Pronunciation Aids Driven by AI and Their Effect on the Oral Fluency of ESL Learners

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Abstract—**Artificial intelligence (AI) has brought new tools that provide real-time correction, automated evaluation, and individualized feedback to English language instruction. ELSA Speak, Google Speech Recognition, and other mobile applications are examples of AI-powered pronunciation aids that have become well-known due to their capacity to give learners immediate remedial feedback. The effect of these tools on college-level English as a Second Language (ESL) learners' oral fluency is examined in this study. 60 undergraduate students were split into control and experimental groups for an eight-week intervention using a mixed-methods approach. Quantitative findings showed statistically significant gains in the experimental group's oral fluency as assessed by correctness, articulation, and speech pace. Improved student confidence, less speaking anxiety, and greater drive to practice spoken English were all suggested by qualitative feedback. Although more research is needed to determine their long-term durability, cultural adaptability, and teacher-mediated integration, the results indicate that AI-powered pronunciation aids are useful in promoting oral fluency.**

Index Terms—**Artificial Intelligence, CALL, ESL, Pronunciation Tools, Oral Fluency, Language Learning**

I. INTRODUCTION

English has emerged as the universal language of academics, businesspeople, and international communication. Oral fluency is one of the most important but difficult skills for ESL (English as a Second Language) learners to acquire. While reading and writing can help build vocabulary and grammar, frequent exposure, practice, and corrective feedback are necessary for learning fluent, understandable spoken English. These resources are not always available in typical classroom settings.

A key component of communicative ability is pronunciation in particular. Intelligibility can be hampered by poor pronunciation, independent of a learner's lexical or grammatical proficiency. Phonetic drills, instructor modeling, and repetition are examples of traditional pronunciation training techniques that have frequently been criticized for being tedious, time-consuming, and reliant on teacher knowledge. Furthermore, because of time limits and differing learner demands, individual corrective feedback is practically impossible in big ESL classrooms. This has caused a disconnect between the limited chances offered in traditional educational environments and the learners' need for increased oral fluency.

This gap has started to be filled with the introduction of artificial intelligence (AI) in education. Natural language processing (NLP), machine learning techniques, and voice recognition technologies are used by AI-powered pronunciation tools to evaluate learners' spoken input and deliver immediate, personalized feedback. These systems, in contrast to traditional training, may identify mispronunciations, compare learner output to models of native speakers, and provide real-time remediation suggestions. More significantly, AI systems can track progress over time and adjust to the pace of learners, providing a degree of personalization that is challenging to accomplish in traditional classroom settings.

According to recent research, learners' confidence and accuracy can be improved by using AI pronunciation tools (Li, 2021; Wang & Chen, 2022). ESL students are using programs like ELSA Speak, Google's voice recognition APIs, and Duolingo's speaking exercises more and more. But even if anecdotal evidence and small-scale studies point to advantages, thorough research on the precise effects of these technologies on

oral fluency in formal educational settings is still lacking.

By investigating how AI-powered pronunciation aids can improve the oral fluency of college-level ESL students in India, our study fills that knowledge vacuum. The following questions are the focus of the study:

1. In comparison to traditional training, how much do AI-powered pronunciation aids enhance the oral fluency of ESL learners?

2. How do students feel about the value of AI-powered pronunciation aids in boosting self-esteem and lowering nervousness when speaking?

3. What obstacles and restrictions appear when incorporating these resources into ESL courses at the college level?

By examining these issues, the study adds to the expanding corpus of research on artificial intelligence in applied linguistics and offers useful advice to educators, curriculum developers, and legislators who want to include technology into ESL instruction.

II. LITERATURE REVIEW

2.1 Pronunciation and Oral Fluency in ESL Learning

The ability to pronounce words correctly is essential to effective communication. Derwing and Munro (2005) assert that comprehensible pronunciation frequently has a greater impact on effective communication than vocabulary or grammatical precision. Conversely, oral fluency is typically assessed by speech rate, pause frequency, and delivery smoothness (Tavakoli & Skehan, 2005). But being fluent is still a constant struggle for ESL students, especially in situations where they don't have much exposure to English outside of the classroom. The emphasis on accuracy rather than communicative usage in traditional pronunciation education, such as phonetic transcription, choral repetition, and instructor modeling, has reduced its ability to improve fluency (Celce-Murcia et al., 2010). This shows that learner-centered and participatory methods are needed.

2.2 Computer-Assisted Language Learning (CALL) and Pronunciation Practice

The advent of Computer-Assisted Language Learning (CALL) gave students more chances to practice pronouncing words correctly outside of the classroom. However, the capacity of early CALL systems to offer real-time remedial feedback was constrained (Levis, 2007). Instead of emphasizing real-world communication skills, they frequently concentrated on monotonous training. However, CALL established the foundation for incorporating technology into teaching pronunciation. Although learner involvement varied, studies have demonstrated that students benefit from the visual and auditory models offered by CALL software (Neri et al., 2002).

2.3 Artificial Intelligence and Speech Recognition Technologies

Artificial Intelligence (AI) has transformed CALL by making speech recognition systems that can analyze learners' pronunciation in real time possible. According to Eskenazi (2009), speech recognition algorithms detect errors, provide personalized feedback, and compare learner output with native-speaker models. Machine learning algorithms that "learn" from large voice corpora are used in modern AI-powered products, boosting their accuracy across a range of accents and speech types (Li, 2021). This translates into more individualized, flexible pronunciation assistance for ESL students outside of the classroom.

2.4 AI-Powered Pronunciation Tools in ESL Contexts

The function of AI-based pronunciation aids in language acquisition has been the subject of numerous studies. For example, it has been noted that ELSA Speak greatly enhances learners' segmental and suprasegmental characteristics, such as intonation, rhythm, and emphasis (Wang & Chen, 2022). According to Tsai's (2020) research, mobile AI pronunciation apps promoted regular speaking practice and enhanced student autonomy. In a similar vein, Saito and Akiyama (2017) found that advanced learners' fossilized errors decreased when they received real-time feedback from AI-driven systems. These results are consistent with Swain's Output Hypothesis (1985), which emphasizes the importance of pushing output in fluency development, and Krashen's Input Hypothesis (1985), which stresses intelligible input.

2.5 Learner Perceptions and Affective Outcomes

Artificial intelligence (AI) pronunciation aids enhance learners' emotive aspects in addition to their quantifiable fluency increases. In contrast to speaking

in front of classmates or teachers, learners frequently say they feel more at ease practicing with AI applications (Burston, 2015). The digital interface's anonymity lowers anxiety, and gamified features like badges, scores, and progress tracking boost motivation (Godwin-Jones, 2018). Students that used AI pronunciation tools reported feeling more confident when performing oral tasks, according to a 2013 study by Li and Hegelheimer. These affective advantages are essential because speaking fear is one of the biggest obstacles to the development of oral fluency (Horwitz et al., 1986).

2.6 Challenges in Using AI Pronunciation Tools

Artificial intelligence-driven pronunciation aids have drawbacks despite their potential. First, device quality, background noise, and the learner's accent can all affect accuracy, resulting to inaccurate feedback or misrecognition (Mishra & Li, 2020). Second, whereas suprasegmental elements like intonation and rhythm are equally crucial for fluency, these tools frequently place a higher priority on segmental accuracy (particular sounds) (Levis & Suvorov, 2012). Furthermore, an excessive dependence on AI could result in less human engagement and communication in the classroom. Additionally, ethical considerations like accessibility and data protection continue to be crucial (Zawacki-Richter et al., 2019).

2.7 Research Gap

Few studies have thoroughly investigated AI pronunciation tools' precise effects on oral fluency in higher education ESL environments, especially in multilingual nations like India, even though previous research has shown how successful these tools are at increasing accuracy and lowering anxiety. Furthermore, a large portion of the literature focuses on brief interventions or small pilot studies, which leaves open the issues of scalability, integration with the curriculum, and long-term sustainability.

2.8 Conclusion of Literature Review

According to the research, by offering real-time feedback, boosting learner confidence, and encouraging autonomy, AI-powered pronunciation tools have a great deal of promise for strengthening the oral fluency of ESL students. However, more empirical study is needed to address issues with sustainability, accessibility, and pedagogy as well as

to examine their quantifiable impacts in formal classroom settings. By examining how AI pronunciation tools can improve oral fluency among college-level ESL students in India, the current study aims to close this gap.

III. THEORETICAL FRAMEWORK

Three fundamental theories of second language acquisition (SLA) serve as the foundation for this investigation:

1. The 1985 Krashen Input Hypothesis: Exposure to understandable input that is just a little bit above their current level of ability helps learners become more proficient in the language. By offering personalized feedback and simulating native-like pronunciation, AI-powered pronunciation tools support this idea by assisting learners in comprehending and mimicking real speech.

2. According to Swain's Output Hypothesis (1985), speaking output is crucial for language development because it compels students to identify discrepancies between their target and existing interlanguage forms. AI tools help students enhance their oral production and fluency by promoting repeated practice and instant self-correction.

3. Sociocultural Theory (Vygotsky, 1978): Through mediated interaction, learning takes place within the Zone of Proximal Development (ZPD). As a "digital mediator," AI offers scaffolding that is comparable to that of a human teacher, providing modeling and remedial feedback within the zone of propensity of learners.

These theories collectively imply that by providing understandable input, promoting pushed output, and mediating learning interactions, AI-powered pronunciation aids can aid in the cognitive and affective aspects of oral fluency development.

IV. METHODOLOGY

4.1 Research Design

A mixed-methods, quasi-experimental design was used to investigate how AI pronunciation tools affected oral fluency. While qualitative data recorded student perspectives and experiences, quantitative data quantified fluency gains.

4.2 Involvees

In Tamil Nadu, India, 60 undergraduate ESL students from an arts and science college participated in the study. Using purposive sampling, participants were chosen and split up into:

Experimental Group (n=30): ELSA Speak, an AI pronunciation tool, was used for training.

Control Group (n=30): Obtained conventional, AI-free classroom-based pronunciation training.

With the Oxford Placement Test (OPT), the students' skill level was determined to be intermediate.

4.3 Instruments

1. AI Pronunciation Tool: Because ELSA Speak is widely used, easily accessible, and incorporates AI speech recognition for feedback, it was selected.
2. Oral Fluency Test: Before and after the test, a brief interview and a speaking exercise based on pictures were administered. To test fluency, three markers were used:
3. Words per minute (WPM), mean length of utterance (MLU), and frequency and duration of pauses
4. Questionnaire: Learners' opinions of the tool were assessed using a 15-item Likert-scale survey that covered usability, motivation, confidence, and anxiety.
5. Semi-structured Interviews: To learn more about affective consequences, ten participants from a randomly chosen experimental group participated in semi-structured interviews.

4.4 Procedure

Pre-Test: An oral fluency test was finished by both groups.

Intervention: For eight weeks, the experimental group spent twenty minutes every day, five days a week, outside of class, practicing their pronunciation with ELSA Speak. The control group practiced typical pronunciation exercises while receiving feedback from the teacher.

Post-Test: The oral fluency test was administered again to both groups.

At the conclusion of the session, the experimental group was given a survey and interviews.

4.5 Data Analysis

Quantitative Analysis: To assess statistical significance, pre- and post-test scores were examined using independent sample t-tests (between groups) and paired sample t-tests (within groups).

Qualitative Analysis: Transcripts of interviews were subjected to thematic classification in order to find recurrent themes about obstacles, motivation, and confidence.

4.6 Ethical Considerations

Participants gave their informed consent, and data anonymization preserved anonymity. The study was approved by the institution's ethics committee. Students were assurances that their academic assessments would not be impacted by their involvement.

V. RESULTS

5.1 Quantitative Results

Oral Fluency Pre-Test and Post-Test Scores

Measure	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Gain	p-value
Speech Rate (WPM)	Experimental	82.4 (10.6)	108.7 (9.8)	+26.3	<0.001
	Control	81.9 (11.2)	87.1 (10.5)	+5.2	0.072
Mean Length of Utterance	Experimental	6.3 (1.1)	8.4 (1.0)	+2.1	<0.001
(MLU, words per clause)	Control	6.4 (1.2)	6.9 (1.1)	+0.5	0.089
Pause Frequency (per minute)	Experimental	5.8 (1.5)	3.2 (1.0)	-2.6	<0.001
	Control	5.6 (1.4)	5.1 (1.2)	-0.5	0.064

Interpretation:

All fluency metrics (speech rate, MLU, and fewer pauses) indicated statistically significant gains in the experimental group.

Although there was some improvement in the control group, the improvements were not statistically significant ($p > 0.05$).

Post-test differences between groups were verified to be significant (p < 0.001) by independent sample t-tests.

Learner Perceptions Survey (n = 30, Experimental Group)

Statement (Likert Scale: 1–5)	Mean Score	Interpretation
The AI tool improved my pronunciation.	4.6	Strong agreement
The AI tool helped me speak more fluently.	4.5	Strong agreement
I felt less anxious practicing with AI than in class.	4.3	Agreement
The feedback was clear and useful.	4.4	Agreement
I am motivated to continue using AI tools.	4.7	Strong agreement

Interpretation: In general, learners thought AI-powered pronunciation aids were useful, inspiring, and calming.

5.2 Qualitative Results
Three main topics emerged from the interviews' thematic analysis:
1. A rise in self-assurance and a decrease in anxiety
Since no one was looking, I didn't mind making mistakes with the app. I practiced till I perfected it. (Participant 7) Compared to classroom corrections, learners valued the private practice setting because it decreased humiliation.
2. Perceived Improvements in Fluency
"After a few weeks of practice, I was able to talk more quickly without pausing too much. My speech began to flow more easily. (Participant 12) Students said they felt more comfortable speaking in both formal and informal settings.

3. Difficulties and Restrictions
"Even though I thought I pronounced it correctly, there were times when the app mistook my accent and gave me incorrect feedback." (Participant 3)
Although generally favorable, students reported sporadic misrecognition problems and indicated a wish for more interactive, dialogue-based AI work as opposed to discrete exercises.

VI. DISCUSSION

According to the study's findings, when compared to conventional classroom instruction, AI-powered pronunciation aids greatly improve the oral fluency of ESL students. Speech rate, mean utterance length, and pause reduction were significantly improved for the experimental group, but just slightly for the control group. These findings imply that AI-based feedback has benefits that increase and sometimes even outweigh those of conventional teaching techniques.

6.1 AI Feedback and Oral Fluency Development
Swain's Output Hypothesis (1985), which holds that language production and reflection on performance gaps help learners gain proficiency, is supported by the increase in speech tempo and utterance length. The AI pronunciation tool encouraged students to try more fluid output without the burden of immediate peer review by acting as a virtual interlocutor. Likewise, the decrease in the frequency of pauses indicates that students were more automatic in their speech production, which is consistent with Segalowitz's (2010) notion of fluency as processing efficiency.
Giving prompt, constructive criticism has a very significant impact. In contrast to classroom settings, where time restrictions frequently result in restricted or delayed teacher feedback, AI systems offered real-time analysis of individual words and intonation. Since learners got corrected models and updated input at the precise point of difficulty, this feature aligns with Krashen's Input Hypothesis (1985) by making the feedback more actionable and salient.

6.2 Affective Factors: Confidence and Motivation
The favorable effect on learners' affective factors was another important discovery. The results of the survey and interviews showed greater motivation to practice English outside of the classroom, less speaking fear, and enhanced confidence. Sociocultural Theory (Vygotsky, 1978) can be used to analyze these results, as AI technologies served as mediators that allowed students to operate within their Zone of Proximal Development (ZPD). Learners who practiced in private felt less anxious about receiving a poor grade,

which is in line with research on foreign language anxiety by Horwitz et al. (1986).

Significantly, even after the intervention, learners indicated that they would be willing to keep utilizing AI technologies, indicating long-term motivating potential. This is in line with Deci and Ryan's (2000) Self-Determination Theory, which holds that intrinsic motivation is fostered by autonomy and perceived competence.

6.3 Limitations of AI Pronunciation Tools

Notwithstanding the generally favorable results, students mentioned certain difficulties. The AI's sporadic inability to identify regional accents was a persistent problem that resulted in erroneous feedback. This drawback draws attention to the technological bias present in many AI models, which are usually trained on corpora of conventional native speakers rather than a variety of accents from around the world. If teachers don't moderate these differences, students may become frustrated.

Furthermore, although the technologies successfully addressed prosodic characteristics (stress, intonation) and segmental precision (particular sounds), they provided little chances for participatory, real-time dialogue. Accuracy is only one aspect of oral fluency; other components include pragmatic competence, turn-taking, and interactional strategies—all of which are still difficult for modern AI technologies to mimic.

6.4 Comparison with Previous Studies

The current study supports earlier studies demonstrating the advantages of computer-assisted pronunciation training (CAPT) and artificial intelligence. For instance, Li (2021) discovered that intelligibility significantly improved for Chinese learners who used AI pronunciation tools. Wang & Chen (2022) also found that AI-assisted feedback decreased anxiety and increased learner confidence. However, by concentrating on college-level students in India, where there is still a dearth of research on AI-enhanced oral fluency, our study contributes to the body of knowledge.

6.5 Pedagogical Implications

The results have various ramifications for teaching ESL:

1. Blended Learning: Instructors can incorporate AI tools as additional resources to let students work on their pronunciation on their own while communicative activities take place in class.

2. Personalized feedback: AI can assist with pronunciation issues that teachers would not have time to rectify in large classes because it offers personalized input.

3. Confidence Building: For students who are nervous or shy and are hesitant to speak in front of their peers, AI can act as a "safe space" for practice.

4. Teacher Role: Teachers continue to play a crucial role in contextualizing pronunciation practice, addressing cultural differences, and fostering broader communication competence, even while AI provides helpful correction information.

VII. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

7.1 Conclusion

The current study shows that AI-powered pronunciation aids can significantly improve college-level ESL learners' oral fluency. Through the provision of immediate feedback, personalized remedial feedback, and opportunity for repeated practice, the tool facilitated improvements in speech rate, mean utterance length, and pause reduction. In addition to quantifiable results, students reported psychological advantages such as increased self-assurance, decreased speaking fear, and a stronger desire to interact with spoken English. These results demonstrate that AI is a pedagogical partner that can influence student autonomy and motivation in addition to being a technical help.

However, the findings warn against considering AI to be a substitute for human educators. The social, cultural, and interactional facets of communication that teachers promote cannot yet be replicated by AI, despite its superiority in providing repetitive practice and accurate corrective feedback. Thus, a hybrid approach—where AI tools are incorporated into classroom instruction to enhance rather than replace conventional methods—is the most sustainable way ahead. This integrated paradigm has the potential to democratize access to high-quality pronunciation instruction, especially in areas with little resources or little exposure to English spoken by native speakers.

7.2 Limitations

For a fair evaluation of the findings, it is important to recognize that this study has a number of limitations despite its contributions:

1. Sample Size and Representativeness: Because only 60 students from a single university participated in the study, generalizability was limited. To confirm results across various learner demographics and competence levels, larger, multi-site studies are required.

2. Short Duration: Although the eight-week intervention period yielded valuable short-term insights, it is yet unknown whether the observed long-term fluency improvements are durable. Without more practice, pronunciation improvements could plateau or even decline.

3. Accent Recognition Bias: According to several students, regional accent variances caused the AI technology to occasionally misinterpret their speech. This is indicative of a larger problem in AI design, as training data is frequently skewed toward native-speaker or standardized English, which may disadvantage learners from multilingual environments.

4. Limited Attention to Fluency Metrics: Although the study recorded speech pace, utterance duration, and pauses, it did not systematically evaluate other crucial aspects of oral competency, including intelligibility, comprehensibility, and pragmatic appropriateness. This limits the range of results.

5. Absence of Interactive Features: The AI tool only offered practice at the individual word and phrase levels, with little opportunity to replicate real-world dialogues. The ecological validity of the findings is limited since oral fluency also depends on turn-taking, meaning negotiation, and sociolinguistic awareness.

7.3 Recommendations for Future Research

Future studies can broaden their scope of investigation in the following ways, building on these limitations:

1. Longitudinal Designs: Research that lasts a whole academic year or more can determine whether fluency improvements brought about by AI are maintained, enhanced, or weakened over time.

2. Cross-Cultural and Multilingual Contexts: Research conducted in different regions (such as Africa, Latin America, East Asia, and India) can help determine if AI systems react fairly to different student accents and cultural communication styles.

3. Integration with Other Skills: Although oral fluency was the main focus of this study, future research should examine how AI pronunciation tools can improve conversation management, vocabulary acquisition, and listening comprehension all at once.

4. Promoting Accent Inclusivity: To enable more inclusive feedback for students with different linguistic backgrounds, researchers and developers should look into building AI models trained on World Englishes corpora.

5. Blended Pedagogical Models: More research is required to determine how AI and teachers can jointly create learning environments. To find the method that produces the most thorough progress in oral proficiency, future interventions could, for instance, compare (a) AI-only practice, (b) teacher-only instruction, and (c) blended instruction.

6. Learner Agency and Ethics: Future research should also examine the psychological and ethical aspects of using AI, including learner data privacy, possible over-reliance on technology, and how much algorithmic feedback empowers or limits learners.

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