Investigating the Effects of Using Chatbot AI in Teaching Pronunciation to EFL Learners at Nguyen Tat Thanh University

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Abstract

This study explores the effectiveness of Chatbot AI in improving final consonant pronunciation among 106 A2-level EFL learners at Nguyen Tat Thanh University based on action research. Eight learners were purposefully selected for in-depth analysis of experiencing Chatbot AI based on stimulated recall interviews and thematic analysis. The other 98 participants engaged in quasi-experimental design, divided into a control group (n = 49) and an experimental group (n = 49). The analysis utilized independent samples t-tests to compare the pre- and post-intervention error rates for fricative and plosive omission and substitution. The thematic analysis of the interviews highlighted that the 08 learners appreciated the tool's real-time, detailed, and personalized feedback. Meanwhile, the statistical results revealed significant reduction in the experimental group's error rate after using Chatbot AI: fricative omission decreased by a mean difference of 13.12, plosive omission by 24.00, fricative substitution by 3.86, and plosive substitution by 13.65, compared to the control group. These findings suggest that Chatbot AI effectively reduce pronunciation errors across fricative and plosive final consonants, with potential benefits for EFL instruction when integrated with teacher guidance.

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EFL, pronunciation, final consonants, Chatbot AI

1 Introduction

1.1 Background to The Study

Effective pronunciation is essential for clear communication in English, particularly for English as a Foreign Language (EFL) learners. Particularly, segmental (e.g., individual sounds) and suprasegmental (e.g., stress, intonation) features are major contributors to communication breakdowns among L2 learners [1]. However, in the Vietnamese context, a mismatch was found between what the teachers said about how they teach pronunciation and how they taught it [2] The researchers observed that the teachers'pronunciation teaching practices in intact classrooms were limited, and almost always consisted of correcting students' pronunciation errors through recasts (with or without IPA transcriptions), with little explicit or planned teaching of pronunciation.

At the segmental level, consonants play a critical role in conveying meaning, often carrying more of the message than vowels [3]. More specifically, those consonants at word-final positions are important for distinguishing between, for example, negative and affirmative forms such as 'can' /kæn/ vs 'can't' /kɑ:nt/ [3]. However, EFL learners who are from linguistic backgrounds like Vietnamese, face significant challenges in producing final consonants accurately due to the absence of such sounds in their native phonology. This discrepancy often leads to errors such as omission (e.g., dropping /t/ in '*what*'), or substitution (e.g., replacing /z/ with /s/) [4]. These errors not only reduce intelligibility but also affect learners'

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confidence and communicative competence in real-life interactions.

Despite the importance of final consonants, teaching them effectively poses a challenge in EFL classrooms. Such pedagogical practices as repetition and minimal pair drills, are valued for their effectiveness in teaching discrete sounds, particularly consonants produced at the front of the mouth (e.g., /m/, /f/), which are easier to demonstrate and correct due to visible articulation [3]. However, [4] noted that learners still struggle with distinguishing voiced and voiceless consonants (e.g., /t/ vs. /d/), further complicating their pronunciation training. Also, unsystematic pronunciation instruction often leads to persistent communication breakdowns, with over 50% of surveyed students identifing pronunciation issues (e.g., segmental and suprasegmental errors) as the primary cause of communication failures [5].

Such limitations have drawn attention to the integration of artificial intelligence (AI) tools, such as Chatbot AI, by providing learners with immediate, personalized feedback and practice opportunities. Numerous studies have highlighted the application of AI-driven tools to improving EFL pronunciation through features of error detection, whereby addressing the limitations of traditional teaching methods [6]. However, there remains a noticeable gap in researching how Chatbot AI can improve final consonant pronunciation among EFL learners.

1.2 Chatbot AI and Teaching Final Consonants

Traditional practice of teaching pronunciation, such as repetition, drills, and minimal pair exercises, have long been foundational in EFL classrooms [3]. However, these pedagogical techniques often fail to provide immediate and personalized feedback, which is critical for addressing learner needs in practicing pronunciation [7]. For example, drills may improve recognition of sounds but is insufficient to deal with specific errors, such as omissions (e.g., dropping /t/ in *got*) or substitutions (e.g., /z/ to /s/ in *bears*), which are prevalent among Vietnamese EFL learners [2].

The emergence of artificial intelligence technology in language education has been hoped to address the gap by offering real-time, personalized feedback. Among advanced technologies, Google AI Studio, a Chatbot AI developed by Google, has a potential to apply to EFL pronunciation pedagogy due to its ability to deliver detailed, individualized feedback on final consonant pronunciation. The Chatbot AI utilizes multi-sensor detection and advanced algorithmic feedback to analyze speech patterns [7]. These features are particularly beneficial for Vietnamese EFL learners, who face challenges with final consonants due to phonological differences between Vietnamese and English [2].

Whilst benefits of the AI technology have been widely recognized, little research has focused on the Chatbot AI's impacts on Vietnamese EFL learners, leaving a space where its effectiveness in reducing specific error with omissions and substitutions could be further investigated.

2 Methods

To find effective ways of using Chatbot AI in improving pronunciation of final consonants to A2-level EFL learners at Nguyen Tat Thanh University, the central research question concerns the effects the AI platform has on the learners' performance to pronounce final consonants; more specifically, the present study sought to answer the following questions:

1. How can Chatbot AI be used effectively to improve EFL learners' final consonant pronunciation?
2. To what extent does Chatbot AI help EFL learners reduce omission errors in final consonant pronunciation?
3. To what extent does Chatbot AI help EFL learners reduce substitution errors in final consonant pronunciation?

The present study was based on the model of action research for ensuring continuous observation and reflection [9], consisting of three phases: Planning, Action, and Observation. In the planning phase, the exploration of how Chatbot AI was utilized effectively began with identifying EFL learners' experience and opinions through the use of individual pronunciation assessment. Informed by the findings from the planning phase, the action phase aimed to utilize Chatbot AI, featuring speech recognition and feedback tools, to address the learners' pronunciation problems. As for observation, the performance of pronunciation was tracked after AI intervention to determine the effectiveness of the AI intervention.

2.1 Research Site

This project was conducted within the context of the general English program at Nguyen Tat Thanh University, targeting A2-level EFL learners, as aligned with the Common European Framework of Reference for Languages. The program, administered by the Foreign Languages Center, comprises six courses spanning CEFR levels A1 to B1, designed to enhance students' English proficiency. Purposeful sampling was employed to select 106 participants from three classes, who were using the textbook Personal Best A2B [10]. This sample was chosen due to their documented difficulties with final consonant pronunciation, a common challenge among Vietnamese EFL learners [4]. This sample size allowed both for in-depth data collection and intervention evaluation within a classroom environment. The data collection consisted of two components. The first component spanned over five sessions, drawing on a subsample of eight learners chosen for their perceived pronunciation difficulties with final consonants. The learners experienced with using Chatbot AI and then participated in stimulated recall interviews whereby their experiences with Chatbot AI were explored. The second component, employing quasi-experimental design, drew on the other ninety-eight participants divided into an experimental group (N = 49) and a control group (N = 49) to determine the extent to which Chatbot AI was effective on final consonant improvement. To ensure ethical issues, informed consent forms were handed out to the participants before they took part in the study. Also, the research materials were also adapted from the coursebook so that the learning and teaching would not be affected. In conclusion, the research site and participant selection were carefully designed to align with the study's aim of exploring Chatbot AI's role in addressing pronunciation challenges among the EFL learners.

2.2 Research Tools

2.2.1 The use of Chatbot AI

The Chatbot AI, developed by Google, was utilized to provide automated feedback on the learners' final consonant pronunciation. The tool allowed participants to upload audio recordings and receive immediate feedback on pronunciation errors. The AI was prompted with the command: *"Identify pronunciation errors with final consonants according to substitution and omission in the following.*" This ensured targeted feedback on final consonant accuracy, enabling learners to address errors promptly.

The participants were introduced to the Chatbot AI, including its access, navigation, and features. The learners were encouraged to ask questions to clarify usage, ensuring effective interaction with the tool. The intervention was integrated with listening practice and in-class transcription activities to enhance pronunciation awareness [3]. During each session, the participants engaged in cycles of recording, receiving AI feedback, and correcting errors, aligning with action research principles [9].

The reading-aloud tasks selected texts for their content relevance to the syllabus. Each text was accompanied by its IPA transcription to support pronunciation accuracy. The participants listened to the recordings of the texts while following the written script. They then matched the text's spelling to its IPA transcription to build awareness for final consonant pronunciation [3].

2.2.2 Stimulated Recall Interview

To explore the usefulness of Chatbot AI for the EFL learners' final consonant pronunciation, a stimulated recall interview was employed to elicit their experience and interactions with the AI tool. Eight learners were chosen given their perceived difficulties with final consonant pronunciation. This subsample would allow for an in-depth data analysis of the Chatbot AI's feedback. The interview questions were constructed to first capture learners' overall experiences with Chatbot AI, then focus on specific features, including its feedback features, and any specific limitations encountered in learning final consonants.

2.2.3 Pre-test and Post-test

To investigate the extent to which Chatbot AI was effective in reducing errors of omission and substitution with final consonants among EFL learners, a pre-test and post-test design was employed. Pronunciation errors were identified using an individual pronunciation assessment form that had been adapted, focusing on segmental-level analysis of final consonants, specifically omissions and substitutions [3]. To use this form, the researcher had the students participate in reading-aloud pre-test and post-test, each of which involved reading aloud one passage. The texts to read aloud were selected to ensure a sufficient number of words with final consonants, allowing for robust data collection on pronunciation

errors. The assessment targeted final consonants in content words, excluding function words (e.g., *and*, prepositions, or words with weak forms lacking final consonants, such as *that*) to focus on phonologically significant errors. Errors were counted only for consonants in the final position of individual words, excluding irrelevant cases, such as the addition of consonants (e.g., adding /g/ to *through*) or errors not significantly impacting intelligibility (e.g., dropping /d/ in *and*).

The final consonants were categorized into plosives and fricatives:

- Plosives: /p/, /b/, /t/, /d/, /k/, /g/
- Fricatives: /f/, /v/, /θ/, /ð/, /s/, /z/, /ʃ/, /ʒ/, /h/

Table 1 Number of final consonants in pre-test and post-test texts

Consonants	pre-test	post-test
Plosives	21	17
Fricatives	33	34

2.3 Procedure of Data Collection

The present study adopted the action research model that is structured into three phases to explore the effectiveness of Chatbot AI in enhancing EFL learners' final consonant pronunciation, as follows:

Phase 1: Planning

A stimulated recall interview was conducted. The interview was employed to elicit detailed reflections from EFL learners on their interaction with the AI tool. A purposeful subsample of eight learners was interviewed on their overall experiences with Chatbot AI, its feedback features, and specific limitations encountered in learning final consonants. The questions were constructed to capture both the usability of the platform and its impact on pronunciation improvement.

Phase 2: Action

The action phase involved quasi-experimental design, which was employed to assess Chatbot AI effectiveness in improving final consonant pronunciation. Accordingly, 98 learners from two A2-level classes, one as a control group and the other experimental group. Initially, a pretest was administered to identify baseline performance in final consonant pronunciation, using an individual pronunciation assessment adapted from [3]. However, only 49 participants of the experimental group took part in the Chatbot AI intervention, combined with instruction on the IPA for consonants to ensure familiarity with target sound production.

During the Chatbot AI intervention, the participants read a text aloud and recorded and uploaded their performance to the Chatbot AI for automated feedback on the participants' pronunciation performance. With teacher guidance, the participants reviewed the AI-generated feedback to identify errors and improvements.

Phase 3: Observation

The post-test involved final pronunciation assessment with the same protocol as the pretest to count errors in final consonant on a reading-aloud task [3]. Recordings from both pretest and post-test were analyzed for errors of omissions or substitutions [3]. Data from the stimulated recall interviews and pronunciation assessments were triangulated, to provide a comprehensive evaluation of Chatbot AI's impact on learners' pronunciation of final consonants.

2.4 Data Analysis

The procedure for analyzing data was detailed as follows to address the research questions. Regarding effective features of Chatbot AI, thematic analysis was employed to analyze the interview transcripts, beginning by familiarization with the whole data. The transcripts were then thoroughly reviewed for recurring themes related to participants' experiences with Chatbot AI and its limitations. As for the extent of effectiveness of Chatbot AI, errors of omission and substitution were quantified by analyzing recordings from pretest and post-test based on an individual pronunciation assessment form [3]. The rating for errors was conducted by the two researchers, who independently examined the recordings for errors of omissions and substitutions. Given the huge amount of pronunciation data, the researchers decided to establish agreement through calibration on a subset of 20 first recordings to ensure reliability in the number of errors.

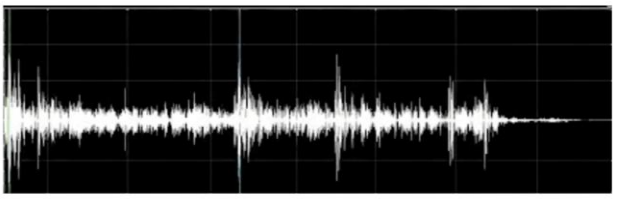

Figure 1 Example of a plosive omission of /t/

Given that the pretest and post-test texts differed, the number of errors were converted to percentages, on

which an independent-samples t-test was conducted using IBM SPSS 20 to determine changes in error of final consonants between the pretest and post-test.

3 Findings

This section presents the findings from stimulated recall interviews as well as the results on errors in final consonants made by the EFL learners to answer the research questions.

For the first research question, the analysis of the interview transcripts revealed three primary themes regarding how useful Google AI Studio was for the learners' final consonant pronunciation: AI feedback, teacher guidance, and regular practice. Specifically, it was considered effective in identifying correct and incorrect final consonant pronunciations and linking pronunciation to grammatical aspects, such as *-ed* endings in past tense verbs. Respondent 1 noted, "It transcribes the pronunciation, so I could read it again based on that feedback." Despite its utility, the participants highlighted several limitations in the AI's feedback clarity. Meanwhile, Respondent 7 emphasized the need for additional teacher guidance to interpret the AI's feedback, stating, "Further assistance is needed to help me understand the AI more clearly." Also, Participant 2 suggested incorporating built-in Vietnamese translations, noting, "I want direct translations in Chatbot AI." This suggests that while the Chatbot AI raised awareness of pronunciation errors, its feedback still required scaffolding from instructors. Regarding regular practice, Participant 2 recommended regular use of the platform to maximize its benefits, "With feedback, I can improve those words, make fewer mistakes, and practice multiple times." Overall, the qualitative data suggest that the Chatbot AI was useful in raising learners' awareness of final consonant pronunciation, error types such as omissions and substitutions, and articulatory features, e.g. place and manner of articulation.

However, as for the effectiveness of the Chatbot AI, an independent-samples t-test was conducted using IBM SPSS 20 to compare pretest and post-test error rates.

Table 2 Independent-sample t-test results of pretest

Pretest		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
Fricative omissions	Equal variances assumed	4.75	0.03	3.09	96	0.00	6.06	1.96	2.17	9.96
	Equal variances not assumed			3.09	91.89	0.00	6.06	1.96	2.16	9.96
Fricative substitutions	Equal variances assumed	1.83	0.18	−2.49	96.00	0.01	−3.12	1.26	-5.62	-0.63
	Equal variances not assumed			−2.49	94.49	0.01	−3.12	1.26	-5.62	-0.63
Plosive omissions	Equal variances assumed	1.04	0.31	9.08	96.00	0.00	16.35	1.8	12.77	19.92
	Equal variances not assumed			9.08	95.80	0.00	16.35	1.8	12.77	19.92

Plosive substitutions	Equal variances assumed	0	1	1.82	96.00	0.07	3.18	1.75	−0.28	6.65
	Equal variances not assumed			1.82	95.48	0.07	3.18	1.75	−0.28	6.65

The pre-test results show the control group had a higher mean error percentage for fricative omission compared to the experimental group with a statistically significant difference, t(91.89) = 3.09, p = 0.00, and a mean difference of 6.06. Similarly, plosive omission errors were also higher in the control group than in the experimental group, t(95.80) = 9.08, p < 0.00, with a mean difference of 16.35. For fricative substitution, the experimental group showed a higher mean error rate than the control group, t(94.49) = −2.49, p = 0.01, with a mean difference of −3.12. No significant difference was found for plosive substitution, with means of 25.51 for the control group and 22.33 for the experimental group, t(95.48) = 1.82, p = 0.07, and a mean difference of 3.18.

Table 3 Independent-sample t-test results of posttest

Pretest		**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**
Fricative omissions	Equal variances assumed	3.27	0.07	7.42	96.00	0.00	13.12	1.77	9.61	16.63
	Equal variances not assumed			7.42	94.12	0.00	13.12	1.77	9.61	16.63
Fricative substitutions	Equal variances assumed	0.07	0.79	3.47	96.00	0.00	3.86	1.11	1.65	6.06
	Equal variances not assumed			3.47	95.68	0.00	3.86	1.11	1.65	6.06
Plosive omissions	Equal variances assumed	9.26	0.00	14.34	96,00	0.00	24.00	1,67	20,68	27.32
	Equal variances not assumed			14.34	87.51	0.00	24.00	1.67	20.67	27.33
Plosive substitutions	Equal variances assumed	2.90	0.09	5.99	96.00	0.00	13.65	2.28	9.13	18.18
	Equal variances not assumed			5.99	88.76	0.00	13.65	2.28	9.12	18.18

After using the Chatbot AI, the experimental group showed significant improvements across all error categories compared to the control group. As for fricative omissions, the experimental group's mean percentage of error was substantially lower than the control group's, $t(94.12) = 7.42$, $p < 0.00$, with a difference of 13.12. This large effect size (etasquared = 0,36) for fricative omission indicates the variance in this type of errors is linked to the group difference, reflecting a strong intervention impact.

For plosives, omission errors also decreased significantly in the experimental group when compared to the control group $t(87.51) = 14.34$, $p < 0.0001$, with a mean difference of 24.00. Plosive omission shows a very large effect size (etasquared = 0.68), which highlights a strong intervention effect, with the experimental group demonstrating a significant decrease in plosive omission errors compared to the control group.

Concerning fricative substitution, the experimental group's mean error percentage was lower than the control group's, $t(95.68) = 3.47$, $p = 0.00$, with a mean difference of 3.86. Fricative substitution had a medium effect size (etasquared = 0.11), showing that 11,1% of the variance in fricative substitution errors was explained by the group, suggesting a moderate improvement due to the intervention.

Lastly, plosive substitution errors were significantly reduced in the experimental group ($M = 20.04$, $SD = 9.54$) compared to the control group ($M = 33.69$, $SD = 12.80$), $t(88.76) = 5.99$, $p < 0.00$, with a mean difference of 13.65. Plosive substitution saw a large effect size (etasquared = 0.27), which means that 27.2% of the variance in plosive substitution errors was due to the group difference, reflecting a meaningful reduction in errors for the experimental group.

The results indicate that the experimental group, who received the informed Chatbot AI intervention, exhibited significant reductions in both omission and substitution errors for fricatives and plosives post-intervention.

4 Discussion

The aim of the present study was to explore effective uses of Chatbot AI to address the EFL learners' errors with final consonant pronunciation. The findings suggested the Chatbot AI led to lower proportion of errors in the posttest pronunciation for omission and substitutions. The effectiveness of Chatbot AI's feedback involved explicit corrections on the learners' final consonant errors, articulation guidance, and regular practice. The findings echo with comments on new technology's "potential future developments include automated pronunciation assessment and feedback with individually tailored instruction" [1]. Within the context of A2-level classes, the combination of quantitative and qualitative analysis provided a detailed account of pronunciation errors of omission and substitutions, and the effects of Chatbot AI had on the learners' pronunciation of final consonants, offering a pedagogical tool for enhancing EFL pronunciation learning in the immediate context.

However, several inherent limitations restrict the generalizability of these findings. First, the quasi-experimental design relied on convenience sampling of 98 A2-level learners from two classes, which limits its generalization to other EFL contexts or proficiency levels. Second, the five-sessions intervention period of using Chatbot AI may have been insufficient to achieve significant error reduction, as phonological acquisition often requires longer-term engagement.

With these limitations, future research may adopted larger sample sizes to address a variety of linguistic backgrounds and levels of English proficiency. By this way, generalization of findings could be applied to broader EFL contexts. Besides, the pedagogical intervention should be extended to a longitudinal design, whereby long-term pronunciation improvements could be assessed in more detail.

5 Conclusion and Recommendations

This study offered significant insights into how useful Chatbot AI was in dealing with final consonant pronunciation challenges faced by A2-level EFL learners at Nguyen Tat Thanh University. The thematic analysis highlighted the AI tool's real-time error detection and detailed feedback were highly appreciated by the learners, especially for enhancing their pronunciation awareness of final consonants. Also, the independent samples t-tests revealed significant reductions in error rates for the experimental group with mean differences applying to all the types of errors, namely, fricative omission, plosive omission, fricative substitution, and plosive

substitution, supported by moderate to large effect sizes.

However, while significant improvements in error reduction were observed, the varying effect sizes suggest that the tool's impact seems to differ across the consonant categories as well as the error types, hence requiring for integration and scaffolding from the teacher to maximize the AI efficacy and address remaining pronunciation issues.

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Khảo sát hiệu quả của việc sử dụng Chatbot AI trong dạy phát âm tiếng Anh cho sinh viên không chuyên tại Trường Đại học Nguyễn Tất Thành

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TÓM TẮT Nghiên cứu này khám phá hiệu quả của Chatbot AI trong việc cải thiện phát âm phụ âm cuối của 106 người học EFL trình độ A2 tại Trường Đại học Nguyễn Tất Thành, sử dụng mô hình nghiên cứu hành động. Tám người học được chọn có chủ đích để phân tích sâu dựa trên phỏng vấn gợi nhớ và phân tích định tính theo chủ đề. 98 người học còn lại tham gia vào thiết kế nghiên cứu bán thực nghiệm, được chia thành nhóm đối chứng (n = 49) và nhóm thực nghiệm (n = 49). Phân tích kiểm định t mẫu độc lập để so sánh tỷ lệ lỗi trước và sau can thiệp liên quan đến việc bỏ sót và thay thế phụ âm xát và tắc. Kết quả phân tích chủ đề cho thấy 08 người học đánh giá cao phản hồi chi tiết, theo thời gian thực và được cá nhân hóa của công cụ. Trong khi đó, kết quả thống kê cho thấy tỷ lệ lỗi của nhóm thực nghiệm giảm đáng kể sau khi sử dụng Chatbot AI, bao gồm: lỗi bỏ sót phụ âm xát giảm trung bình 13,12, lỗi bỏ sót phụ âm tắc giảm 24.00, lỗi thay thế phụ âm xát giảm 3,86, và lỗi thay thế phụ âm tắc giảm 13,65 so với nhóm đối chứng. Kết quả này cho thấy Chatbot AI hiệu quả trong việc giảm lỗi phát âm phụ âm cuối xát và tắc, mang lại lợi ích cho việc giảng dạy tiếng Anh khi kết hợp với sự hướng dẫn của giáo viên.

Từ khóa EFL, phát âm, phụ âm cuối, Chatbot AI