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The Effectiveness of The "PRAAT" Application in Improving Students' Phonemes Pronunciation

Dian Shafwati[1]*, Endang Komariah [2], Feni Munifatullah [3]
dianshaf89@gmail.com[1], endang.komariah@fkip.unila.ac.id[2], feni.munifatullah@fkip.unila.ac.id[3]
[1]University of Lampung, Indonesia
[2]University of Lampung, Indonesia
[3]University of Lampung, Indonesia
*Correspondence: dianshaf89@gmail.com

Abstract

Prospective teacher students at University of Lampung often face challenges in pronouncing certain phonemes such as close mid vowels, plosive consonants, and fricative consonants. These difficulties may arise from various factors, such as lack of practice, influence from their native language, or auditory impairments. This study aims to examine the effectiveness of the PRAAT application in improving students' pronunciation, focusing on close mid vowels, plosive consonants, and fricative consonants. Pre-test and post-test data were collected from 50 participants to evaluate changes in pronunciation after the intervention using PRAAT. The average spectrum deviation in the pre-test was 24.5%, which decreased to 14.3% in the post-test, with a total gain of 10.2%. This significant reduction indicates an improvement in pronunciation, approaching the standard of native speakers in the analyzed phoneme categories. Statistical analysis revealed a significant change with a p-value < 0.001, affirming that PRAAT plays a crucial role in enhancing students' pronunciation quality. These findings provide empirical evidence that PRAAT is effective as a tool for improving the pronunciation of specific phonemes in language learning and recommend its broader application in educational contexts.

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INTRODUCTION

In the era of globalization, teachers are required to possess strong communication skills. One of the key factors influencing communication ability is accurate pronunciation, particularly of phonemes. Accurate phoneme pronunciation is also a crucial skill for prospective teacher students, as they need to articulate phonemes clearly and precisely to ensure students can understand them effectively (Asrul, N & Husda, A, 2022). Teachers who are confident in their pronunciation abilities will feel more self-assured in teaching and interacting with students. However, based on the preliminary observation, prospective teacher students from the English Education Department, Faculty of Teacher Training and Education (FKIP), at the University of

Lampung often face challenges in pronouncing certain phonemes, such as close-mid vowels, plosive consonants, and fricative consonants. These difficulties may arise from various factors, such as lack of practice, influence from their native language, or auditory impairments.

To address this issue, the researcher proposes the use of PRAAT as an instructional tool to teach phoneme pronunciation to prospective teachers. PRAAT is computer software designed for analyzing and improving pronunciation. It offers a variety of features that assist users in identifying and correcting pronunciation errors, such as acoustic spectrogram analysis and formant visualization. This study aims to contribute to improving the quality of teacher education in Indonesia. Teachers with accurate phoneme pronunciation will be able to help students understand the lesson material more effectively.

Pronunciation is the process of producing speech sounds, which involves the use of various articulatory organs, such as the lips, tongue, teeth, and the palate, to generate different sounds. Nguyen, T. T. T. (2023) describes pronunciation as a combination of stress, sounds, intonation, and "comprehensibility of meanings," identifying it as essential for optimal oral communication and personal identity. Numerous factors can influence pronunciation, According to Levis et al. (2024), pronunciation is a multi-dimensional communicative skill influenced by a combination of learner-internal factors—including age, motivation, and first language (L1) background—and external factors such as the quality of phonetic instruction and the amount of language exposure.

In a study by Hassan (2014), four factors were identified that impact English language learners' ability to pronounce English words: differences between the phonological systems of their native language and the target language (English), inconsistencies in certain English sounds, native language interference, and the influence of spelling on pronunciation. These factors are commonly referred to as linguistic factors. Several methods can be employed to learn and improve pronunciation, such as listening to native speakers, attending pronunciation classes, receiving feedback from tutors, or using pronunciation-enhancing software. Kelly (2000) notes that pronunciation consists of two main features: phonemes and supra-segmental. This research focuses on phonemes.

Phonemes are the basic sound units in a language that can differentiate meaning between words. In other words, the difference in phonemes results in differences in meaning. When producing words, the speaker pushes air from the lungs, up through the throat and vocal cords, through the mouth, passing over the tongue, and out between the teeth and lips. Based on Schmitt and Rodgers (2024), the primary characteristics of phonemes include:

1. Contrastive Function: They serve as the fundamental tool for distinguishing meaning between words (e.g., the difference between /p/ and /b/ in *pin* and *bin*).
2. Abstract Representation: A phoneme is a mental category rather than a physical sound; the actual physical variations we speak are called allophones.
3. Distinctive Features: Each phoneme is defined by a unique set of phonetic attributes, such as voicing, place of articulation, and manner of articulation.
4. Language Specificity: Phonemic status is unique to each language; a sound that distinguishes meaning in one language may be a mere variation in another.
5. Phonotactic Constraints: Phonemes are governed by specific rules that dictate how they can be legally combined to form words within a particular language.

Phonemes can generally be categorized into two types:

a. Segmental Phonemes:

Segmental phonemes are produced by a single articulatory organ at a time. These can be divided into two subcategories:

• Vowels: Produced with vocal cord vibration and without airflow obstruction. Vowels are distinguished by tongue height, tongue position, and lip rounding.

• Consonants: Produced with airflow obstruction. Consonants are categorized by their place of articulation, manner of articulation, and whether or not the vocal cords vibrate.

b. Supra-segmental Phonemes:

Supra-segmental phonemes involve more than one articulatory organ over a longer period. Often referred to as prosody, supra-segmental phonemes include stress, pitch, length, and intonation. These features shape how words and sentences are emphasized and structured in speech.

In this study, the researcher will focus the scope on vowels and consonants, specifically the pronunciation of close-mid vowels, plosive consonants, and fricative consonants. These phonemes are described as follows:

a. Close-Mid Vowels: Close-mid vowels are articulated with the tongue positioned in the mid-high area of the mouth. These vowels have a duration that is longer than close vowels but shorter than open-mid vowels. For the purpose of this analysis, the researcher will focus on the close-mid vowel /o/ as in the word “law.”

b. Plosive Consonants: Plosive consonants are produced by completely closing off the airflow and then releasing it suddenly with a burst of pressure. These consonants have a very short duration. To simplify the analysis, the researcher will focus on the plosive consonant /b/ as in the word “bad.”

c. Fricative Consonants: Fricative consonants are produced by creating friction as air passes through a constricted part of the vocal tract. These consonants have a longer duration compared to plosive consonants. For the purpose of this analysis, the researcher will focus on the fricative consonant /ʒ/ as in the word “vision”.

The researcher will utilize PRAAT to improve phoneme pronunciation accuracy due to its various advantages. PRAAT is free, open-source, and user-friendly, with many online tutorials and guides available to support its use. Additionally, it offers a wide range of features, including the ability to analyze, edit, synthesize, and visualize speech. These benefits make PRAAT a valuable tool for investigating phonetic accuracy.

According to Larassati et al. (2022), PRAAT is free computer software designed for acoustic speech analysis. Commonly used by linguists for phonetic research, PRAAT provides visual representations of speech in the form of sound wave images, which reflect pitch variations. Based on its website, PRAAT can be used for various functions, such as recording, analyzing, editing, synthesizing, and also visualizing our speech. PRAAT offers several pronunciation training tools that can help users improve their phoneme pronunciation, including:

- Acoustic target visualization: Users can view the acoustic spectrogram of the target pronunciation and compare it with the spectrogram of their own pronunciation.

- Listening practice: Users can listen to recordings of native speakers and attempt to mimic the pronunciation.

- Feedback: PRAAT provides feedback on users' pronunciation, indicating whether it matches the desired acoustic target.

PRAAT's comprehensive functionality and its feature make it an excellent tool for enhancing phoneme pronunciation accuracy in this study.

METHODS

The researcher employed an experimental method with a quantitative research approach, which meets all the requirements for investigating cause-and-effect relationships. This study used a quasi-experimental design. According to Creswell (2015), a quasi-experiment is an experimental design conducted without randomization, but it involves assigning participants to groups. The study follows a pretest-posttest design.

T1 X T2

T1 referred to the pretest that was given before the researcher taught using the PRAAT in order to measure the students' achievement before they received the treatment.

X referred to the treatments provided by the researcher through the PRAAT application to improve students' pronunciation.

T2 referred to the posttest that was given after implementing the PRAAT application to measure the extent of the students' improvement following the treatment.

The subjects of this study were undergraduate students from the English Education Department, Faculty of Teacher Training and Education (FKIP), at the University of Lampung. The participants consisted of 50 students from the 2020 and 2021 cohorts of the English Education program. Those participants were chosen because they belong to the class of pronunciation that was the class being used in preliminary observation. The research was conducted at the same institution.

The primary instrument used in this study was speaking performance, specifically focusing on pronunciation accuracy. For both the pre-test and post-test, each student was given time to record their spoken performance using material from the book English Phonetics and Phonology by Roach (1991). This ensured consistency in content and difficulty level between the pre-test and post-test. The researcher assessed speaking accuracy in terms of pronunciation, with particular emphasis on pitch and intensity, focusing on words containing the phonemes of interest: the close-mid vowel /o/ in the word "law," the plosive consonant /b/ in the word "bed," and the fricative consonant /ʒ/ in the word "vision."

In this study, the researcher also utilized PRAAT's sound analysis features to examine various aspects of the recorded speech, such as pitch, intensity, duration, and formant structure. Specifically, the focus was on analyzing the pronunciation of the close-mid vowel /o/ as in "law," the plosive consonant /b/ as in "bed," and the fricative consonant /ʒ/ as in "vision." The speaking performance of the students was evaluated by comparing their pronunciation with that of native English speakers, which served as a benchmark for measuring sound similarity.

By analyzing the recordings using PRAAT, the researcher was able to assess factors such as pitch, intensity, and duration and compare them to the speech patterns of native English speakers. This comparison provided an objective evaluation of how closely the students' pronunciation aligned with native speakers, offering valuable insights into their progress and areas for improvement in mastering pronunciation. The accuracy of each student's pronunciation was compared to native English speakers' pronunciation using the percentage difference/deviation formula as follows:

Initial Value:
Student Speaking Performance (Pitch (Hz) + Intensity (dB))
Final Value:
Native Speaking Performance (Pitch (Hz + Intensity (dB))

The results are expressed as a percentage, with a lower percentage indicating a closer similarity to native pronunciation and a higher percentage reflecting more errors in the students' speaking performance.

This research analyzed the students' speaking performance in terms of pronunciation. The researcher computed the students' scores based on their performance to find out the students' improvement in speaking ability when pronouncing a text using PRAAT application. The following steps were taken:

a) The pre-test and post-test were scored using the PRAAT application. Since the data was scored by PRAAT, the researcher used a native English speaker as a benchmark to assess pitch and intensity in the students' speaking performance.

b) The results of the test were tabulated, and the scores of the pre-test and post-test were calculated and compared to native speaker scores.

c) Conclusions were drawn from the tabulated results of the pre-test and post-test, which were statistically analyzed using statistical computerization. A Paired Sample t-test was conducted using the Statistical Package for Social Science (SPSS) to determine whether the improvement gained by students was significant. The significance was determined by sig. 2 tailed <0.05 as minimum.

RESULTS AND DISCUSSION

The deviation shown in the research result is the percentage difference between the students' pronunciation and native pronunciation. The native speaker has 0% deviation, indicating perfect pronunciation. A smaller percentage indicates a better comparison, while a higher percentage signifies greater errors in pitch and intensity in the students' pronunciation, as assessed by using

1. Pronunciation Test for /ʒ/ as in "vision"

Data /vision/ or /ʒ/	Pre-test	Post-test	Gain
Deviation Total	1939	1172	767
Deviation Mean	38,78%	23,44%	15,34%

For the fricative consonant /ʒ/ in "vision," there was a significant improvement in pronunciation after using PRAAT. The total deviation decreased from 1939 in the pre-test to 1172 in the post-test, with an average deviation dropping from 38.78% to 23.44%, reflecting an average gain of 15.34%. Most participants showed a substantial reduction in deviation, with some examples being a decrease from 83% to 77.93% for one of the subject and a notable improvement from 69.61% to 21.34% for another subject.

2. Pronunciation Test for /o/ as in "law"

Data /law/ or /o/	Pre-test	Post-test	Gain
Deviation Total	1355	1109	246
Deviation Mean	27,1%	22,18%	4,92%

For the close-mid vowel /o/ in "law," the total deviation reduced from 1355 in the pre-test to 1109 in the post-test. The average deviation decreased from 27.1% to 22.18%, indicating an

average improvement of 4.92%. It is enough to showing the significant progress towards native pronunciation standards.

3. Pronunciation Test for /b/ as in "bad"

Data /bad/ or /b/	Pre-test	Post-test	Gain
Deviation Total	1253	558	695
Deviation Mean	25,06%	11,16%	13,9%

For the plosive consonant /b/ in "bad," the total deviation dropped from 1253 in the pre-test to 558 in the post-test, with the average deviation falling from 25.06% to 11.16%, reflecting an average improvement of 13.9%. Participants who achieved very low deviations demonstrated substantial progress towards native pronunciation standards.

Overall, the use of PRAAT significantly improved students' pronunciation accuracy across all tested sounds.

Discussion

Roach (2009) discusses pitch and intensity as crucial components of supra-segmental features in pronunciation. He describes pitch as the perceived frequency of sound, which plays a significant role in intonation patterns. Intensity, or loudness, is associated with stress in syllables and words, impacting the rhythm and emphasis in speech. This research is in line with Roach's (2009) statement because it employs the PRAAT application to teach speaking and assess performance based on pitch and intensity. Roach emphasizes the importance of pitch and intensity as crucial components of supra-segmental features in pronunciation, noting that pitch, as the perceived frequency of sound, significantly influences intonation patterns, while intensity, or loudness, is associated with stress in syllables and words, impacting the rhythm and emphasis in speech. These elements are essential for conveying meaning, emotion, and speaker intent in spoken language as already stated before.

The purpose of PRAAT application is grounded in principles of imitation, active engagement, and comprehensible input in language learning. By integrating pitch and intensity into shadow reading method, this research supports Roach's assertion that these elements are vital for effective spoken communication. The use of PRAAT application thus aligns with contemporary linguistic theory and pedagogical practice, demonstrating how these supra-segmental features can be systematically taught and evaluated to enhance learners' overall speaking proficiency.

Furthermore, this research highlights that students, as assessed by PRAAT, often encounter more difficulties with pitch than with intensity in pronunciation. Pitch presents greater challenges due to its intricate control mechanisms, perceptual sensitivity, and linguistic complexity. This research finding aligns closely with the study conducted by Ghanie (2019), which investigated student phoneme pronunciation and utilized PRAAT for assessment. Ghanie's research also revealed that students faced challenges, particularly in mimicking and producing correct pitch. The similarities between the findings of both studies underscore the significance of pitch as a major hurdle in pronunciation acquisition. The intricate nature of pitch control, as highlighted in both studies, poses considerable difficulties for learners. These findings suggest that the mastery of pitch in pronunciation is crucial yet challenging, requiring targeted instructional approaches and pedagogical interventions to support learners in overcoming these obstacles.

In summary, while PRAAT might seem similar to other language learning tools, it offers distinct advantages and unique benefits. Unlike traditional methods that focus solely on repetitive practice, PRAAT provides a comprehensive analysis of speech through real-time acoustic feedback. By offering detailed visualizations of pitch, intensity, and formants, PRAAT enhances pronunciation accuracy and helps users refine their intonation and rhythm. This tool not only improves phonetic precision but also boosts overall speaking confidence by allowing users to compare their speech patterns with native speakers. Through its sophisticated analysis features, PRAAT facilitates a deeper understanding of the nuances of spoken language, making it an invaluable asset for achieving more accurate and natural speech.

CONCLUSION

Based on the analysis and testing conducted, it can be concluded that the use of PRAAT as a speech training tool significantly improves the speaking abilities of participants from the 2020 and 2021 English Study Program, FKIP University of Lampung. This conclusion is supported by the data and findings across specific phoneme categories: close mid vowels, plosive consonants, and fricative consonants.

For close mid vowels, data indicates a significant improvement in pronunciation ability after applying PRAAT. The average error rate decreased from 27.1% in the pre-test to 22.18% in the post-test, reflecting an improvement of 4.92 percentage points per participant. Paired samples testing showed a p-value of 0.000, highlighting the statistical significance of this improvement. This reduction in deviation demonstrates that PRAAT effectively aids in refining close mid vowel pronunciation, bringing participants closer to native speaker standards.

Regarding plosive consonants, the analysis revealed a notable enhancement in pronunciation accuracy following PRAAT use. The total errors decreased from 1253 in the pre-test to 558 in the post-test, with the average error rate dropping from 25.06% to 11.16%. The paired samples test yielded a p-value of 0.000, indicating a highly significant improvement. This result underscores that PRAAT not only reduces the number of errors but also substantially enhances the accuracy of plosive consonant pronunciation.

For fricative consonants, the total errors reduced from 1939 in the pre-test to 1172 in the post-test, with the average error rate decreasing from 38.78% to 23.44%. Although the improvement was less pronounced compared to plosive consonants, the reduction remains significant with a p-value of 0.000 in the paired samples test. This finding suggests that PRAAT contributes to better fricative consonant pronunciation, though the improvement is more gradual compared to other phoneme categories.

Overall, PRAAT has proven to be an effective tool for enhancing speech abilities among participants, particularly in reducing pronunciation deviations for close mid vowels, plosive consonants, and fricative consonants. The significant improvements observed in the data indicate that PRAAT helps participants approach native speaker pronunciation standards more closely, thereby improving their overall speaking accuracy and quality.

Furthermore, PRAAT proves to be a valuable tool for speech training. Educators should start with thorough training on PRAAT's features and gradually introduce its use, integrating it with existing teaching methods. Providing detailed feedback, monitoring progress, and offering additional resources will enhance its effectiveness. For future researchers, a deep understanding of PRAAT, a well-structured research design, and validation of the tool are essential.

Overall, PRAAT is an effective tool for improving pronunciation and should be considered a strong asset in both teaching and research contexts.

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