The Analysis of Pronouncing Post-Alveolar Fricative Faced by the English Education Students of Tanjungpura University

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The objective of this research is to describe the percentage of post-alveolar fricative sound pronunciation acceptability among the English Language Education students in their sixth semester at the University of Tanjungpura. The scope of the study would be limited to the comparison of the first and second formants of the participants with those of the native speaker, whose formants were evaluated utilising the PRAAT software. The data was gathered from a pronunciation performance test that was conducted via an audio recording procedure. The study involved a total of 15 participants who were categorised into three distinct ethnic groups, including Indonesian Tionghoa, Dayak, and Malay. Each participant pronouncing a set of 20 words, consisting of both voiceless and voiced post-alveolar fricatives. According to the findings of the study, 1) the percentage of voiceless post-alveolar fricative sounds that were considered 'Acceptable' was 40.5%, whereas the percentage of those that were considered 'Not Acceptable' was 59.5%., 2) the percentage of 'Acceptable' pronunciation of voiced post-alveolar fricative sounds was 42%, while the percentage of those that were 'Not Acceptable' was 58%. The inference that can be drawn is that students encounter challenges when attempting to articulate post-alveolar fricative sounds.

Keywords: pronunciation, acoustic phonetic, post-alveolar fricative.

INTRODUCTION

Speaking ability is very important in English. Mastering speaking helps practise patterns of a language and for supporting good communication. There are many essential aspects in speaking that must be known and applied to communication, one of which is pronunciation. Good pronunciation is the key to success in communication, without exception in English. International students who study English are required to be able to pronounce English well in order to communicate efficiently. In addition, using proper pronunciation in a variety of circumstances may help enhance English language abilities across the board, including all of the aspects that pertain to it (Tabula et al., 2020). After acquiring greater understanding regarding the proper pronunciation of words, one will finally be able to experience this impact.

According to Richard cited in Komariah (2019), pronunciation can mean the formation of sounds in the mouth, which means that pronunciation is the sound produced by movements in the mouth. In this case, pronunciation has a vital role because if the students mispronounce a word, there will be a misunderstanding between the speakers. Learning pronunciation is not an easy thing, especially for EFL students.

Pronunciation is a skill that must be considered by students who study English as EFL students. By mastering pronunciation, little by little, students will also form good communication. Silfiani et al. (2017) states that many students are confused that, though their identical forms, words may not always sound the same.

Because they are not native speakers, there are still many mistakes made by students, especially students who are already in university. A common mistake that is often faced is the wrong pronunciation of sounds in English. Tabula et al. (2020), explain this particular pronunciation mistake can be attributed to a number of different causes, one of which is an individual's level of awareness of the correct pronunciation. This competence has a considerable impact on such a person's pronunciation skills (Tabula et al., 2020). This capability is meant to be related to the capacity of individuals who are able to differentiate between two sounds more precisely than other people and who can likewise reproduce the proper sound or pronunciation greater than the others. Phonetics is a branch of linguistics that deals with speech sound (Fromkin et al., 2011).

Several studies discuss sounds. In the context of pronouncing consonant sounds, the first is a study conducted by Untoro & Rustipa (2020), who found many English fricative pronunciation errors from English students. The results obtained were errors in the pronunciation of labiodental fricative (/f/ and /v/), dental fricative (/θ/ and /ð/), and post-alveolar fricative (/ʒ/, and /ʃ/) which were the most common. Puspita et al. (2017) furthermore conducted research pertaining to pronunciation, which seeks to determine how students with a Sambas Malay background pronounce English fricatives, including post-alveolar fricatives.

Some literature reveals the study of acoustic phonetic. In terms of acoustic phonetics, there is a study by Wulandari et al. (2018) that discusses the analysis of acoustic properties, specifically formants. Through application, the acoustic properties of a sound are contrasted using the differences between participant formants and native speaker formants as standards. This analysis was conducted with PRAAT Software. This is similar to the study conducted by Rahmatunisa & Syarifudin (2021), which used PRAAT to study intonation and stress characteristics in pronunciation. Nguyen et al., (2022, pp. 378–379) conducts research in the field of acoustic phonetics. The study focuses on the acoustic properties of fricatives, specifically examining amplitude and formant features when speaking with and without a mask. The study revealed that the acoustic characteristics of fricatives were notably reduced when wearing a mask compared to when not wearing one, namely in terms of spectral moment. In particular circumstances, there is a slight variance in amplitude and formant, indicating that each phoneme unit is produced differently in the sound production process. Phoneme unit formation is affected by phonetic context, speaking style, and prosodic qualities, which vary among individuals (Bhagath & Das, 2016). Hashimoto et al. (2018) conducted another study on the application of PRAAT in acoustic-phonetic research.

They utilized PRAAT in his research to evaluate the acoustic characteristics of post-alveolar fricatives in children with speech difficulties. Subsequent studies by Adhani et al. (2021), Situmeang & Lubis (2020), and Eldika & Zainil (2022) examined the significant challenges students faced in pronouncing English fricatives, attributing the difficulties to factors such as a lack of knowledge of the proper pronunciation of consonant fricatives. A study conducted by Putra (2019) also explores the examination of students' pronunciation issues in plosive and fricative consonants. The primary source of errors was determined to be students lack of comprehension on proper pronunciation. Elfahm et al. (2022) additionally looks at comparable fricatives in Arabic consonants.

Although the research about sounds has been conducted by many researchers, there are still some gaps that need to be filled. Based on this, the difference lies in discussing specific sounds pronunciation problems that were not discussed in detail in the previous studies which is post-alveolar fricative (/ʒ/, and /ʃ/). This discussion is premised here on students' basic competence of pronouncing post-alveolar fricative sounds, which are notoriously challenging to pronounce appropriately.

This is also demonstrated by the research that Untoro & Rustipa (2020) conducted about the number of students that incorrectly pronounce post-alveolar fricative sounds. Research involving post-alveolar fricative becomes one of the rare topics to be one of the considerations for conducting this research, considering that post-alveolar fricative is also found in many English words. Another consideration for filling the gaps is that there are rarely topics related to linguistics, especially phonetics, which English Language Education students carry out at the University of Tanjungpura. In addition, topics related to acoustic phonetic analysis, which would use PRAAT software, have never been carried out within the scope of the Tanjungpura University English Education study program.

Post-Alveolar Fricative

The term "post-alveolar"/"palato-alveolar" refers to the area situated behind the alveolar ridge and adjacent to the front of the hard palate. The tongue has a raised form, and the blade is positioned at the post-alveolar area. Fricatives are sounds created by forming a narrow opening in the mouth and allowing air to escape with numerous attempts (Rogers, 2014, p. 23). The post-alveolar region is the area between the backside of the alveolar ridge and the front part of the hard palate, situated on the roof of the mouth (Beňuš, 2021, p. 73; Carr, 2013, p. 39; Fromkin et al., 2001, p. 502, 2018, p. 196; Kelly, 2001, p. 53). Fricative refers to airflow that traverses tight areas in the human respiratory system (Carr, 2013, p. 43; Fromkin et al., 2001, p. 504). The narrow openings are formed by the motion of two articulators that contract to generate a restricted separation between them. Post-alveolar fricatives originate from the front part of the tongue shortening as it approaches the post-alveolar region, resulting in tiny gaps (Fromkin et al., 2018, p. 196).

Therefore, a post-alveolar fricative is a specific form of consonant sound. The sound is produced by the front part of the tongue moving towards the post-alveolar area. This motion forms a narrow opening that forces air to enter the lungs.

A study by Mokoagouw et al. (2022) explores how students' pronunciation of post-alveolar/palato-alveolar fricatives leads to differences in existing pronunciation. Fauzi (2021) also conducted a comparable analysis in their research. The results of this research examine the phonological variances present in the interlanguage of Indonesian learners. It is because of these variances that the majority of Indonesian students find the pronunciation of post-alveolar fricatives to be rather challenging, particularly for sounds that are pronounced in a way that is similar to one another.

METHODS

A descriptive research design was used in this study to conduct the research. The main focus of descriptive study is to discover the features of a phenomenon (Kothari, 2004). A descriptive study is also used to learn more about the conditions and settings around a current phenomenon. A descriptive study would not be complete without an analysis. Researcher should pay close attention to the aspects required for analysing the information acquired during the data analysis procedure. The researcher would describe the phonetics study particularly in articulatory and acoustic phonetic in this case. The major data used in this study would be post-alveolar fricative pronunciation. In line with that, the purpose of using descriptive research is to find out the comparison of acoustic properties between participants' first formant (F1) and second formant (F2) to native speakers' first formant (F1) and second formant (F2) in pronunciation post-alveolar fricative.

Participants

Participants was chosen based on a set of criteria and objectives (Gay et al., 2012, p. 141). As a result, the researcher chosen will have a substantial impact on the research topic. By considering how the participant's problem correlates to the research to be conducted, this issue may draw the researcher closer to the participant. The approach taken in purposive sampling is intended to obtain information that can answer research questions and research objectives to be achieved (Leavy, 2017, p. 79). The selection of these characteristics is carried out in the same proportion as the representation of the population (Kothari, 2004; Leavy, 2022).

The participants in this study were sixth-semester English language education study program students from Tanjungpura University for the 2022/2023 academic year. The total population is 71 people. Based on purposive quota sampling, researcher selected 15 participants from

four different ethnicities as quota sampling segmentation, in this case, Indonesian Tionghoa, Indonesian Malay and Dayaknese, with the same proportion based on a predetermined purposive sampling population. Researcher chose sixth-semester students for this study based on the phonetic topics mentioned in the Introduction to Linguistics course in fourth-semester and select students who graduate with a minimum grade of B as the purposive sampling. Indonesian Tionghoa students are sixth-semester students who come from a Chinese family or grew up in a Chinese culture surroundings. The same applies for Indonesian Malay and Dayaknese. Indonesian Malay students come from a Malay family background, while Dayaknese students come from a Dayak family background. In addition, the researcher chose participants for the study based on the students' level of comprehension of the fundamental idea of the discussion, which was the voiced and voiceless post-alveolar fricatives. The study would investigate the sixth-semester students at Tanjungpura University's English education study program's voiced and voiceless post-alveolar fricative pronunciation.

Data Collection

To collect data related to the pronunciation of the post alveolar fricative from the participants, here researcher used a data collection technique, specifically measurement. In this study, researcher used a pronunciation test aimed at knowing the participants' pronunciation. Researcher also used audio recording, PRAAT software and rating scale to support the process of data collection. Furthermore, to analyse the data, the researcher utilised PRAAT analysis, coding, sorting and calculating percentages.

The researcher has been records the pronunciation of the students during the research process, particularly those that focus on the voiced and voiceless post-alveolar fricative, which is designed to record all of the pronunciation test results. This is done so that the researcher can provide evidence of all of the activities that are carried out throughout the process of collecting information. In this study, researcher would use PRAAT to analyse data resulting from recordings which has been processed at PRAAT in the form of a visual spectrogram. Then, the rating scale used is the itemized rating scale based on statements representing the participants' scores to reflect on their test results. In this study, after the measurement process through the pronunciation test, an evaluation has been carried out by the evaluator with criteria based on specific standards to determine the acceptability of the participants' pronunciation.

Data Analysis

In PRAAT analysis, the researcher analysed the participants' recordings using PRAAT. In this computer software, there is an analysis related to the spectrogram of the sound that has been spoken. Through this spectrogram, there is a visualization of how the sound is. With visualization, it will be possible to analyse the available acoustic properties, such as the formant, which is the benchmark for measurement in this study. Through the information that has been analysed by PRAAT, later the frequencies associated with these sounds will be obtained, including the formant frequencies, which will later be compared between F1 and F2 participants and also native speakers.

Then the coding that is chosen should be able to summarise or retain the substance of the relevant data segment. The researcher was labelling the results of the formant analysis of the participants by referring to the standard values of the native speakers. The results of the labelling process related to standard values will be assessed through a rating scale of acceptability for each word spoken, whether it meets the criteria according to the available standard values. It has also been examined in this coding how the process of deciding acceptability is dependent on the Z-Score value of each formant participant. The Z-Score value is derived from the determination of the participant formant, native speaker formant, and previously determined standard deviation value. The standard deviation value is calculated by how far the formants of native speaker pronunciation deviate from each other in five online English dictionaries, which are used as standards for participants' pronunciation deviations: Oxford Learners Dictionary, Cambridge Dictionary, Merriam-Webster Dictionary, Macmillan Dictionary, and Longman Dictionary. Finally, acceptability can be determined by determining the standard deviation value, which also determines the participant's Z-Score score. The final Z-Score will be used to determine acceptability, which is subsequently matched with a rating scale.

This grouping process involved grouping based on the ethnicity of the participants to make it easier to sort. In this research, the first sorting process is the sorting related to the acceptability of the participant's pronunciation according to the standard values that have been grouped. The standard deviation value and the Z-Score value were also grouped according to the participant and the spoken word in which there was a post-alveolar fricative sound. After doing this, the data grouped based on each ethnicity. Then after all the sorting processes are complete, the data would be more easily grouped for the next process, namely the percentage calculation process.

Before calculating the percentage, the researcher first discovered each rating scale category on the results of the earlier pronunciation test; this step was followed by the continuation of the average score of acceptability for participants. In that case, the data would be grouped in order to find out the overall percentage value of all participants for the acceptability of post-alveolar fricative pronunciation. The findings show how many pronunciations fit into a specific rating scale out of a total of 300. The data has been compiled to calculate the percentage. The data has been combined again after determining the percentage on each rating scale for each formant to obtain the average value of the two percentages. It is also established that pronunciations that fall within the Excellent to Fair range are classed as Acceptable, while those that fall within the Poor to Within Limitation range are considered Not Acceptable by determining the range of formant native speaker values obtained at the initial stage.

RESULTS AND DISCUSSION

This section presents the outcomes of the conducted research as described by the researcher. Following the audio recording process that was conducted to gather data on the pronunciation of post-alveolar fricative sounds commonly used in communication, the researcher proceeded to analyse the acceptability of such pronunciations. This was achieved by comparing the formant, or resonant frequency in the vocal tract, of both the participants and a native speaker. The present study utilises five online dictionaries, specifically Oxford Learners Dictionary, Macmillan Dictionary, Longman Dictionary, Merriam-Webster, and Cambridge Dictionary, as the basis for the pronunciation of native speakers. The process of frequency comparison shall be subjected to analysis through employment of the computer software PRAAT. The software has the capability to generate a graphical representation of the acoustic waveform in the form of a spectrogram. The visualisation of formants can be achieved through the use of the spectrogram.

The current analysis executed data gathered from the pronunciation of the post-alveolar fricative by a sample of 15 participants. The study involved the recitation of a set of 20 words for voiceless sounds and another set of 20 words for voiced sounds of the post-alveolar fricative. The participants were instructed by the researcher to record the outcomes of their individualised pronunciation of the designated words. All of the words that have been prepared contain voiceless and voiced post-alveolar fricatives. The post-alveolar fricative sounds demonstrate similar features and characteristics, despite their distinct positions and phonetic compositions. This points out the analysis that has been carried out. Prior to conducting the audio recording process for pronunciation evaluation, the researcher provided the participants with information regarding the research objectives and methodology.

This was done to ensure that the participants were adequately prepared for the task at hand and to minimise any potential impact on the accuracy of the pronunciation results.

Standard Formant Value

Prior to defining the outcomes of the participants' formants, the researcher started with the formants of the native speaker, which would be shown via a table representation. The acceptability of the participant form is determined by highlighting the range of formants from native speakers, which may vary due to the use of five different online dictionary sources and result in several different form deviations. Subsequent to acquiring understanding of the range of formants, the mean formant

value (as mentioned in and) is also calculated, which can be considered as the 'acceptable' standard for the suitable pronunciation of the previously obtained range outcomes.

The outcomes derived from the analysis of formant participants through the utilisation of PRAAT software are subsequently contrasted with those of formant native speakers. This analysis will be predicated on the standard deviation of the formant of the source native speaker, which is the benchmark value for comparison. The research findings indicate that a considerable number of students demonstrate deviations from the standard native speaker pronunciation values when pronouncing voiceless and voiced post-alveolar fricative sounds. There exist 300 distinct pronunciations for voiceless sounds and an equal number of 300 pronunciations for voiced sounds.

TABLE 1 | Standard Formant Value Voiceless Post-Alveolar Fricative

No.	Words (ʃ)	First Formant (F1)	Second Formant (F2)
1	Fishing (/ˈfɪʃɪŋ/)	1873 Hz	2651 Hz
2	Shore (/ʃɔː(r)/)	1708 Hz	2433 Hz
3	Share (/ʃeə(r)/)	1856 Hz	2709 Hz
4	National (/ˈnæʃnəl/)	1820 Hz	2655 Hz
5	Show (/ʃəʊ/)	1848 Hz	2578 Hz
6	Position (/pəˈzɪʃn/)	1643 Hz	2657 Hz
7	Information (/ˌɪnfəˈmeɪʃn/)	1855 Hz	2684 Hz
8	Additional (/əˈdɪʃənl/)	1932 Hz	2674 Hz
9	Dish (/dɪʃ/)	1820 Hz	2539 Hz
10	Ash (/æʃ/)	1717 Hz	2469 Hz
11	Flash (/flæʃ/)	1723 Hz	2413 Hz
12	Rush (/rʌʃ/)	1730 Hz	2587 Hz
13	Crash (/kræʃ/)	1817 Hz	2512 Hz
14	Trash (/træʃ/)	1721 Hz	2516 Hz
15	Brush (/brʌʃ/)	1797 Hz	2545 Hz
16	Ship (/ʃɪp/)	1826 Hz	2598 Hz
17	Shirt (/ʃɜːrt/)	1805 Hz	2581 Hz
18	Sheep (/ʃiːp/)	1888 Hz	2608 Hz
19	Recreational (/ˌrekriˈeɪʃənl/)	1709 Hz	2661 Hz
20	Assumption (/əˈsʌmpʃn/)	1840 Hz	2489 Hz

The voiceless post-alveolar fricative sound is represented by 20 words. The results of the known formant mean values from the PRAAT software were used to generate these 20 words. The first formant (F1) and the second formant (F2) are the two formants

that each word has. It would be compared between the participant's formants and the two formants of the voiceless post-alveolar fricative used by native speakers of these 20 words.

TABLE 2 / Standard Formant Value Voiced Post-Alveolar Fricative

No.	Words (ʒ)	First Formant (F1)	Second Formant (F2)
1	Visions (/ˈvɪʒn/)	2196 Hz	2904 Hz
2	Genre (/ˈʒɒnrə/)	1004 Hz	2515 Hz
3	Treasure (/ˈtreʒə(r)/)	1856 Hz	2814 Hz
4	Usually (/ˈjuːʒuəli/)	1921 Hz	2671 Hz
5	Measure (/ˈmeʒə(r)/)	2011 Hz	2798 Hz
6	Decision (/dɪˈsɪʒn/)	1447 Hz	2738 Hz
7	Illusion (/ɪˈluːʒn/)	1945 Hz	2804 Hz
8	Fusion (/ˈfjuːʒn/)	2031 Hz	2836 Hz
9	Division (/dɪˈvɪʒn/)	1901 Hz	2678 Hz
10	Erosion (/ɪˈrəʊʒn/)	1834 Hz	2711 Hz
11	Enclosure (/ɪnˈkləʊʒə(r)/)	1965 Hz	2782 Hz
12	Pleasure (/ˈpleʒə(r)/)	1864 Hz	2853 Hz
13	Leisure (/ˈleʒə(r)/)	2033 Hz	2851 Hz

14	Invasion (/ɪnˈveɪʒn/)	2066 Hz	2679 Hz
15	Explosion (/ɪkˈspləʊʒn/)	1816 Hz	2711 Hz
16	Massage (/ˈmæsɑːʒ/)	1755 Hz	2597 Hz
17	Confusion (/kənˈfjuːʒn/)	1946 Hz	2632 Hz
18	Occasion (/əˈkeɪʒn/)	1951 Hz	2734 Hz
19	Camouflage (/ˈkæməflɑːʒ/)	1851 Hz	2570 Hz
20	Sabotage (/ˈsæbətɑːʒ/)	1812 Hz	2565 Hz

Z-Score

Upon calculation of the standard deviation for individual words, the Z-Score can be derived (as shown in Table 3). This statistical measure represents the expected value that provides an estimate of the degree of deviation of the mean data point. The calculation of Z-Score can be performed by using a specific formula:

$$Z = (x-\mu) / \sigma$$

Z = Z-Score
x = Observed Value (Formant Results From Participants)
μ = Standard Value of Native Speaker
σ = Standard deviation

Subsequently, the acceptability results were acquired with the help of a Z-Score-based comparison with the following criteria:

TABLE 3 / Z-Score Category

Category	Criteria of Z-Score
Excellent	(-1) – 1
Good	(-1.5) – (-1.1)
Fair	(-2) – (-1.6)
Poor	(-2.5) – (-2.1)
Very Poor	<2.5
Within Limitation	>1

The voiced post-alveolar fricative sound is represented by 20 words. The results of the known formant mean values from the PRAAT software were used to generate these 20 words. The first formant (F1) and the second formant (F2) are the two formants that each word has. It would be compared between the participant's formants and the two formants of the voiced post-alveolar fricative used by native speakers of these 20 words.

The outcomes of the participants' voiceless pronunciation with the first formant reveal that 72 pronunciations were classified as Excellent, 13 as Good, 19 as Fair, 16 as Poor, 90 as Very Poor, and 90 as Within Limitation. Regarding the second formant, the Excellent category had 113 instances, while the Good category had 14 instances, the Fair category had 12 instances, the Poor category had 3 instances, the Very Poor category had 13 instances, and the Within Limitation category had 145 instances. Upon identifying the suitable pronunciation categories, the proportion of each formant in the participant's pronunciation was determined.

The first formant's outcomes for the Excellent categorization were determined to be 24.0% in the voiceless sound, while the ratings for Good, Fair, Poor, Very Poor, and Within Limitation were 4.3%, 6.3%, 5.3%, 30.0%, and 30.0%, respectively. In relation to the second formant, the findings indicate that the Excellent category accounted for 37.7% of the results, while the Good category were responsible for 4.7%, Fair for 4%, Poor for 1%, Very Poor for 4.3%, and Within Limitation for 48.3%.

Based on the data presented, it can be inferred that the cumulative proportion of the outcomes is as follows: 30.8% for the Excellent, 4.5% for the Good categorization, 5.2% for the Fair categorization, 3.2% for the Poor categorization, 17.2% for the Very Poor categorization, and 39.2% for the Within Limitation categorization (as mentioned in in Table 4).

TABLE 4 | Total Percentage Voiceless

	Excellent	30.8%
	Good	4.5%
	Fair	5.2%
Total Percentage:	Poor	3.2%
	Very Poor	17.2%
	Within Limitation	39.2%
	Total	100%

Moreover, in the voiced pronunciation, the outcomes of the first formant displayed scores of 76 in the Excellent category, 14 in the Good category, 10 in the Fair category, 12 in the Poor category, 108 in the Very Poor category, and 80 in the Within Limitation category. Regarding the second formant, there were 122 results categorised as Excellent, 22 as Good, 8 as Fair, 6 as Poor, 18 as Very Poor, and 124 as Within Limitation.

Then, the results of the voiced sounds revealed that the first formant obtained a high percentage of Excellent category ratings at 25.3%, followed by Good at 4.7%, Fair at 3.3%, Poor at 4%, Very Poor at 36%, and Within Limitation at

26.7%. In the second formant, the distribution of results was as follows: 40.7% were classified as Excellent, 7.3% as Good, 2.7% as Fair, 2% as Poor, 6% as Very Poor, and 41.3% as Within Limitation.

The findings indicate that 33% of the total number of participants falls under the Excellent category, while 6% are classified under the Good category. The Fair and Poor categories both account for 3% of the sample, respectively. Moreover, 21% of the sample falls under the Very Poor category, while 34% are classified under the Within Limitation category (as mentioned in Table 5).

TABLE 5 | Total Percentage Voiced

	Excellent	33.0%
	Good	6.0%
	Fair	3.0%
Total Percentage:	Poor	3.0%
	Very Poor	21.0%
	Within Limitation	34.0%
	Total	100%

Discussions

This study aims to find the percentage of post-alveolar fricative pronunciation of Sixth-semester English education students' at Tanjungpura University in the academic year 2022/2023. Based on the research findings, it was found that the majority of students still found it difficult to pronounce the post-alveolar fricative. This was indicated by the deviation of the formant frequency of students' pronunciation compared to formant native speakers. As mentioned in the background related to students' ability to distinguish between two sounds, the findings show that some students' pronunciations deviate from post-alveolar fricative sounds to other sounds. The research findings align with what has been mentioned in the background, which states that students have difficulty pronouncing sounds because they are not familiar with them. This affected students' awareness of pronouncing sounds properly, including post-alveolar fricative pronunciation.

In the first formant (F1) of voiceless sound, the majority of the students' voiceless pronunciation was classified as 'Very Poor' and 'Within Limitation', indicating a significant deviation from the standard pronunciation of a native speaker. The results indicate that the students' pronunciation in the second formant (F2) was primarily characterised by the 'Within Limitation' category, which suggests that the participants' formant values surpassed the range of formants obtained from the standard of deviation. The results revealed that the majority of the students presented poor pronunciation in voiced sound as well, as demonstrated by their classification in the 'Very Poor' category for the first formant (F1). This suggests that their

formant values were significantly lower than those of a native speaker. In contrast to the first formant (F1), which failed to show significant differences across categories, the second formant (F2) displayed a notable disparity. Specifically, the 'Within Limitation' category demonstrated the highest F2 values, while a considerable number of participants also demonstrated F2 values getting within the 'Excellent' category, indicating a pronunciation form that closely approximated that of a native speaker.

Following collecting the percentages for each pronunciation category of the participant, proceed with the categorization of the groups that are considered 'Acceptable'. The researcher categorised the accepted categories into categories ranging from Excellent to Fair. The previous claim is grounded on the usage of the Z-Score range, specifically ranging from -2 to 1. This range serves as an indicator that the outcomes obtained continue to be considered acceptable and fall within the standard values. Categorising individuals as "Not Acceptable" due to their pronunciation's formant falling outside of the standard numerical range that represents a poor pronunciation, particularly for those who are classified as Poor and Within Limitation.

TABLE 6 | Acceptability (Voiceless)

Acceptable	40.5%
Not Acceptable	59.5%

TABLE 7 / Acceptability (Voiced)

Acceptable	42.0%
Not Acceptable	58.0%

Based on the findings of the analysis, the researcher arrived at the conclusion that English Language Education students in their sixth-semester at Tanjungpura University encountered difficulties in correctly articulating voiceless and post-alveolar fricative sounds. Specifically, many students struggled with distinguishing between post-alveolar fricative sounds (/ʃ/) and (/ʒ/) and alveolar fricative sounds (/s/) and (/z/), which are similar in position, but the first two are produced slightly behind the later one. The confusion between the pronunciation of post-alveolar fricative and alveolar fricative is frequently seen. The variation in resonant frequency values, also known as formants, is attributed to the disparity in position. The post-alveolar fricative and alveolar fricative exhibit distinct first and second formants. It is noteworthy that these formants are frequently employed for assessing an individual's articulation. The formants mentioned earlier are subject to inter-individual variation owing to the distinct characteristics of the vocal tract that differ across individuals.

The findings of this study may only be generalised to the English student population at Tanjungpura University, which is one of the limitations of this study. In the case of pronunciation, data gathering methods that are restricted to voice recordings might not be able to capture relevant non-audio factors. In addition, the limits of formant analysis when utilising the PRAAT programme can make it difficult to gain a comprehensive knowledge of the phenomenon of post-alveolar fricatives in pronunciation. Furthermore, the utilisation of data analysis techniques that are restricted to coding, sorting, and the calculation of percentages may restrict the capability to capture more substantial components as well as individual factors that can influence the acceptability of the pronunciation.

There is the potential for future research in this area to cover a wide variety of topics that are attached. Comparative demographic research has the potential to broaden the scope of the study by comparing English students from different educational institutions or universities in order to evaluate differences in the acceptability of the pronunciation of post-alveolar fricatives. Additionally, a full understanding of the factors that influence the acceptability of pronunciation can be obtained by integrating a number of different methods of data collection, such as direct observation, interviews, and surveys. In addition, computational research has the capability of integrating acoustic analysis with computational approaches and artificial intelligence in order to get a more comprehensive and effective comprehension of the patterns of pronunciation of post-alveolar fricatives. It is possible for neurolinguistic research

to explore how the brain processes and comprehends pronunciation, as well as the factors that influence the degree of difficulty or simplicity of pronunciation. Through the investigation of these research topics, it is predicted that a more extensive and comprehensive understanding of the acceptability of the pronunciation of post-alveolar fricatives would be achieved. In addition, this investigation may result in the development of methods for improving pronunciation competencies in English education, particularly through research that focuses on acoustic qualities being investigated.

CONCLUSION

The researcher discovered the percentage of students who demonstrated voiceless post-alveolar fricative pronunciation. The findings revealed that 31% of students were categorised as Excellent, 5% as Good, 5% as Fair, 3% as Poor, 17% as Very Poor, and 39% as Within Limitation. The researcher determined the percentage of cases of voiced post-alveolar fricative pronunciation among students, revealing a distribution of 33% for the Excellent category, 6% for the Good category, 3% for the Fair category, 3% for the Poor category, 21% for the Very Poor category, and 34% for the Within Limitations category. The findings indicate that the criteria for acceptable pronunciation fall within the range of Excellent to Fair categories, as it aligns with the standard range of pronunciation among native speakers. Specifically, the analysis reveals that the voiceless post-alveolar fricative was pronounced properly 40.5% of the time, while the voiced post-alveolar fricative was pronounced properly 42% of the time. Conversely, the outcomes pertaining to pronunciation that were deemed not acceptable fall within the Poor to Within Limitation range. Specifically, 59.5% of the voiceless post-alveolar fricative sounds and 58% of the voiced post-alveolar fricative sounds were pronounced in a way that is unsuitable.

Drawing from the previous description, the researcher concluded that a substantial percentage of sixth-semester students enrolled in the English Language Education programme at Tanjungpura University during the academic year 2022/2023 are still having difficulties when precisely reciting post-alveolar fricatives, thereby resulting in a deviation from the standard pronunciation of native speakers.

Based on the findings discussed above, the researcher would like to provide the following suggestions: (1) The English Language Education Study Programme at Tanjungpura University is expected to establish a pleasant atmosphere for students to enhance their proficiency in pronunciation.

(2) The researcher intends to offer suggestions to English Education students regarding increasing their level of awareness concerning the significance of phonetic and phonological learning. (3) The researcher intends that this study can serve as an idea of reference for future researcher who are interested in investigating the same subject matter. In light of the limitations faced by the researcher in this particular study, it is recommended that future researcher explore additional sub-fields within the field of phonetics.

Through a better understanding of the difficulties that university students experience when pronouncing post-alveolar fricatives, this study makes a substantial contribution to English language study programmes. Based on these findings, it appears that the implementation of a curriculum that is more efficient, teaching methods that are more focused, and the incorporation of technology into learning can ultimately improve the quality of English language education and the outcomes for students at Tanjungpura University and other institutions of a similar nature.

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