

Sound Production of English Dental Fricatives by Papuan EFL Students

Wira Kafryawan
IAIN Fattahul Muluk Papua, Indonesia
wira@iainfmpapua.ac.id

Zulihi
IAIN Fattahul Muluk Papua, Indonesia
zulihi@iainfmpapua.ac.id

Article History

Received: 2023-06-15
Reviewed: 2023-07-09
Accepted: 2023-08-12
Published: 2023-09-30

Highlights

Production of English dental fricatives by Papuan EFL students lies on low-level.

ABSTRACT: This study aims to reveal to what extent Papuan EFL students correctly produce English dental fricatives and to find out what consonants substitute voiceless dental fricative /θ/ and voiced dental fricative /ð/ when misarticulation occurs. A descriptive analysis of 30 native Papuan EFL students was taken as the participants of the study. Data were collected by giving pronunciation tests and targets of either voiceless dental fricative /θ/ or voiced dental fricative /ð/ in an onset or coda syllable position. Correct sound production of English dental fricatives, both voiceless and voiced dental fricatives, by Papuan EFL students hardly found and almost unrecognized that only 12.0% of Papuan EFL students correctly pronounce voiceless dental fricative /θ/ and only 3.3% of Papuan EFL students correctly pronounce voiced dental fricative /ð/. It can be stated that the sound production of English dental fricatives lies in low-level production. Furthermore, Papuan EFL students mostly substitute voiceless dental fricative /θ/ with voiceless alveolar plosive /t/ indicated by 84.0% sound substitution. In other words, Papuan L1 speakers dominantly substitute the consonant /θ/ with the consonant /t/. Papuan EFL students frequently substitute voiced dental fricative /ð/ with both voiced alveolar plosive /d/ indicated by 51.6%, and voiceless alveolar plosive /t/ indicated by 43.3% substitution. Thus, Papuan L1 speakers primarily replace the consonant /ð/ with both consonant /d/ and /t/. The implications for the EFL teaching and learning process may assist Papuan EFL students in learning the correct pronunciation of English dental fricatives in order to improve their speaking proficiency.

Keywords: Dental, Fricative, Papuan, EFL Students

Introduction

Phonetics is the study of human speech sounds and how they are produced. Sound production in human speech is generally classified into consonants and vowels. Consonant sounds are articulated with an obstruction of the airflow from the larynx to either the oral cavity or the nasal cavity. Dental fricatives are known as notorious consonant sounds to produce. Dental fricatives are consonant sounds usually produced by pushing the air flow out while the tongue tip touches behind the upper front teeth. Others produce them by placing the tongue tip between the upper and lower teeth. Consonant sounds have two dental fricatives in English, consisting of a voiceless dental fricative symbolized by /θ/ and a voiced dental fricative symbolized by /ð/.

Standard consonant sounds generally in English consist of a voiceless dental fricative and a voiced dental fricative represented in the International Phonetic Alphabet (IPA) by /θ/ and /ð/, respectively. A voiceless dental fricative is symbolized by /θ/, given the name as theta and a voiced dental fricative is symbolized by /ð/, also known as eth (Pullum & Ladusaw, 1996). Nevertheless, the terminology of dental fricative does not only refer to English /θ/ and /ð/ sound production. Dental fricatives are also found in other languages around the world and are actually pronounced rather differently from how they are in English. The /θ/ and /ð/ going to

the sounds in British English (BrE) and American English (AmE) are non-sibilant fricatives, where the vibration is created at the dental (BrE) or interdental (AmE) constriction (Ladefoged & Maddieson, 1996). Thus, the complete name of English /θ/ and /ð/ are non-sibilant (inter-)dental fricatives.

Dental fricatives attract much more attention than other common sounds in the world's languages because of their infrequent use worldwide and their being learned late by speakers when acquiring languages (Dubois & Horvath, 2008). The dental fricative consonants are also considered to be complicated and difficult to learn, produce, and perceive, which accounts for their rarity among the languages of the world. Based on the data from The UCLA (University of California, Los Angeles) Phonological Segment Inventory Database, only 32 out of 451 languages have voiced and voiceless dental fricatives, whereas 22 languages only have the voiced dental fricative without a voiceless pair (Maddieson & Precoda, 1990). 43 (7.6%) of the 566 languages which had been studied had dental fricative sounds despite the fact that due to this outcome, dental fricative sounds are among the most infrequent sounds in all languages (Maddieson, 2005).

Dental fricatives can be analyzed based on the physical properties of speech sounds which are comparatively focused on the science of acoustic phonetics compared to other sounds of the world's languages. The consonant sounds /θ/ and /ð/ are perceptually difficult to recognize by ears and are frequently mistaken with labiodental fricatives /f/ and /v/, making it difficult to collect accurate acoustic measurements for them (Smith, 2013). Moreover, these challenges are mostly caused by the spectrum properties of dental fricatives. It is essential to elaborate an acoustic study of these consonant sounds and carefully examine the voicing which impacts recognition the most in order to resolve such misunderstandings. Spectrogram analysis of fricative sounds is displayed to compare the physical properties respectively from dental fricatives.

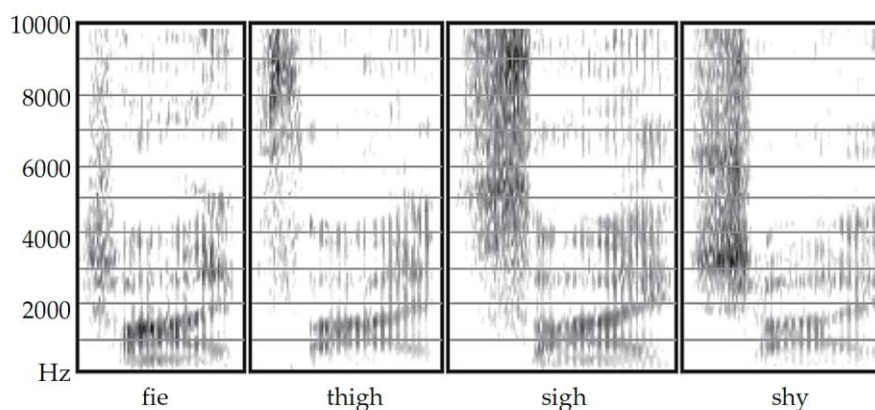


Fig. 1 Spectrogram of voiceless fricatives (Ladefoged & Disner, 2012)

According to the spectrogram of voiceless fricatives, the figure above shows a set of sounds /f/ for fie, /θ/ for thigh, /s/ for sigh, and /ʃ/ for shy. The spectrogram of /θ/ reveals energy throughout a variety of frequencies, although in this context, it is focused above 8.000 Hz. The energy in the spectrogram of /f/ spans a broad range of frequencies. The intensity area is higher between 3,000 and 4.000 Hz. Nevertheless, there are distinctions between the formants of the neighbouring vowels. In fie, the fourth formant is below 4.000 Hz, whereas in thigh, it is above. Similar to the first formant, the second formant of /f/ for fie begins at a rather lower frequency about 1.200 Hz and then rises sharply. The second formant of the /θ/ for thigh begins gently

flat at 1.250 Hz (Ladefoged & Disner, 2012). In pairings of words like *whether* and *ever*, the second formants are substantially higher around /ð/ than they are around /v/ (Ladefoged & Johnson, 2014).

Dental fricatives are consonant sounds that are often made by forcing air out while placing the tongue tip behind the upper front teeth. Others create them by interposing the tongue tip between the top and bottom teeth. Roach (2009) simply states that dental fricatives are articulated by the tongue placed between the front teeth and when trying to teach students how to produce this sound, teachers frequently make the students do this. According to Cruttenden (2014), the production of English dental fricatives is precisely described where the soft palate is raised and the nasal resonator shuts off, the tip and rims of the tongue make light contact with the edge and inner surface of the upper incisors and a firmer contact with the upper side teeth, so that the air escaping between the forward surface of the tongue and the incisors causes friction. Due to the relatively flat structure of the tongue, the air escapes through a slit instead of a groove, creating a lower-frequency fricative sound. With regard to /θ/, the friction is voiceless producing voiceless dental fricatives. However, with regard to /ð/, the condition may cause some vocal fold vibration producing voiced dental fricatives. A few instances of dental fricative sounds in English words are *thin*, *thanks*, *mouth*, and *north* for voiceless dental fricatives as well as *this*, *they*, *breathe*, and *with* for voiced dental fricatives (Hancock, 2012).

It is well known that BrE and AmE speakers pronounce dental fricatives differently. While the tongue tip is typically hidden behind the upper front teeth in BrE speakers, the tongue tip is frequently placed between the upper and lower front teeth in AmE speakers (Ladefoged & Johnson, 2014). Notwithstanding this distinction, /θ/ and /ð/ continue to be widely recognized as dental sounds. If a distinction is required, interdental sounds are sometimes known as sounds made with the tongue placing between the teeth for AmE. Furthermore, dental fricatives are occasionally substituted by other consonant sounds. There is a lot of evidence shown by Blevins (2004) in English varieties in the British Isles, North America, the Caribbean, the Pacific, Australasia, Africa, and Southeast Asia, where /θ/ and /ð/ are frequently recognized as distinct consonant sounds, for instance, alveolar stops /t/ and /d/, labiodental fricatives /f/ and /v/, or palatal affricates /tʃ/ and /dʒ/.

In addition to being perceptually ambiguous, the sounds /θ/ and /ð/ are problematic for both native speakers and EFL students to produce. Dental fricatives are commonly considered difficult sounds to learn in L1 and L2. In fact, the difficulties come from acoustic and articulatory features (Cruttenden, 2014). The consonant /f/ is one of the earliest consonants learnt by children, whereas the consonant /θ/ is one of the most difficult consonants to learn. Moreover, in the early stages of phonological acquisition, fricatives are substituted by stops at each place of articulation corresponding to the fricatives (Ingram et al., 1980). The linguist Roman Jakobson suggested that children first acquire a small set of common sounds to all languages of the world, no matter what language they hear. And in later stages, they acquire the less common sounds of their own language. Thus, most languages at an early age have /p/ and /s/ but /θ/ is a rare (Fromkin et al., 2018). Eventually, children acquire /θ/ at the age of seven and the voiced counterpart /ð/ is acquired at the age of eight (Edwards, 2003).

There is substantial evidence revealing that the majority of non-native English speakers substitute both /θ/ and /ð/ sounds similar to their L1 sounds. Sundanese L1 speakers mostly substitute dental fricatives with /f/ (Guntari, 2013). Japanese and German L1 speakers substitute the dental /θ/ with the alveolar /s/ sound, while Turkish and Russian L1 speakers substitute the fricative /θ/ with the stop /t/ sound (Yildiz, 2006). Dutch L1 speakers substitute both /θ/ and /ð/ with /t/, /f/, /s/ and /d/, /v/, /z/ (Wester et al., 2007). Polish L1 speakers substitute /θ/ with /t/ or /f/ and /ð/ with /d/ or /v/ (Gonet & Pietron, 2006). Furthermore, some substitutions in previous studies of dental fricatives have been found recently. Indonesian and

Javanese L1 speakers substitute both fricatives /θ/ and /ð/ with stops /t/ and /d/, respectively (Kurniawan, 2016). Moreover, Slovak L1 speakers substitute /θ/ with both /t/ and /f/ while /ð/ is substituted with /d/ and /t/ (Metruk, 2017). French L1 speakers substitute /θ/ with /f/ whereas /ð/ is substituted with various sounds between /v/ and /z/ (Tyler et al., 2019). Even if there is considerable variation among non-native English speakers, their decisions can be explained phonetically and phonologically. The findings on acoustic study of dental fricatives indicated that /f/ and /v/ share a highly considerable acoustic resemblance with /θ/ and /ð/ than other consonant sounds.

Papuan L1 speakers certainly own the language with distinct sounds in which both vowels and consonants also exist. Simple phonological structures are characteristic of the Papuan languages. In the Papuan language, vowel systems with far more than seven vowels are exceedingly uncommon and no Papuan languages have been found to have more than ten vowel sounds. Likewise, the system of consonants in Papuan languages tends to be quite simple and nearly all Papuan languages have simpler consonantal inventories than English. Furthermore, as in Chinese or the languages of Southeast Asia, several Papuan languages also use tone, the particular use of variations in pitch to differentiate words. (Foley, 1986). In several Papuan languages, there is no phonemic contrast at the phonological level and complex suprasegmental systems are encountered more commonly than uncommon vowel features (Wurm et al., 1975).

Native speakers of English commonly produce dental fricative sounds based on their place and manner of articulation. English dental fricatives frequently give constraints in second and foreign language learning. ESL/EFL students tend to have difficulties producing dental fricatives and substituting them for other sounds. These previous studies before can be briefly analyzed to show that different first languages possessed by EFL students bring distinct sound production varieties to their dental fricatives respectively in learning English. Furthermore, errors in sound production may be due to a cross-linguistic influence. A set of consonant sounds existing in their first language contributes to the cross-linguistic influence of learning a second or foreign language. The transfer will be positive when the aspects of L1 are similar to L2. On the contrary, the transfer will be negative when the aspects of L1 differ from L2 (Yule, 2022). However, Papuan EFL students certainly have different aspects of L1 from those of English, in which L1 can be the local language or Bahasa Indonesia. Regarding Papuan local languages, the phonemic systems of consonants tend to be relatively simple and have less complexity orders. Most of Papuan languages use simpler inventories of consonant phonemes than English does (Foley, 1986). By all means, a set of consonants in Papuan, or the national language of Indonesia, is significantly different from a set of consonants in English. Consequently, the sound productions of Papuan EFL students are highly suspected of giving influences and spreading variations in determining the sound production of their English dental fricatives, both voiceless dental fricative /θ/ and voiced dental fricative /ð/.

Therefore, it is pivotal to deeply examine the sound production of English dental fricatives pronounced by Papuan EFL students. Specifically, the purposes of this study are to reveal to what extent Papuan EFL students precisely articulate dental fricatives and to find out what consonants play a role as the substitution of voiceless dental fricative /θ/ and voiced dental fricative /ð/ when misarticulation occurs. This study is certainly important in addressing certain gaps related to the previous studies of English dental fricatives which can bring other novel consonantal variations of their substitutions. Furthermore, the results can help improve better the quality of EFL teaching and learning processes associated with pronunciation, phonetics, and phonology in Papua.

Method

This study focuses on to what extent Papuan EFL students pronounce English dental fricatives correctly and to find out what consonants play a role as the substitution of English dental fricatives when mispronunciation occurs. Therefore, a descriptive analysis covering studies of English dental fricatives was conducted. Then, 30 native Papuan EFL students involving 10 male students and 20 female students that have similar English proficiency level based on their academic grade, were taken as the participants of the study. Data were collected by giving pronunciation tests which contained 20 words packaged in a simple sentence respectively as the instrument of the study and every word had a pronunciation target of either voiceless dental fricative /θ/ or voiced dental fricative /ð/ in an onset or coda syllable position. Every single sentence was recorded separately and the sentence pronunciations are repeated twice in order to be clearly analyzed related to the target of English dental fricatives and their substitution. Data were analyzed by applying direct phoneme distribution where every word was specifically identified related to the phonemic unit of consonants and vowels.

Findings and Discussion

Findings

To answer the questions that to what extent Papuan EFL students correctly articulate dental fricatives and to find out what consonants play a role as the substitution of voiceless dental fricative /θ/ and voiced dental fricative /ð/ when misarticulation occurs, results of data analysis had been displayed based on either voiceless dental fricative /θ/ or voiced dental fricative /ð/ in an onset or coda syllable position. Specifically, the analysis is elaborated separately involving the onset of voiceless dental fricative (thin /θɪn/, thumb /θʌm/, and three /θri:/), the coda of voiceless dental fricative (month /mʌnθ/, north /nɔ:θ/, death /deθ/), the onset of voiced dental fricative (this /ðɪs/, then /ðen/, and thus /ðʌs/), and the coda of voiced dental fricative (scythe /saɪð/, smooth /smu:ð/, and bathe /beɪð/). Finally, the analysis gives the level of correctness in articulating English dental fricatives by Papuan EFL students and shows characters of sound substitution when they misarticulate the target of the sounds.

In the first table, the data of voiceless dental fricative in the initial position of /θ/ show only 10.6% produce the target correctly. The data also reveal that the dominant substitution produced by students is /t/ (e.g. /θɪn/ becomes /tɪn/), which hit the numbers 82.0% drastically different from the target. Moreover, other substitutions are /d/ (e.g. /θru:/ becomes /dru:/) with 1.3% and /s/ (e.g. /θri:/ becomes /sri:/) with 6.0%, respectively. Nevertheless, no substitution is considered from consonants /ð/, /f/, /v/, and /z/. Thus, correct sound production in the onset of voiceless dental fricative /θ/ articulated by Papuan EFL students lies on the low level and the dominant substitution is voiceless alveolar plosive /t/.

Table 1.

Onset of Voiceless Dental Fricative

Target	Onset of /θ/							
	Substitution	/ð/	/t/	/d/	/f/	/v/	/s/	/z/
/θ/								
16	0	123	2	0	0	9	0	
10.6%	0.0%	82.0%	1.3%	0.0%	0.0%	6.0%	0.0%	

In the second table, the data of voiceless dental fricative in the final position of /θ/ show only 13.3% produce the target correctly. The data also expose that the dominant substitution produced by students is /t/ (e.g. /deθ/ becomes /det/), which reaches the number 86.0%, extremely different from the target. Furthermore, another substitution is /s/ (e.g. /mʌnθ/ becomes /mʌns/) with 0.6%. Nonetheless, no substitution comes from consonants /ð/, /d/ /f/,

/v/, and /z/. Therefore, correct sound production in the coda of voiceless dental fricative /θ/ articulated by Papuan EFL students lies on the low level and the dominant substitution is voiceless alveolar plosive /t/.

Table 2.

Coda of Voiceless Dental Fricative

Coda of /θ/							
Target	Substitution						
/θ/	/ð/	/t/	/d/	/f/	/v/	/s/	/z/
20	0	129	0	0	0	1	0
13.3%	0.0%	86.0%	0.0%	0.0%	0.0%	0.6%	0.0%

In the third table below, the data of voiced dental fricative in the initial position of /ð/ show only 3.3% produce the target correctly. The data also reveal that the dominant substitution produced by students is /d/ (e.g. /ðɪs/ becomes /dɪs/) which hit the numbers 87.3% drastically different from the target. Moreover, other substitutions are /θ/ (e.g. /ðəʊ/ becomes /θəʊ/) with 1.3% and /t/ (e.g. /ðʌs/ becomes /tʌs/) with 8.0%, respectively. Nevertheless, no substitution is considered from consonants /f/, /v/, /s/, and /z/. Thus, correct sound production in the onset of voiced dental fricative /ð/ articulated by Papuan EFL students lies on the low level and the dominant substitution is voiced alveolar plosive /d/.

Table 3.

Onset of Voiced Dental Fricative

Onset of /ð/							
Target	Substitution						
/ð/	/θ/	/t/	/d/	/f/	/v/	/s/	/z/
5	2	12	131	0	0	0	0
3.3%	1.3%	8.0%	87.3%	0.0%	0.0%	0.0%	0.0%

In the fourth table below, the data of voiced dental fricative in final position /θ/ show only 3.3% produce the target correctly. The data also expose that the dominant substitution produced by students is /t/ (e.g. /saɪð/ becomes /saɪt/) which reaches the number 78.6% drastically different from the target. Furthermore, other substitutions are /θ/ (e.g. /smu:ð/ becomes /smu:θ/) with 2.0% and /d/ (e.g. /saɪð/ becomes /saɪd/) with 16%. Nonetheless, no substitution comes from consonants /f/, /v/, /s/, and /z/. Therefore, correct sound production in the coda of voiced dental fricative /ð/ articulated by Papuan EFL students lies on the low level and the dominant substitution is voiceless alveolar plosive /t/.

Table 4.

Coda of Voiced Dental Fricative

Coda of /ð/							
Target	Substitution						
/ð/	/θ/	/t/	/d/	/f/	/v/	/s/	/z/
5	3	118	24	0	0	0	0
3.3%	2.0%	78.6%	16%	0.0%	0.0%	0.0%	0.0%

The overall analysis of the data reveals that correct articulation of English dental fricatives, both voiceless and voiced one by Papuan EFL students is barely used and almost unrecognized that only 12.0% of Papuan EFL students correctly pronounce voiceless dental fricative /θ/ and only 3.3% Papuan EFL students appropriately articulated voiced dental

fricative /ð/. Some kinds of consonants constitute the substitution involving voiceless alveolar plosive /t/, voiced alveolar plosive /d/, and voiceless alveolar fricative /s/. Papuan EFL students dominantly substitute voiceless dental fricative /θ/ into voiceless alveolar plosive /t/ with 84%. Only a few substitutions get into voiced alveolar plosive /d/ with 0.6% and voiceless alveolar fricative /s/ with 3.3%. Likewise, most Papuan EFL students substitute voiced dental fricative /ð/ into both voiceless alveolar plosive /t/ with 43.3% and voiced alveolar plosive /d/ with 51.6%. The rest substitutes it into voiceless dental fricative /θ/ with 1.6%. Therefore, Papuan EFL students almost do not produce English dental fricatives appropriately and most of them substitute English dental fricatives into different consonant sounds which are familiar to them. The following table gives detailed information about the data distributions and substitutions of English dental fricatives:

Table 5.

Substitution of Dental Fricatives

Voiceless Dental Fricative /θ/			Voiced Dental Fricative /ð/		
36			10		
12%			3.3%		
/t/	/d/	/s/	/θ/	/t/	/d/
252	2	10	5	130	155
84%	0.6%	3.3%	1.6%	43.3%	51.6%

Discussion

The results above have clearly responded to certain gaps related to the previous studies of English dental fricatives to reveal to what extent Papuan EFL students appropriately articulate English dental fricatives and to find out what consonants play a role as the substitution of voiceless dental fricative /θ/ and voiced dental fricative /ð/ when misarticulation occurs. This portion attempts to state the profound interpretations and opinions, describe the implication of the findings, and give constructive suggestions for future studies related to sound production of English dental fricatives by Papuan EFL students.

As previously stated, dental fricatives are consonant sounds that are often produced by expelling air while placing the tip of the tongue behind the upper front teeth. Others produce them by inserting the tip of their tongue between their upper and lower teeth. The sounds /θ/ and /ð/ are problematic for both native speakers and EFL students to produce. Dental fricatives are typically regarded as tough to learn in L1 and L2 production. Acoustic and articulatory characteristics cause difficulty in learning (Cruttenden, 2014). The statement is synchronized with the findings in the field that most Papuan EFL students have difficulty producing English dental fricatives. Appropriate production of English dental fricatives, both voiceless and voiced dental fricatives by Papuan EFL students hardly found and almost unrecognized that only 12.0% of Papuan EFL students correctly pronounce voiceless dental fricative /θ/ and only 3.3% of Papuan EFL students correctly pronounce voiced dental fricative /ð/ based on the data. It can be stated that sound production of English dental fricatives is on the low-level production. Consonant /θ/ and /ð/ are rare sounds in the early age of acquiring languages (Fromkin et al., 2018). In addition, voicing for /θ/ and /ð/ is not able to be predicted by phonemes in speech (Smith, 2013). Dental fricatives tend to be fairly unstable, that native speakers usually interchange voiceless and voiced sounds (Rosewarne & Basso, 2018). Related to the findings, Papuan EFL students almost do not produce English dental fricatives appropriately because of their unusual and unrecognized sounds to produce. Due to the fact that the Papuan language actually has no dental category in their sound production. Neither

voiceless dental fricative /θ/ nor voiced dental fricative /ð/ has been ever perceived and accepted in acquiring their first language in general. Therefore, Papuan EFL students have difficulties in articulating English dental fricatives since they have no fundamental experience of dental fricative sounds in their native language to transfer imitatively.

The difficulties in dental fricative production bring not only challenges but also an answer to the problems. Several consonant sounds are almost similar to dental fricative sounds, with both acoustic and auditory characteristics. They are labiodental fricatives /f/ and /v/, which are phonetically the most similar to dental fricatives, alveolar fricatives /s/ and /z/ which are which are phonologically the most similar to dental fricatives, and alveolar plosives /t/ and /d/ which are segmentally the least symbolized sounds (Wester et al., 2007). Based on the findings above, it can be stated that EFL students tend to substitute dental fricatives with other similar sounds to cope with the difficulties of sound production. EFL students with various L1 naturally substitute their English dental fricatives where voiceless /θ/ and voiced dental fricative /ð/ are changed with certain types of consonant sounds. Whatever consonant substitutions are employed by Papuan EFL students, they will indeed impart pieces of knowledge within the processes of phonetic and phonological influences. Papuan EFL students mostly substitute voiceless dental fricative /θ/ with voiceless alveolar plosive /t/ indicated by 84.0% substitution. In other words, Papuan L1 speakers dominantly substitute the consonant /θ/ with the consonant /t/ in sound production.

The findings of the /t/ substitution are almost similar and supported to some previous studies which involve /t/ substitution but are different in various types and degrees. Turkish and Russian L1 speakers also substitute voiceless dental fricative /θ/ with voiceless alveolar plosive /t/. Moreover, Indonesian and Javanese L1 speakers also substitute voiceless dental fricative /θ/ with voiceless alveolar plosive /t/. Dutch L1 speakers substitute voiceless dental fricative /θ/ with three types of variation involving voiceless alveolar plosive /t/, voiceless labiodental fricative /f/, and voiceless alveolar fricative /s/. Polish and Slovak L1 speakers substitute voiceless dental fricative /θ/ with either voiceless alveolar plosive /t/ or voiceless labiodental fricative /f/. It can be stated that not only Papuan L1 speakers but also several L1 speakers with diverse languages replace voiceless dental fricative /θ/ with voiceless alveolar plosive /t/ because of their place and manner of articulation. Consonants /θ/ and /t/ have close place of articulation, which consonant /θ/ touches near the alveolar ridge and consonant /t/ touches the alveolar ridge when sound production occurs.

However, another different substitution comes from the voiced dental fricative /ð/. Papuan EFL students mostly substitute voiced dental fricative /ð/ with both voiced alveolar plosive /d/ indicated with 51.6% and voiceless alveolar plosive /t/ indicated with 43.3% substitution. To put it another way, Papuan L1 speakers primarily replace the consonant /ð/ with both consonant /d/ and /t/ in sound production. The substitution occurred because they are not able to perceive and recognize the actual voiced dental fricative sound in their L1 consonantal inventory as a result close and similar consonant substitution arose. The dental sound substitution is commonly influenced by their place of articulation where close to the alveolar position. Moreover, the findings of the /t/ and /d/ substitution seem to be similar to and confirmed by those of prior research involving /d/ and /t/ substitution, but they differ in a number of ways and to varying degrees. A similar substitution comes from Slovak L1 speakers that they replace voiced dental fricative /ð/ with voiced alveolar plosive /d/ and voiceless alveolar plosive /t/. Dutch L1 speakers substitute voiced dental fricative /ð/ with three kinds of variation involving voiced alveolar plosive /d/, voiced labiodental fricative /v/, and voiced alveolar fricative /z/. Polish L1 speakers substitute voiced dental fricative /ð/ with voiced alveolar plosive /d/ or voiced alveolar fricative /v/. Indonesian and Javanese L1 speakers replace voiced dental fricative /ð/ with voiced alveolar stop /d/ in their sound substitution. If

voiced and voiceless dental fricatives are specifically compared and related to the unusual articulation, the voiced dental fricative is more difficult to articulate than the voiceless dental fricative.

The acquisition of Papuan language is similar to other languages in general. Although consonants in the Papuan language are limited compared to other languages, Papuan EFL students have their own way of coping with difficulties and unrecognized sounds by replacing them with similar sounds that exist in their native sound inventory. Difficulties in dental fricatives create pronunciation variations (Owolabi, 2012). The cross-linguistic influence of producing sounds involves in this process. The different background factors are also considered giving contribution in pronunciation variation, such as social situation factors (Marudin et al., 2018). At that point, there is an interlanguage which means a language system produced to learn a language having features of the language they are learning and also of their first language (Yule, 2022). Moreover, place and manner of articulation certainly have an impact in replacing the sound produced when the sound target is unusual or unrecognized. EFL students naturally replace the place of the dental category with the closest positions, which are labiodental and alveolar positions. Thus, dental fricatives /θ/ and /ð/ turn into either labiodental fricatives /f/ and /v/ or alveolar fricatives /s/ and /z/. A similar process related to the way of the fricative category is replaced. EFL students naturally change how to articulate the sounds to the closest way to produce the sounds. Therefore, fricative is naturally replaced by plosive that dental fricatives /θ/ and /ð/ are substituted by alveolar plosive /t/ and /d/ in certain conditions. From the explanation, Papuan EFL students tend to naturally substitute dental fricatives for alveolar plosive due to the manner of the articulation similarity process.

The difficulties of sound production can be solved in other ways, instead of consonant substitution. The way to overcome the difficulties can be answered by oral training and pronunciation practice. Thus, the findings will be highly efficient and give positive implications to EFL teaching and learning processes that can assist Papuan EFL students learn and practice the correct pronunciation of English dental fricatives in order to achieve better pronunciation like native speakers of English, especially in spoken language. Furthermore, Papuan EFL students need to recognize the characteristics of English dental fricatives in words and sentences before articulating them. Conditionally, EFL teachers should give pronunciation instruction intensely related to place and manner articulation of English dental fricatives and they must improve their pronunciation skills related to the phonetics and phonology study in order to be well conveyed to their students in EFL learning process as well as additionally supported by learning materials and language laboratory.

Conclusion

This study accomplishes some important points that Papuan EFL students have a low tendency in producing English dental fricatives. Appropriate production of English dental fricatives both voiceless and voiced dental fricatives hardly found and almost unrecognized that only a few Papuan EFL students properly articulate voiceless dental fricative /θ/ and voiced dental fricative /ð/. They almost do not produce English dental fricatives appropriately because of their lack of experience in their native language. Furthermore, Papuan EFL students dominantly substitute voiceless dental fricative /θ/ with voiceless alveolar plosive /t/ and substitute voiced dental fricative /ð/ with both voiced alveolar plosive /d/ and voiceless alveolar plosive /t/. It can be stated that Papuan EFL students naturally substitute dental fricatives for alveolar plosive because of the manner of the articulation similarity process. The study definitely has positive implications for the EFL teaching and learning process, which can assist Papuan EFL students in learning and practising the correct pronunciation of English

dental fricatives in order to improve their pronunciation, particularly in spoken English, similar to that of native English speakers.

Acknowledgements

The researcher would like to express thanks to the Faculty of Tarbiyah in IAIN Fattahul Muluk Papua for their information and assistance in completing this work.

References

- Blevins, J. (2004). *Evolutionary phonology: The emergence of sound patterns*. Cambridge University Press.
- Cruttenden, A. (2014). *Gimson's pronunciation of English*. Routledge.
- Dubois, S., & Horvath, B. (2008). Cajun vernacular English: phonology. *Varieties of English*, 2, 208–218.
- Edwards, H. T. (2003). *Applied phonetics: the sounds of American English*. United Nations Publications.
- Foley, W. A. (1986). *The papuan languages of new guinea*. Cambridge University Press.
- Fromkin, V., Rodman, R., & Hyams, N. (2018). *An Introduction to Language (w/MLA9E Updates)*. Cengage Learning.
- Gonet, W., & Pietron, G. (2006). English interdental fricatives in the speech of Polish learners of English. *Dydaktyka Fonetyki Języka Obcego. Neofilologia*, 8, 73–86.
- Guntari, A. K. (2013). Sundanese students' production of English dental fricative consonant sounds. *Lexicon*, 2(1), 75–84.
- Hancock, M. (2012). *English Pronunciation in Use Intermediate with Answers*. Cambridge University Press.
- Ingram, D., Christensen, L., Veach, S., & Webster, B. (1980). The acquisition of word-initial fricatives and affricates in English by children between 2 and 6 years. *In Child phonology* (pp. 169–192). Elsevier.
- Kurniawan, D. (2016). The error analysis of the pronunciation of dental fricative consonants (/θ/, /ð/) by the students of English education study program faculty of teacher training and education Sriwijaya University. *The Journal of English Literacy Education: The Teaching and Learning of English as a Foreign Language*, 3(2), 157–163.
- Ladefoged, P., & Disner, S. F. (2012). *Vowels and consonants*. John Wiley & Sons.
- Ladefoged, P., & Johnson, K. (2014). *A course in phonetics*. Cengage learning.
- Ladefoged, P., & Maddieson, I. (1996). *The sounds of the world's languages*. Blackwell.
- Maddieson, I. (2005). Presence of uncommon consonants. *Haspelmath et Al.(Eds.)*, 82–85.
- Maddieson, I., & Precoda, K. (1990). *The UCLA phonological segment inventory database*. <http://web.phonetik.uni-frankfurt.de/upsid.html>
- Marudin, N., Ratnadewi, D., & Hamsia, W. (2018). Background factors of Thai students' speaking achievement in English learning. *Tell : Teaching of English Language and Literature Journal*, 6(2), 106-115.
- Metruk, R. (2017). Pronunciation of English dental fricatives by Slovak university EFL students. *International Journal of English Linguistics*, 7(3), 11–16.
- Owolabi, D. (2012). Production and Perception Problems of English Dental Fricatives by Yoruba Speakers of English as a Second Language. *Theory & Practice in Language Studies*, 2(6).
- Pullum, G. K., & Ladusaw, W. A. (1996). *Phonetic symbol guide*. University of Chicago press.
- Roach, P. (2009). *English phonetics and phonology paperback with audio CDs (2): A practical course*. Cambridge university press.
- Rosewarne, D., & Basso, R. B. (2018). On English Dental Fricatives. *Ideas*, 3(3).

- Smith, B. (2013). An acoustic analysis of voicing in American English dental fricatives. *Working Papers in Linguistics: Volume 60*.
- Tyler, M., Clot, E., Villain, M.-S., & Pattamadilok, C. (2019). Perceptual assimilation of English dental fricatives by native speakers of European French. *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019*, pp-2580.
- Wester, F., Gilbers, D., & Lowie, W. (2007). Substitution of dental fricatives in English by Dutch L2 speakers. *Language Sciences*, 29(2–3), 477–491.
- Wurm, S. A., Laycock, D. C., & Voorhoeve, C. L. (1975). General Papuan characteristics. *In New Guinea area languages and language study, Vol. 1, Papuan languages and the New Guinea linguistic scene*. Pacific Linguistics.
- Yildiz, Y. (2006). The acquisition of English interdental fricatives by Turkish learners: explaining age effects in L2 phonology. *Essex Graduate Student Papers in Language and Linguistics*, 8, 144–165.
- Yule, G. (2022). *The study of language*. Cambridge university press.

