, apart from several deviations in tongue position. Vowel shift in pronouncing words tended to the lips movements, rounding or less rounding, rather than tongue position. However, most vowel sounds were able to be sounded apart

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from the shifting in tongue positions and the length of vowels. It took efforts certainly in order to shape typical pronunciation although this had to be done repeatedly. In lip rounding cases of phoneme /ɜ/, the dynamic could be drawn accordingly to the vowel chart.

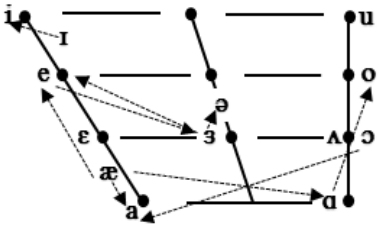

Figure 6: Dynamic shift of vowel phonemes in pronunciation of hearing-impaired students

Based on the directions shown by the arrows, random movements occurred between fronting and retraction (backing) of vowel positions, as well as between closing and opening of lips. Treatments could be suggested since this brings up an assumption that the students' unawareness to the existing vowels in English is quite certain, especially those similar sounds, for instance in phoneme /e/, /ɛ/, /ɜ/, /ə/, and /æ/. In vowel length, phoneme /i/ and /ɪ/ are possible to be introduced, whether in isolation or in different position in a word. However, phoneme /ɔ/ underwent a significant movement into /a/ as in the word 'dog'. Vowel length should be considered, whether or not, as priority as long as the distinction in those vowel sounds could be perceived well.

The vowel sounds were also identified by measuring the formant, a concentration of energy around certain frequencies, which were shown in the spectrogram display (Ladefoged, 2012). In order to view some shifting in vowel frequencies, formant patterns are displayed as in the following figure.

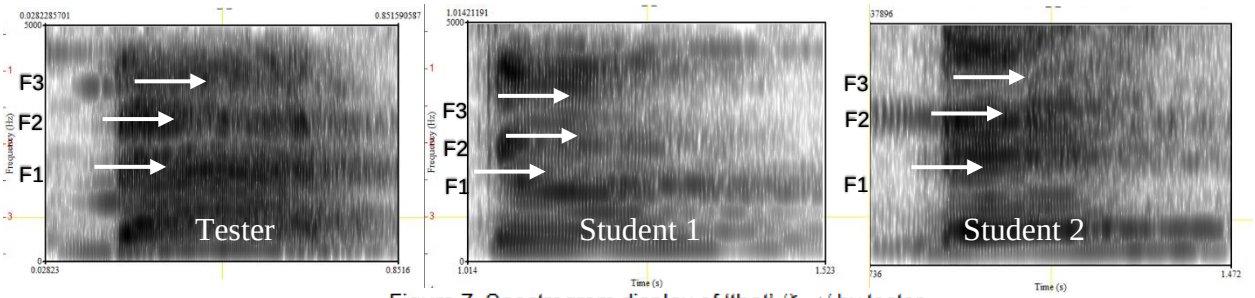

Figure 7: Spectrogram display of 'that' /ðæt/ by tester, /ðɑn/ by student 1, and /ðan/ by student 2

Apart from the consonants produced by student 1 and 2 who are both females, the vowel sounds in both students tended to be lower in the first formant (F1, shown by the white arrow), accordingly to the vowel position of / æ/, /ɑ/ and /a/, and by the same time less energy was resulted in their frequencies as shown in the following list of first formant.

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Table 2: List of formants from the three spectrogram displays

Speaker	Mean of F1	Mean of F2	Mean of F3
Tester	1184.40 Hz	2366.84 Hz	3320.39 Hz
Student 1	1090.82 Hz	2466.62 Hz	4087.01 Hz
Student 2	758.85 Hz	2800.64 Hz	4784.08 Hz

The second and third formants of both students were higher than the tester's, which was the inversion in vowel height, since the higher the formant frequency, the lower the vowel height. Therefore, in comparing the three phonemes, first formants of both students signified that vowel height moved from higher to lower position, vice versa to the tester. It showed that the three phonemes must be undistinguishable by the partially-deaf ears, or perceived as bias based on the lip and tongue movements (this condition happened as the tester pronounced words and the students noticed more on the tester's mouth attentively).

Another significant process was nasalization in which vowels tended to be nasalized, occurred in pronouncing most words by student 2, but not in student 1. A typical nasalization was in pronouncing 'we' in which both the semivowel and vowel were nasalized.

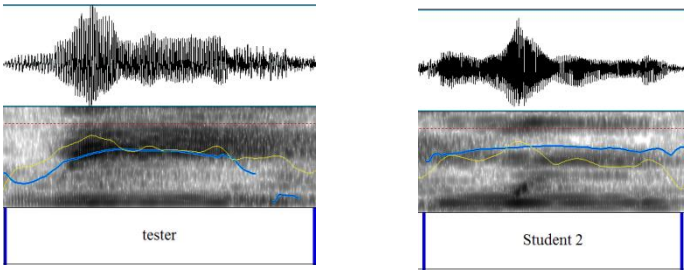

Figure 8: Spectrogram display of 'we' comparing tester and student 2

In nasalized sound of student 2, it was characterized by the density of frequencies which was culminated in vowel /i/ and contrast with the scarcity in the tester's part. This student favored in nasalized the vowel sounds by assuming that all sound should be pronounced in that way, although it is necessary to find out whether her hearing perception receives all messages in nasal forms. However, another student with partial hearing impairment did not produce this kind of nasal sound.

On the other hand, students were able to reach approximately 50% proximities in producing consonant sounds since the rest of the consonant production led to proximities in place of articulation. Phoneme /m/ in 'many' was replaced by /p/ and /b/ which are bilabial, phoneme /d/ in 'dog' was replaced by /t/ and phoneme /l/ in leaf was replaced by /n/ which is alveolar. In manner, the approximant /r/ in 'root' was replaced by /j/. However, ability to produce consonant cluster as in 'tree' needed more observation, whether their perception to both consonants was blurred by closeness in alveolar position or due to the unclear flap [ɾ] sound.

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In total deafness case, speech production mostly faced barriers phonetically rather than segmental problems as were faced in partial deafness cases. It was termed 'phonetically' because of the complexity in phonatory system as well as the prosody aspects that emerged during the experiment. When discussing about phonation, it deals a lot with the function of larynx as a vibration source (Collins and Mess, 2013). Phonatory system is concentrated in human's throat where larynx and vocal folds exist where various kinds of sounds are produced, such as modal, harsh, creaky, voiced, voiceless, falsetto, and other voices are resulted. In order to draw the speech production, the following table compared the pronunciation made by the tester and two students with total deafness.

Table 2: Phonemic transcriptions of two total hearing-impaired students

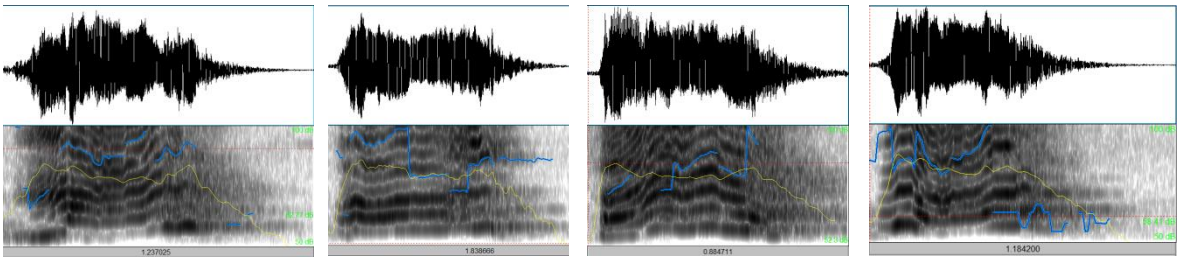
Words	tester	Total hearing-impaired	
		Student 3	Student 4
All	/ɔl/	/ɔl/	/buː/
Bird	/bɜɪd/	/baː/	/bəː/
Dog	/dɔg/	/dɔ/	/lɔː/
Fish	/fiʃ/	/fiː/	/fɛs/
I	/aɪ/	/ah/	/eɪ/
Leaf	/lif/	/lif/	/lif/
Man	/mæn/	/meː/	/mæ/
Many	/meni/	/meni/	*babbling*
Not	/nɑt/	/nɑh/	*babbling*
Root	/ruːt/	/uh/	/u/
Seed	/sɪd/	/siː/	/sɪd/
Skin	/skɪn/	/sɪ/	/sɪd/
That	/ðæt/	/næh/	/det/
This	/ðɪs/	/aːh/	*babbling*
Tree	/triː/	/hiː/	/niː/
We	/wiː/	/eh/	/weː/
What	/wʌt/	/wɑh/	/wɑt/
Who	/huː/	/uːh/	/uː/
Woman	/wʊmən/	/uəh/	/wum/
You	/juː/	/uːh/	*babbling*

Based on the table, disparities in some of the speech sound seemed high and in some cases, students were not able to pronounce the words which resulted in babbling nonsense voices. Consonants which took place in final position were often left unsounded, and coincidentally were voiced sounds, though it could not be taken as certainty. In conducting the experiment, tester treated the students equally without raising the intensity significantly, between the range 86 dB up to 88dB according to the maximum intensity shown in Praat window.

In speech production, it was found in one of the female students with total deafness, a particular speech with creaky voice, pronouncing all words in such manner and with high

Lire Journal (Journal of Linguistics and Literature)
https://lirejournal.ubb.ac.id/index.php/LRJ/index
P-ISSN: 2598-1803 E-ISSN: 2581-2130
Volume 7 Number 1 2023

intensities. It would be an advantage for further research to figure out whether it was what the student perceived (in auditory phonetics, as this is a case of total, or nearly total deafness) or simply her presupposition that all human speak in such manner as she did. Praat windows displayed the speech production by this female student, identified as student 3.



that all I not

Figure 9: Praat windows showing creaky voice of male student with total deafness

From the displays above, creaky voice was identified by the density of frequencies, broad distribution of wavy formants, high intensities (yellow line) and high peaks in pitch. Concentration of energy accumulated in vowel sounds as the center of syllable. In segmental analysis, shifting in place of articulation often occurred as initial /ð/ was replaced by /n/. It had to be remembered that the student's speech was determined a lot by what they perceive, and in total deafness, it was what they assumed from what was proposed by the tester. In pronouncing 'root', 'not', 'that', and 'what', the final /t/ sound was replaced by glottal sound /h/, contrary to student 4, who could track only the vowel sound despite the absence of several consonants and babbling non-sense sounds. Besides, student 4 used her modal voice, with little harsh during the speech, as if trying to stretch and tie the sounds into strings of meaningful word. In pronouncing 'many', 'not', 'this', 'you', tester was trying to guide the student 4 several times and ended with babbling, as murmuring sound. Having consulted the class teacher, it was found that the student also received partial mental disorder; hence, speech production faced obstruction from the nervous system. It is expected that further research would be carried out in order to figure out the problem.

5. CONCLUSION

In finding out opportunities for the Indonesian students with special needs in using English in communication, speech production in English becomes fundamental to untangle the barriers in communication. Of the four categories in physical and mental disabilities, students with partial and total hearing impairment were taken into analysis. The experimental phonetic had been carried out and it emphasized that proximity in pronunciation and visual ability, made the students with hearing disabilities be possible to be taken as the subject of analysis. In partial hearing impairment, dynamic shift in vowel position indicated that lip rounding and opening was the benchmark to

identify vowel sounds, although several phonemes should be given carefully especially the low and open-mid vowels, since they were often misperceived. *Nasalization* of vowels occured persistently in one case and absence of consonants in final position directed the conclusion into student's limitation in perception, while the speech production counted on articulator movements. Phonation occured in student with total deafness in which creacky sound, high intensity, and high pitch became identical. Segment analysis signified that several phonemes in English, especially that do not exist in Indonesian language should be given in certain treatment. Hence, the tendency of speech production referred to not only resembling other speaker's articulators, indicated by inability in imitating internal articulator, but also triggered by low frequency perceived by the auditory, indicated by proximity in certain vowel and consonant sounds.

ACKNOWLEDGEMENT

The authors express their deepest gratitude to the Research and Community Service Institute, University of Bangka Belitung, for academic and financial supports for the completion of this research, and all lecturers who have contributed their ideas in completing this article. Special thank is dedicated to the principal and teachers at SLB Negeri Pangkalpinang for the access to their great students.

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1) Dr. Diana Anggraeni, M.Hum. is the Head of Department of English Literature, Universitas Bangka Belitung. In this research, her role was including in the data collection, application design and review, as well as responsibility in the publication of this article and final reports to the Research and Community Service Institute.
2) Donal Fernado Lubis, S.S., M.A., lecturer and researcher at Department of English Literature, Universitas Bangka Belitung, took his role in data processing, focus group discussion, and also co-corresponding of this article.
3) Dini Wulansari, S.S., M.A., lecturer and researcher at Department of English Literature, Universitas Bangka Belitung, took her role in data processing, and focus group discussion.

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