

EXPLORING ENGLISH-MAJOR STUDENTS' PERFORMANCE ON FOSSILIZATION THROUGH WEB-BASED PHONETIC TRAINING AND THEIR PERCEPTIONS

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Abstract

The research aims to investigate the application of web-based phonetic training to cope with pronunciation fossilization by English majors at a university in Vietnam. Students' perception of the web-based phonetic training and its impact on phonetic performance was examined. The study consisted of forty English majors divided into the experimental group (ECG) and the control group (CG). A 12-week intervention and a mixed method approach were used, with pre-and post-phonetic performance tests and a questionnaire for students' perceptions. Results showed that students had significantly positive attitudes towards web-based platforms and ratings of continued use intention and preference over traditional methods. Post-intervention analysis revealed considerable phonetic improvement for the EG than the CG. These findings verify web-based phonetic training as an instrument to overturn pronunciation fossilization and point the direction to future work on this platform, significantly enhancing the practice opportunity and feedback mechanism.

Keywords: *Fossilization, phonetic training, quasi-experimental design, web-based materials*

1. Introduction

Since pronunciation is essential to English language proficiency, it dramatically influences successful communication. Thomson and Derwing (2015) and Lee et al. (2015) report that (Thomson & Derwing, 2015; Lee et al., 2015). According to Monroy Casas (2001), segmental feature fossilization is a significant obstacle for many non-native English learners, especially English majors. The most common cause of these errors is inadequate early phonetic training, first language (L1) interference, or a lack of opportunities for authentic communication. Even with traditional teaching, students need help to eliminate these fossilized features, resulting in lower student confidence and intelligibility in speech (Derwing et al., 1997). It is a prevalent fact that fossilization occurs in second language (L2) learning; that is, the phenomenon of fossilization in interlanguage (as proposed by Selinker, 1972) has received much attention and has widely been acknowledged in the field of Second Language Acquisition (SLA) (Long, 2003).

The characteristic that distinguishes SLA and has a significant value in promoting foreign language teaching is interlanguage fossilization (Selinker, 1972). In part, it is recognized that previous studies have shown the potential for acquiring native-like proficiency in morphology and syntax but lack the same potential in pronunciation, which has been of interest to linguists (Long, 2003; Han, 2004). This provides an excellent chance for teachers and students to understand the nature of fossilization better and overcome fossilization in English language pronunciation.

The erroneously followed pronunciation of a learner's mouth sounds becomes fossilized in the segmental features of a learner (Acton, 1984). In particular, English majors in non-native settings seem to undergo great difficulties with these challenges, even at the University of Economics – Technology for Industries (UNETI), given that their exposure to authentic pronunciation models can be minimal. Early language learning habits, L1i, and inadequate corrective feedback account for fossilization (Long, 2003; Monroy-Casas, 2001). For example, learners from tonal or syllable-timed language backgrounds may poorly deal with vowel reduction, accent placement, or consonant articulation of the different English stress-timed rhythms. Phonetic awareness is one major problem (Acton, 1984). For example, many learners fail to distinguish between sounds that do not sound very different to the human ear, for example, between /l/ and /r/, resulting in problems with listening and speaking skills (Guevara-Kuroz et al., 2019). In traditional teaching, pronunciation tends to be the neglected part of curriculum learning, with a sprinkling of cardinal words here and there, some sound practice based on grammar or vocabulary, but nothing intentional towards development. It follows that students have poor training in finding and correcting such errors methodically. With time, these features become difficult to correct, thus affecting their academic and professional prospect.

Furthermore, phonetic training materials in a web-based environment constitute a transformative solution to unlearn fossilized features in segmental phonetics (Derwing et al., 1997; Jiang & Chun, 2021). Learners are provided resources that combine technology with phonetic instruction, resources aimed at improving both auditory perception and articulation (Son, 2008). Interactive features, like audio playback, visual articulatory models for visual display, and honest time feedback, enable students to identify their errors and make corrections independently, learning to feel autonomous. Bashori et al. (2020) noted that web-based training offers one of the most essential advantages, that is, accessibility. Materials can be accessed at any pace with a return to challenging concepts as necessary. This type of flexibility is beneficial when unlocking fossilized features, which almost always need to be reposed and practiced. Moreover, Yan and Lin (2019) argue that this material is also multimedia, allowing the various learning styles to make phonetic concepts more easily understood and engaging. In addition, web-based tools offer exposure to authentic pronunciation models and fill the gap in pronunciation instruction in the classroom. Various accents and speech contexts contributing to learning English phonology were engaged on several platforms (Chiu et al., 2007) integrated with automated speech recognition technology (ASR). Furthermore, the gamified aspects of the applications, such as quizzes and pronunciation challenges, increase user motivation and avoid the harshness of the traditional correction approach (Retnomurti et al., 2008).

Nevertheless, although work has focused on the positive impact of technology in language learning, more research needs to be done on its effect on overcoming fossilized pronunciation features. It is hoped that targeted interventions can fill this gap, particularly at the University of Economics – Technology for Industries (UNETI) where English-major students are studying to enter professional fields that require precise and accurate English communication. Consequently, the researcher conducted a study to help English majors perceive and produce fossilized segmental features via web phonetic training materials. However, more specifically, it attempts to determine to what degree training improves students' perceptual and productive abilities regarding segmental features at a finer level of accuracy. Moreover, students' perception of the effectiveness and usability of web-based phonetic materials is studied. With the aim of these objectives, the study suggests the following research questions:

- What are students' perceptions of the effectiveness and usability of web-based phonetic training materials?
- To what extent does the training improve their production of these features?

2. Literature review

2.1. Fossilization

2.1.1. *Fossilization in Second Language Acquisition*

Linguistic errors ingrained in learners' speech are a persistent phenomenon in SLA, where fossilization is an obstacle to acquiring the features involved. Because of the complex combination of segmental and suprasegmental phonetic features, pronunciation is particularly vulnerable to fossilization. According to Wei (2008, p.127), "*phonological fossilization is the repetition of phonological errors that have occurred due to L2 pronunciation acquisition difficulties, most of the time impacted by L1.*" Stevick (1978) states that pronunciation concerns the articulation of phonemes, the syllabic structure, and prosodic elements (stress and intonation), and all areas are open to interference from the learner's L1.

The first causes of difficulty are often segmental features (Han, 2004). For example, consonants are a blockage or restriction in the vocal tract, while vowels are created with an open vocal track. The articulatory distinctions are difficult to learn for speakers whose native phonetic system is so much at variance from English. Over time, these persistent misarticulations, like substituting /θ/ with /t/ or /ð/ with /d/, tend to solidify or become "*fossilized.*" Second, SLA is more complicated further due to suprasegmental aspects such as stress, intonation, and connected speech (Lee et al., 2015). According to Acton (1984), stressed syllables currently deal with loudness, pitch, and duration variations. Stress can be misplaced when sending meaning in English, where stress patterns signal differences in grammar or meaning. Intonational patterns convey interpersonal attitudes, and connected speech blurs word boundaries, creating other challenges for the learner (Lee et al., 2015).

2.1.2. *Common fossilization*

Segmental features fossilized in L2 learners' pronunciation are persistent pronunciation errors that L2 learners cannot overcome through extensive training and practice (Lee et al., 2015). These errors are often attributed to interference from their L1 phonological system, producing deeply ingrained habits resistant to change (Derwing et al., 1997).

A frequent example is replacing dental fricatives /θ/ and /ð/ with sounds more familiar (Han, 2004). For example, many Asian learners tend to say /tɪŋk/ for 'think' and /dɪs/ for 'this' because dental fricatives are not in their native phonological inventory. This is a common substitution that even advanced learners who are otherwise fluent in English often make. Another common fossilization, according to (Monroy-Casas, 2001), is with vowel distinctions, usually in differentiating between tense and lax vowels. Many learners struggle with the contrast between /ɪ/ and /i:/ and consequently have trouble with minimal pairs such as "ship" and "sheep." (Long, 2003). Similarly, Wei (2008) observes that the schwa sound /ə/ is sometimes substituted with a full vowel, e.g., "about" as /ə'baʊt/ instead of /æbaʊt/. Another place where fossilization often occurs is the aspiration of initial stops (/p/, /t/, /k/), particularly in the case of speakers whose L1 lacks aspirated consonants. For instance, Vietnamese speakers might not puff air with their tongue, which is typically characteristic, so the 'pen' sounds like "ben."

As such, the concentration of features about segmental features, or consonant and vowel sounds, is chosen in this current study as segmental features play a huge role in getting intelligible pronunciation in English. That is, errors in segmental features are the fundamentals on which spoken language is built and often needed for better communication. English learners with an L1 lacking equivalent consonant sounds and syllable structures (including final consonant clusters, e.g., /nd/, /ts/) experience difficulty with these consonant sounds (/θ/, /ð/). For instance, many Vietnamese learners substitute /θ/ with /t/ or omit final consonants, creating word meaning distortions and loss of clarity of communication. Even more similarly, vowel sounds, like the contrast between /ɪ/ and /i:/ or /æ/ and /e/, are essential but often fossilized because the vowels of the learner's native system interfere. Listeners may confuse live as /li:v/ instead of /lɪv/ as a mispronunciation.

2.2. Phonetic training approaches

2.2.1. Theoretical foundations and web-based phonetic training

Phonetic training in SLA is underpinned by two primary theoretical foundations: Retnomurti et al. (2008) find articulatory phonetics and auditory discrimination (articulatory phonetics and auditory discrimination). Speech sounds are produced in articulatory phonetics, such as where the tongue, lips, and vocal cords are placed or moved (Thomson & Derwing, 2015). With basing training in articulatory phonetics, learners develop awareness of the articulation of sounds. Thus, it is easier to replicate correct pronunciation (Jenkins, 2014). For example, learners can feel vibrations in their vocal cords during articulation of consonants to understand the difference between voiced and voiceless consonants such as /b/ and /p/. Unlike auditory discrimination, it enhances students' ability to perceive and distinguish between similar sounds, a skill that helps improve listening comprehension and pronunciation (Jenkins, 2014). For example, training that enhances the ability to differentiate between /ɪ/ in "sit" and /i:/ in "seat" will reduce vowel production errors and increase intelligibility. One methodology complements the other and supplies a foundation for sufficient phonetic education.

Articulatory phonetics and auditory discrimination underpin web-based materials for training in phonetics (Bashori et al., 2020; Son, 2008). The two theoretical foundations complement each other and are often packaged in web-based tools to offer such a rich learning experience. Secondly, Guevara-Ruko et al. (2019) claim that many web-based materials, such as animations or videos, demonstrate them physically, like the movement of the tongue, lips, and jaw. This fits right in with articulatory phonetics, a view that newcomers should learn and imitate how sounds are made. For example, tools that present how the tongue is placed for various vowels or consonants assist learners in cultivating the habit of correct articulation. Secondly, as Hwang et al. (2016) assert, web-based materials contain audio features that allow learners to listen to and contrast minimal pairs (ship vs. sheep). The activities teach learners to distinguish between sounds on more minor distinctions to increase their auditory discrimination capacities. Other features, like playback options, speech recognition, and the like, further reinforce the learner's abilities to hear and produce sounds correctly.

2.2.2. Benefits and challenges of using web-based phonetic training

Web-based materials are vital devices for phonetic preparation with some key benefits. First, they are interactive with audio playback, visual models, and real-time feedback (Jiang & Chun, 2021). Students with different learning styles could accommodate their diversity to master the target sounds (Chun, 2021). These resources help accommodate different learning styles and offer students the ability to both see and hear the production of target sounds, which is necessary for connecting the perception of sounds and articulating those same sounds. Second, learning with web-based tools is accessible and flexible in that students can practice at their speed and revisit problems that prove difficult (Pino, 2008). This is a great thing to have, especially when it comes to problems with fossilized pronunciation errors, as it takes a lot of exposure and practice to fix things like that. However, there are challenges in using web-based materials. A limitation found is that many digital tools need more personalized feedback (Retnomirti et al., 2008). Though these resources can supply automated feedback, they cannot necessarily tackle individual learner mistakes in depth or source individual strategies for improvement. Another challenge is the possible technology problem(s), like limited access to constant internet connection or compatible devices, especially in resource-constrained educational contexts (Yan & Lin, 2019). Furthermore, learners may need to be more motivated or disciplined to take full advantage of self-directed online training (Chiu et al., 2007).

2.3. Previous studies on web-based training

Recent research has demonstrated the significant potential of web-based training approaches in enhancing L2 pronunciation skills, particularly in addressing fossilization and phonetic challenges.

Building on Jiang and Chun's (2021) substantial study, their comprehensive study provides strong evidence supporting the efficacy of web-based discourse intonation training through substantial improvement in speech comprehensibility and speaking confidence. They discovered that learners' geographical location did not impact training outcomes and reinforced web-based instruction's versatility. Specifically, the revelation that Chinese learners have more incredible difficulty with thought groups and prominence than tone choices is beneficial for designing instructional interventions.

Web-based features across these studies were demonstrated to integrate in several diverse ways. The second emphasized the importance of embedding interactive components, such as songs and games (Retnomurti et al., 2018), and the third involved the effectiveness of handling specific pronunciation difficulties, such as consonant clusters with the web-based applications (Alsuhaibani et al., 2024). Guevara-Rukoz et al.'s (2019) work on gamified elements in phonetic training showed that our findings are based on their findings. Bashori's (2022) research on the psychological dimension of language learning is particularly interesting. An essential advantage of web-based training, evidenced in the research findings, is that Automatic Speech Recognition (ASR) tools can decrease speaking anxiety and create a low-risk environment for immersion in speech production.

Nevertheless, the existing literature suggests essential gaps in the researcher's knowledge about how web pronunciation training can be used, particularly about web pronunciation training's use in overcoming fossilized pronunciation features. Previous studies have shown that web-based pronunciation instruction is generally effective; however, current research needs to adequately address some significant limitations in pronunciation instruction for L2 speakers of English. While studies like Jiang and Chun (2021) positively affected discourse, Alsuhaibani et al. (2024) also succeeded with consonant clusters. Nevertheless, very few attempts were made to deal with fossilized segmental features. However, fossilized errors, by definition, resist normal teaching means and require particular intervention approaches, making this gap particularly important. The current research addresses this gap by treating fossilized segmental features foremost among English majors at UNETI. Second, phonetic training through web-based platforms has also been studied, like Guevara-Rukoz et al. (2019). However, most works addressed general pronunciation rather than focusing on frequent and deeply entrenched pronunciation errors. The present study's emphasis on fossilized features is a vital step toward understanding how technology can surmount complex pronunciation problems to which pronunciation learning is particularly resistant. However, Bashori's (2022) study of affective aspects of web-based language learning did not provide an in-depth understanding of how learners perceive web-based materials' efficiency in dealing with fossilized pronunciation features. This is significant because it is well-established that students' perceptions and engagement are critical factors for any educational intervention, especially for addressing fossilized errors that require considerable persistence over time. Another notable gap is the application of web-based pronunciation training in context-specific ways. Previous research has considered different learning contexts. However, research into English primary students is limited, particularly among UNETI learners enrolled in specialized technical education institutions where correct pronunciation is necessary for a bright future career. The fact that this gap is in context has a special significance because the students in question prepare for future careers in fields where high-level English speaking is needed.

3. Research methodology

3.1. Research setting and participants

In the UNETI research setting, typical and unique features of an EFL learning environment in Vietnam are also found. The everyday reality of overcrowded English classrooms in Vietnamese universities mirrors the learning conditions, which tend to create an average class of 50 students and factors in limiting self-attention and practice of speaking.

This is especially significant regarding its institutional context: an engineering university at which English does not play a central role but which is an essential skill for students' future professions. The timing of the study (September 2023 to May 2024) permitted a full academic year investigation with the length necessary to realize and evaluate pronunciation development.

Several methodologically sound considerations are evident in the selection of the participants. However, the sample size of 40 English majors is relatively modest yet sufficient for controlling an experimental study on pronunciation training. The equal division of 20 students into two groups of 20 each ensures balanced comparison groups (EG as the experimental group and CG as the control group). The participants are the same age (18–20 years), and their proficiency level in B1 regarding CEFR indicates a relatively homogeneous group regarding linguistic maturity. Typical of many Vietnamese EFL learners, the participants had no prior pronunciation practice and learned English in high school through test-oriented English study that placed little or no emphasis on pronunciation. Given their place in this context, they are particularly appropriate subjects for pronunciation intervention effectiveness investigations.

Minimizing researcher bias and participant engagement was assisted by the fact that participants were not the researcher's students but were motivated by course credit (assignment replacement). A primary methodological strength of this study is the involvement of a single instructor for EG and CG. On this ground, the lecturer passed the scientific and linguistic competencies and the C1 level of English proficiency needed for teaching pronunciation. Their years of experience, over five years of direct teaching ESP pronunciation in particular, lend them great credibility in instructional delivery. The particular importance of this expertise is due to the specialized nature of the pronunciation teaching and the specificity of some phoneme contrasts. Still, their previous emphasis on grammar, vocabulary, and reading skills, but may ignore their fossilized pronunciation errors.

3.2. Research design

This study adopted a quasi-experimental design with quantitative methodology, which serves as a pragmatic and methodologically sound design for educational research in a natural classroom. Accurate experimental designs are thought by many to be the gold standard, which is why the quasi-experimental approach is a response to the real-world reality of doing educational research in the real world, where randomizing subjects is often not possible, or at the very least, not ethical (Creswell, 2013). As a result, the impacts of web-based pronunciation training and students' phonological development can be investigated, and their perceptions of the intervention as well. The inclusion of EG and CG, despite the nonrandom assignment of phonemic focus areas, affords a meaningful basis for comparing various phonemic focus areas.

3.3. Data collection instruments

The study's data collection strategy employs a quantitative approach through two primary instruments: tests of pronunciation and perception questionnaires.

With "testyourenglispronunciation.com," the design is pre- and post-test to offer a standardized and objective measure of students' pronunciation improvement.

On this online platform, both groups are being assessed under the same conditions, eliminating any possibility of bias through the administrator. The same testing platform used to administer the pre- and post-assessments reduces measurement inconsistency issues and allows students' progress to be directly compared.

In addition, incorporating a perception questionnaire provides a qualitative feature to the research (Creswell, 2013) that enriches the understanding of the students' experiences with web-based pronunciation training. The questionnaire was adapted following Bashori et al. (2020), which provided a clear framework based on critical aspects of web-based learning materials. Given the demographic information, the instrument used a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree) to assess student perceptions over several dimensions. A web-based learning platform is evaluated across five dimensions using a questionnaire. First is System Usability, where we assess the students' interface in our system, from navigating to the ease of reading and finding the material to progress tracking. Content Quality, the second dimension, assesses the pedagogical value of pronunciation materials in terms of native speaker samples, accuracy of ASR technology, and a structured progression in the exercises. In the third dimension, Interaction and Feedback Mechanisms, we discuss student engagement with interactive features and the quality of feedback from those tools, including the timeliness and usefulness of phonetic feedback, opportunities for peer interaction, and the quality and functionality of recording and playback tools for pronunciation practice. Supplementary Features in the fourth dimension answer what additional tools can help motivate and support learning, such as learning diaries, progress-tracking systems, and features that connect a learner to a community. Finally, the fifth dimension, Overall Effectiveness, evaluates the platform's impact on students' pronunciation capabilities, confidence and satisfaction, and students' intention to use further and recommend the platform.

Both assessment and instructional needs are considered when selecting specific web-based platforms. An excellent assessment website is testyourenglishpronunciation.com, which provides instructional intervention for Englishwithlucy.com. The fact that the latter has been included is especially noteworthy for many reasons. The first is that the platform is brought to the student using a native speaker (Ms. Lucy) to help expose students to authentic pronunciation models. The second feature is that the platform comprises various interactive lessons supplementing modern computer-assisted language learning principles. The platform covers many consonants and sounds, providing substantial coverage of pronunciation features beyond those involved in realizing the phonemic contrasts in the study. A standardized testing platform is combined with an interactive learning website, and this approach, which is aligned with current educational technology trends, provides pronunciation instruction with the rigor of assessment.

3.3. The procedure of the study

A structured procedure for implementing web-based pronunciation training was done over a 12-week period. Both groups were tested before the intervention on pronunciation as a baseline measure of proficiency levels before the intervention. Comprehensive orientation was provided to members of the EG on how to use the web-based platform, how to log into the platform, navigate through the various features, and how to use technical support protocols. Orientation is essential here to guarantee that technical problems will not hinder learning. As presented in Table 1, the interventions conducted in EG and EG are different.

Table 1. Interventions conducted in EG and CG in the current study

Week	EG	CG
Week 1	<ul style="list-style-type: none"> - Pre-test - Regular classroom instruction - Platform orientation - Account set up 	<ul style="list-style-type: none"> - Pre-test - Regular classroom instruction - Traditional course orientation
Week 2-11	<ul style="list-style-type: none"> - Web-based training - Self-paced practice - Online assignments - Self-paced monitoring 	<ul style="list-style-type: none"> - Teacher-centered instruction - Textbook exercises - In-class pronunciation drills
Week 12	<ul style="list-style-type: none"> - Post-test - Questionnaire - Learning analytic review 	<ul style="list-style-type: none"> - Post-test - Learning analytic review

Throughout the intervention, the students in both conditions attended regular classroom instructions, but the EG learning incorporated materials from the web. On the one hand, the EG used the online platform in and out of class, encouraging flexible and individual learning. The course instructor displayed and moderated the class activity through the platform's analytics dashboard if additional assistance was required. The interactive aspects of the web-based training included ASR technology, native models, and feedback mechanisms in the integrated training. Using the internet, EG students were expected to make weekly online submissions and perform pronunciation exercises and self-recording exercises. In addition, it has a tracking of progress system that allows learners to see that they are improving and which areas they need to practice more. On the other hand, the CG worked in a typical didactic way with everyday classroom tasks and homework. Their pronunciation was practically developed only through pronunciation exercises and examples in the textbook, with feedback from the instructor only within the classroom. This traditional approach involved much more lecturing than rather than the rich, self-organized, collaborative learning system that the experimental group enjoyed.

Both groups took a timed post-test in the last week to assess the change in pronunciation. Further, the EG members completed the satisfaction questionnaire after the virtual experiment to collect qualitative data. The data gathered through learning analytics throughout the semester provided helpful information about students' activity and learning pace in the experimental group.

3.3. The procedure of the study

The statistical analysis used in this research used descriptive and inferential statistics to provide a more detailed evaluation of web-based pronunciation training. Descriptive analysis of both EG and CG quantitative data was conducted using SPSS version 27.0. First, to examine the significance of the results on enhancing students' pronunciation, a paired sample t-test was conducted to compare the pre-and post-intervention test scores between each group. This analysis indicated whether there were enhancements in the levels of pronunciation accuracy during the period when the study progressed separately for the EG and CG.

The paired sample t-test was particularly useful in establishing the extent to which web-based training enhanced the pronunciation of the EG by comparing the statistical differences in the scores obtained at the onset of the study and the end of web-based training. In addition, after the post-test had been conducted, an independent t-test was used again to compare the post-test scores of the EG and CG. From this analysis, it was possible to identify whether there were significant differences in pronunciation achievement between EG students who had undergone web-based training and CG students who had received traditional training.

In examining the students' milieu towards the web-based phonetic training, descriptive statistics were also computed from the students' responses to the EG. Descriptive statistics were calculated to analyze the system usability, content quality, interaction and feedback, supplementary features, and overall effectiveness scores determined from the completed questionnaire. The mean scores offered the central tendency measure of the student's attitudes toward web-based training. At the same time, standard deviations showed how responses ranged or scattered in each category.

4. Results

4.1. Students' perceptions of using web-based phonetic training

The findings reveal overwhelmingly positive perceptions towards the web-based phonetic training platform, particularly regarding students' willingness to continue using it (Table 2).

Table 2. Descriptive statistics of students' perceptions of using web-based phonetic training

	Mean	Std. Deviation
i3	4,60	0,598
i5	3,50	0,513
i9	4,55	0,510
i1	4,30	0,470
i4	3,70	0,657
i14	4,50	0,513
i18	3,65	0,489
i11	4,05	0,224
i10	4,35	0,489
i12	3,10	0,308
i2	3,45	0,510
i6	3,75	0,444
i7	3,35	0,489
i8	2,65	0,489
i13	3,65	0,489
i16	4,40	0,754
i17	4,70	0,470
i15	4,80	0,410

The final two items had the highest mean scores, and they were both directly related to engaging with the website: "I would like to continue using this platform for practice" with a mean score of 4.80 and "This platform helps me learn better than traditional methods" with a mean score of 4.70. However, system usability was also positively evaluated: accessibility of the platform was considered high (M=4.60), and the instructions submitted with the assignment were also high (M=4.55). These high scores suggest that technical design and interface are two primary strategies of the CSE that enhance learning. Essential attention was paid to native speaker recordings, which received the highest average rating (M = 4.50), proving once more that authentic models significantly impact students. However, some of the areas analyzed had some opportunities for improvement. The lowest mean score was obtained in the item "I can practice pronunciation as many as I want," for which M = 2.65, suggesting possible restrictions in practice time or a technological problem. Again, recording and checking pronunciation came out

lowest with a mean of 3.1, while receiving feedback had a slightly higher mean of only 3.45. Hence, the researcher believed that these inter-activities may need some fine-tuning.

Interestingly, several items received equivalent mean scores. For instance, "The practice activities match my learning needs" and "Learning pronunciation through this platform is enjoyable" both scored the same (M=3.65), which indicates a balanced perception between functionality and engagement.

4.2. Students’ phonetic performance before and after the intervention

Table 3 illustrates the comparison between EG and CG students’ phonetic performance before and after the intervention with/ without web-based phonetic training.

Table 3. Independent sample test’s result of EG and CG students’ phonetic performance before and after the intervention

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pre	Equal variances assumed	1,759	0,193	1,490	38	0,145	2,400	1,611	-0,862	5,662
	Equal variances not assumed			1,490	36,168	0,145	2,400	1,611	-0,867	5,667
Post	Equal variances assumed	0,207	0,651	11,123	38	0,000	17,650	1,587	14,438	20,862
	Equal variances not assumed			11,123	37,707	0,000	17,650	1,587	14,437	20,863

Statistical analysis before the intervention revealed no significant difference between the EG and CG regarding phonetic fossilization ($t(38) = 1.490, p = 0.145 > 0.05$). The mean difference between groups was slight ($MD = 2.400, SE = 1.611$), and Levene's test was found to demonstrate homogeneous variances ($F = 1.759, p = 0.193 > 0.05$). The most striking feature related to equivalent phonetic fossilization between the two subject groups is indicated in the nonsignificant p-value and the slight mean difference. This finding is further validated by the 95% confidence interval (-0.862 to 5.662) crossing zero. First, this initial equivalence ensures both groups start on roughly equivalent footing, which is essential to attributing any later differences in outcomes post-intervention to the treatment effect instead of pre-existing group differences.

The post-intervention analysis showed with extreme significance that there was a significant effect on phonetic fossilization between the experimental group and the control group ($t(38) = 11.123, p < 0.001$). Levene's test indicated homogeneous variances ($F = 0.207, p = 0.651 > 0.05$), and the mean difference was significant and increased considerably to 17.650 ($SE = 1.587$). The 95% confidence interval (14.438 to 20.862) shows a highly significant positive treatment effect. The most outstanding feature is an increase in the mean difference between groups (from 2.400 in pre-intervention to 17.650 in post-intervention), which indicates a significant improvement in the experimental group's performance. This is translated by the highly significant p-value ($p < 0.001$) compared to a nonsignificant difference ($p = 0.145$) before intervention.

5. Discussions

Concerning the first research question about the students' perception, the findings indicate overwhelming positive perceptions of web-based phonetic training, especially a very high willingness to continue using the platform, consistent with the findings of Bashori et al. (2020) on the motivational benefits of digital learning tools. Jiang and Chun (2021) claim that web-based training has unique pronunciation instruction advantages, corroborated by the strong preference for this platform over traditional methods. Son's (2008) strong claims that user-friendly interfaces are needed in digital learning platforms, thus validated by high ratings for system accessibility and clarity of instructions. However, lower scores in practice opportunities and feedback features align with the concerns Retnomurti et al. (2008) expressed concerning the need for more automated feedback of web-based systems. This finding fills an essential gap in the literature on user experience with web-based phonetic training tools in specialized technical education contexts such as UNETI. Their equivalent scores in learning need alignment and enjoyment support the findings of Guevara Rukoz et al. (2019) on the importance of balancing pedagogical effectiveness with user engagement.

Regarding the second research question on the impacts of web-based phonetic training, the EG's performance significantly improved after the intervention. It provides the convincing evidence that web-based phonetic training is practical for fossilized features.

This answered the literature gap in research about how web-based training affects fossilized segmental features, going beyond that generic pronunciation, as indicated in the works of Thomson and Derwing (2015). The post-intervention results also statistically supported the theoretical foundation discussed by Lee et al. (2015), which suggested that technology-enhanced learning can overcome fossilization. The findings are strengthened by the homogeneous variances maintained throughout the study, answering Han's (2004) concerns about the methodological rigor involved in pronunciation research.

6. Conclusions

The main objective of this study was to investigate the extent of the usefulness of web-based phonetic training in overcoming pronunciation fossilization in English majors at UNETI about the perceptions and their effects on their phonetic performance. In quasi-experimental research, the quantitative approach with EG and CG was used in the pre-test, post-test, and questionnaire. The conclusion addresses both research questions conclusively. The results regarding student perceptions showed an initial overwhelmingly positive attitude toward the web-based phonetic training platform, especially about willingness to continue to use and preference over traditional methods. The platform was highly accessible, and instructions were easy to follow, but practice opportunities and such feedback mechanisms were lacking. Importantly, regarding phonetic impact, the substantial gains made by the EG in phonetic performance strongly suggest that the platform successfully treats fossilized features.

Several limitations should, however, be noted. Second, the study is based on a relatively small sample in a rather specific institutional context at UNETI; thus, findings may need to be more generalizable to broader populations. Second, the intervention period was sufficiently short (12 weeks), possibly missing long-term retention effects. However, another aspect of the study was that it centered solely on segmental features, which ignored other suprasegmental aspects of pronunciation fossilization. Future research needs to be done into longitudinal studies evaluating the long-term effectiveness of web-based phonetic training. If the scope was expanded to include suprasegmental features, we understand the platform's impact comprehensively. Improvements in practice opportunities and feedback mechanisms are identified as areas that should be developed and focused on technical improvements.

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