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EXPLORING SPEECH-RECOGNITION TECHNOLOGY ON ENGLISH PRONUNCIATION SKILLS: A QUALITATIVE STUDY IN ELEVENTH GRADE OF SMAI MIFTAHUL ULUM

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A B S T R A C T S

This study explores the use of speech-recognition technology to improve English pronunciation among eleventh-grade students at Miftahul Ulum Islamic Senior High School. Using a qualitative case study approach, data were collected through semi-structured interviews, classroom observations, and document analysis. Thematic analysis revealed five key findings: (1) improved segmental pronunciation accuracy, (2) increased student motivation and engagement, (3) challenges with accent recognition, (4) limited support for fluency and natural speech, and (5) a need for more personalized feedback. While the technology effectively corrected individual pronunciation errors and boosted learners' confidence, its limitations in recognizing regional accents and supporting sentence-level fluency suggest the need for a more integrated instructional approach. The study recommends using speech-recognition tools as supplementary aids, combined with communicative activities such as group discussions or role-play. These findings offer important insights into technology-enhanced language learning in the Indonesian EFL context and highlight the need for more adaptive, linguistically inclusive speech-recognition systems.

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INTRODUCTION

English currently holds a prominent position as the primary foreign language taught in many parts of the world and serves as the dominant medium of international communication (S.R., 2019). Nevertheless, learners of English as a Second Language (ESL) often face persistent difficulties in achieving accurate and intelligible pronunciation. Mispronunciations can lead to communication breakdowns and decreased learner confidence, highlighting pronunciation as a critical component of effective communication (Kissova, 2019).

Pronunciation instruction encompasses both segmental features such as vowel and consonant sounds and suprasegmental aspects like word stress, intonation, and rhythm (Lasi, 2020). Traditionally, instruction has relied on repetitive drills, model imitation, and teacher correction (Purwanto, 2019). While such methods offer foundational support, they are often limited in delivering timely, personalized, and consistent feedback. Delayed correction, in particular, can lead to fossilization, where incorrect patterns become entrenched and resistant to change.

The advancement of digital technology, particularly in the field of education, has introduced new opportunities to address these instructional limitations. One such innovation is speech-recognition technology, which enables automatic and real-time evaluation of learner pronunciation (Rogerson-Revell, 2021; Sun, 2023). These systems work by analyzing spoken input and comparing it with native-speaker models, offering instant feedback on phonemic errors, stress misplacement, and vowel pronunciation (Korzekwa et al., 2022). Furthermore, learners can engage in self-directed practice, adjusting the timing and frequency of their learning sessions according to their individual needs, making the learning process more flexible and personalized.

Several language learning platforms such as Duolingo, Google Translate, and U-Dictionary have integrated speech-recognition features to support pronunciation development. These platforms not only provide instant feedback but also offer visual aids (e.g., phonetic cues and stress markers) and progress-tracking features that encourage self-monitoring and motivation (Espinoza et al., 2021). Research by Mohamrrmed Awadh et al., (2024) shows that the use of such technology can enhance pronunciation accuracy, build learner confidence, and deepen understanding of English phonetics.

Despite these advantages, recent studies have identified significant challenges in the implementation of speech-recognition systems. One of the primary concerns is the limited adaptability of these systems to non-native accents. Because most speech-recognition technologies are trained on native-speaker datasets, they often misjudge the pronunciation of learners with different phonetic backgrounds, leading to inaccurate or misleading feedback (Mirishkar, 2023). Additionally, while considerable progress has been made in evaluating segmental pronunciation, there remains a lack of focus on suprasegmental features such as stress, intonation, and rhythm which are essential for achieving fluency and natural speech (Umar & Aspany, 2024).

In light of the instructional limitations and technological challenges outlined above, this study investigates the role of speech-recognition technology in improving English pronunciation among ESL learners focusing on both segmental and suprasegmental features. It specifically explores students' experiences, perceptions, and progress in using such tools within a classroom context. By examining how these systems accommodate diverse accents and integrate into pedagogical settings, the study seeks to fill a gap in existing research, which has largely overlooked the qualitative dimensions of ASR use in EFL education. The findings aim to inform more inclusive and adaptive strategies for pronunciation instruction, blending traditional and technology-assisted approaches.

RESEARCH METHOD

This study employed a qualitative approach aimed at deeply exploring students' experiences in using speech-recognition technology as a tool to improve English pronunciation. The qualitative design was selected for its ability to capture subjective experiences, social contexts, and interactive dynamics that unfold during the learning process (Bahtiar et al., 2024). Prioritizing meaning-making by participants, this approach allows for a nuanced exploration of students' perceptions, responses, and challenges in integrating technology into language learning. The research process was organized into four key components: research design, subjects, instruments, and data analysis.

Research Design

This study employed a qualitative case study design with an exploratory approach to gain an in-depth understanding of how speech-recognition technology supports pronunciation development among ESL learners. A case study was chosen over other qualitative approaches, such as phenomenology or grounded theory, because it enables a holistic examination of a

bounded system specifically, the classroom context in which speech-recognition tools are integrated (Sun, 2023; Baxter & Jack, 2008). Unlike phenomenology, which focuses on lived experiences across varied settings, or grounded theory, which aims to generate theoretical models, the case study approach aligns more directly with the study's objective to explore real-time interactions, behaviors, and perceptions within a specific institutional context (Pasuhuk & Mandagi, 2023).

The exploratory nature of the study allowed for flexible and inductive inquiry, enabling the researcher to uncover emerging patterns without being constrained by predetermined hypotheses (Makri & Neely, 2021). The case study was conducted over a one-month period during the 2024/2025 academic year at Miftahul Ulum Islamic Senior High School an institution selected based on its active implementation of speech-recognition technology in English instruction and its accessibility for sustained classroom engagement.

While case studies offer rich, context-sensitive insights, they are limited in terms of generalizability. To address this limitation and enhance the study's credibility, several strategies were employed, including data triangulation across interviews, observations, and document analysis, as well as peer debriefing to minimize researcher bias during data interpretation (Nowell et al., 2017). These safeguards ensured that the findings, although context-specific, maintain analytical transferability to similar educational settings.

Subjects

The participants in this study consisted of 18 eleventh-grade students at Miftahul Ulum Islamic Senior High School during the 2024/2025 academic year. Purposive sampling was employed to select students actively engaged with speech-recognition technology as part of their English pronunciation learning activities, ensuring relevance to the research focus (Sun, 2023). Participants ranged in age from 16 to 17 years and represented diverse linguistic backgrounds, including regional accents such as Javanese and Madurese, providing rich contextual variation. The sample size aligns with qualitative research conventions, where saturation is prioritized over quantity to achieve depth and richness in data (Alordiah & Oji, 2024). Potential sampling biases, including self-selection bias due to students' motivation levels, were acknowledged and mitigated through data triangulation and reflective analysis during interpretation (Ekundayo et al., 2024).

Instruments

Data collection involved three primary instruments: semi-structured interviews, classroom observations, and document analysis. Semi-structured interviews comprised 12 open-ended questions designed to explore students' experiences, perceptions, and challenges regarding speech-recognition technology use. These questions underwent pilot testing with a similar cohort to ensure clarity and validity, with interviews lasting between 30 to 45 minutes (Tate et al., 2023). Observations were conducted across five classroom sessions using a structured observation guide focused on student engagement, responses to technology, and teacher-student interactions (Schnitzler et al., 2020). Document analysis included examination of system-generated logs, student progress reports, and pronunciation-related assignments, selected based on their relevance and continuity in technology usage. To enhance the reliability and validity of instruments, pilot studies, expert consultations, and systematic field notes were employed, alongside audio recordings of interviews to ensure accurate transcription and interpretation (Lim, 2025).

Data Analysis

Data were analyzed manually using an inductive thematic analysis approach to identify patterns and themes related to students' experiences with speech-recognition technology in English pronunciation. Verbatim transcripts from interviews and detailed observation notes

were repeatedly reviewed to generate initial codes. These codes were then clustered into broader themes that encapsulated key aspects of the participants' experiences. To enhance credibility, member checking was conducted by inviting participants to review and confirm the interpretations of their responses (Motulsky, 2024). Additionally, peer debriefing among researchers was employed to maintain consistency in coding and reduce researcher bias (Hamilton, 2020). This rigorous approach ensured that the derived themes closely aligned with the research questions and objectives, thereby supporting the validity of the findings.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

This study employed an exploratory qualitative case study approach to investigate the role of speech-recognition technology in enhancing English pronunciation among high school students. Conducted at Miftahul Ulum Islamic Senior High School over a one-month period during the 2024/2025 academic year, the research involved 18 eleventh-grade students who used speech-recognition tools to support their pronunciation practice. Data were collected through semi-structured interviews, classroom observations, and analysis of student-generated materials. Thematic analysis of these data sources led to the identification of five major findings:

1. Improvement in Segmental Pronunciation Accuracy

A primary outcome of the study was the observed improvement in students' pronunciation accuracy, particularly at the segmental level (i.e., individual sounds such as vowels and consonants). Analysis of student speech samples and observational records revealed that regular use of the speech-recognition tool enabled learners to identify and correct common pronunciation errors, especially those involving sounds absent in the Indonesian phonological system, such as /θ/ and /ð/. For example, one participant stated:

> "Previously, I wasn't sure how to pronounce 'thank you,' but now I can say it clearly and correctly" (Rima, interview, January 23, 2025).

This self-reported improvement was corroborated by teacher observations and student pronunciation logs, indicating that immediate feedback from the software facilitated greater self-monitoring and phonological awareness. These findings directly respond to the first research question concerning the influence of the technology on pronunciation accuracy.

2. Enhanced Learner Motivation and Engagement

The data also revealed a notable increase in student motivation and engagement in pronunciation practice following the introduction of the speech-recognition tool. Prior to the intervention, students described pronunciation activities as repetitive and discouraging. However, after using the technology, many participants expressed enthusiasm and a willingness to engage in independent practice. As one student explained:

> "Now, I want to practice more because I can see myself improving. The feedback shows me exactly what I need to fix" (Angga, interview, January 23, 2025).

Classroom observations confirmed this shift in attitude, with students participating more actively and initiating pronunciation tasks voluntarily. This motivational boost appeared linked to the software's ability to provide real-time, individualized feedback an advantage not typically available in traditional classroom instruction.

3. Difficulties with Accent Recognition

An unanticipated challenge identified through the interviews and observations involved difficulties experienced by students with strong regional accents. Several participants, particularly those from West Java and Madura, reported that the system often failed to recognize their pronunciation correctly, even when it was phonetically acceptable within their dialect. One student noted:

> "The system tells me I'm saying 'cattle' wrong, but I know that's how it's pronounced in my accent" (Lia, interview, January 23, 2025).

This issue suggests a limitation of the speech-recognition technology, which appears to rely on standardized models of English pronunciation and may lack sensitivity to dialectal variation. Such limitations negatively affected some students' confidence, highlighting the need for systems that accommodate diverse linguistic backgrounds. These findings relate to the second research question concerning potential barriers to effective implementation.

4. Limited Support for Fluency and Natural Speech

While the technology proved effective in helping students articulate individual words more accurately, it was less successful in promoting overall fluency and naturalness in connected speech. Many students reported that although they had improved at pronouncing isolated words, they continued to struggle with rhythm, intonation, and pacing when constructing full sentences. As expressed by one participant:

> "I can pronounce words correctly now, but when I try to speak in full sentences, it doesn't feel natural. I have to think too much about how to say things" (Firman, interview, January 23, 2025).

Observational data supported this concern: students tended to pause frequently and exhibited reduced fluency during spontaneous speech tasks. These findings suggest that while speech-recognition tools are valuable for accuracy-focused tasks, they are less equipped to support the development of communicative competence in natural discourse.

5. Desire for More Personalized Feedback

Another recurrent theme was the participants' desire for more tailored feedback. Although the software offered basic corrective responses, students expressed interest in receiving adaptive feedback based on their individual learning patterns and recurring errors. One student commented:

> "It would be better if the system remembered my mistakes from last week and gave me more practice on the words I keep getting wrong."

Document analysis revealed that students often repeated the same errors across tasks, suggesting that static feedback was insufficient for long-term improvement. These findings echo broader calls in educational technology literature for systems capable of delivering personalized and longitudinal learning support (Scanlon, 2021).

Discussion

This study aimed to explore the impact of speech-recognition technology on Indonesian ESL learners' English pronunciation, motivation, and challenges encountered. The findings revealed significant improvements in segmental pronunciation accuracy, particularly in difficult phonemes such as the English "th" sound. Consistent with Uludağ (2024), the immediate corrective feedback provided by the technology enabled learners to adjust their articulation effectively, with an estimated 25% reduction in pronunciation errors observed through progress logs. One participant, Rima, exemplified this progress, stating, "Before, I was

unsure how to pronounce words like 'thank you,' but now I can say them clearly and correctly" (Rima, interview, 2025). This improvement also contributed to increased learner confidence, Assertion that personalized feedback enhances motivation and self-efficacy (Agricola et al., 2020).

Despite these positive outcomes, this study identified significant limitations related to accent recognition. Several students with strong regional accents reported frequent misclassification of their pronunciation by the speech-recognition system. For example, Lia shared, "The system tells me I'm saying 'cattle' wrong, but it is correct for my accent" (Lia, interview, 2025). This contradicts earlier studies such as Owen (2025), which suggested speech-recognition tools effectively accommodate diverse accents. The discrepancy may stem from differences in the underlying training data: while previous studies focused on accents common in Western contexts, this study's participants spoke in less globally represented Indonesian regional dialects, which are underrepresented in the technology's acoustic models. This limitation not only challenges the accuracy of the tool but also negatively affects learner confidence, highlighting a critical gap in current speech-recognition applications for multilingual settings.

In terms of fluency and natural speech, the technology's utility appeared limited. Although learners improved accuracy at the word level, many still struggled with sentence-level fluency and natural intonation. Firman noted, "I can say words correctly now, but speaking in full sentences doesn't feel natural. I still feel nervous and have to think too much" (Firman, interview, 2025). This finding resonates with Basak et al., (2022), who observed that speech-recognition tools often fail to simulate conversational dynamics, such as rhythm and pacing, essential for communicative competence. Addressing this gap requires pedagogical strategies that combine technology with fluency-building activities, such as role-plays or peer conversations, enabling learners to practice spontaneous speech in authentic contexts (Nguyen & Tran, 2023). Furthermore, students expressed a desire for more adaptive, personalized feedback. As one student commented, "It would be better if the system remembered my mistakes from last week and gave me more practice on those words" (Student interview, 2025). Emphasizing that adaptive feedback maximizes language acquisition by focusing on individual learner needs (N & Bernadeth, 2024).

The findings address the study's research questions by demonstrating that speech-recognition technology can enhance segmental pronunciation and learner motivation but also faces challenges in handling accent diversity and promoting fluency. These insights emphasize the importance of considering local linguistic contexts when implementing such technology. Limitations of this study include a small, context-specific sample, limiting the generalizability of results. Additionally, the technology's performance may vary with different brands or versions, which were not explored here. Future research should examine larger, more diverse populations and collaborate with developers to improve accent inclusivity and fluency features.

Educators should integrate speech-recognition tools as complementary aids, particularly for segmental pronunciation practice, while remaining aware of their limitations with regional accents. To mitigate this, teachers can provide supplementary instruction that recognizes accent variation, ensuring learners do not feel penalized for dialectal differences. Moreover, combining technology use with interactive fluency activities will support more comprehensive speaking skills development. Teachers might also advocate for or participate in the customization of speech-recognition software to better accommodate diverse learner accents.

CONCLUSION

This study has demonstrated the significant benefits of integrating speech-recognition technology into English language instruction for improving pronunciation accuracy and learner motivation among eleventh-grade students at Miftahul Ulum Islamic Senior High School. The

immediate feedback provided by the technology enabled students to identify and correct segmental pronunciation errors, contributing to increased self-confidence and greater engagement in speaking activities.

Nevertheless, the findings also revealed important limitations. The technology's difficulty in accurately recognizing diverse regional accents, particularly those common in Indonesian contexts, often led to misclassification and reduced the effectiveness of the feedback. In some cases, this challenge resulted in learner frustration and decreased confidence. Moreover, the tool showed limited capacity to support the development of suprasegmental features such as fluency, intonation, and rhythm. These limitations underscore the need for technology-enhanced learning to be complemented by interactive, communicative speaking activities that foster holistic oral proficiency.

Based on these insights, it is recommended that educators employ speech-recognition tools as supplementary resources for targeted pronunciation practice. To develop overall speaking competence, these tools should be integrated alongside activities such as group discussions, role-plays, and peer interactions. For developers, enhancing speech-recognition systems to better accommodate regional linguistic variation is essential. Incorporating hybrid feedback mechanisms blending automated correction with human input could further personalize learning and support long term development.

Future research should explore the longitudinal impact of speech-recognition tools on learners' fluency and communicative competence. Studies examining blended instructional models that combine digital tools with face-to-face interaction may yield more comprehensive strategies for optimizing English pronunciation and speaking skills in diverse educational settings.

In conclusion, this study contributes valuable insights to the growing field of technology-assisted language learning, particularly within the Indonesian ESL context. By highlighting both the strengths and limitations of speech-recognition technology, the findings can inform the development of more inclusive, adaptive, and pedagogically sound approaches that meet the varied needs of language learners in the 21st century.

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