

THE EFFECTIVENESS OF THE ELSA SPEAK APPLICATION IN TEACHING PRONUNCIATION AMONG STUDENTS AT MA. AN-NIDHOMIYAH

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ABSTRAK

Penelitian ini bertujuan untuk menganalisis efektivitas penggunaan aplikasi *ELSA Speak* dalam meningkatkan kemampuan *pronunciation* bahasa Inggris siswa di MA An-Nidhomiyah. Penelitian ini dilatarbelakangi oleh masih rendahnya akurasi pengucapan siswa yang dipengaruhi oleh interferensi bahasa pertama (*first language/L1*), keterbatasan pemberian umpan balik secara individual, serta rendahnya kepercayaan diri siswa ketika melakukan komunikasi lisan menggunakan metode pembelajaran konvensional. Penelitian menggunakan pendekatan kuantitatif dengan desain *quasi-experimental* tipe *One-Group Pre-test/Post-test Design*. Populasi penelitian adalah seluruh siswa MA An-Nidhomiyah tahun ajaran 2025–2026, sedangkan sampel penelitian berjumlah 27 siswa kelas XI yang dipilih menggunakan teknik *purposive sampling*. Data dikumpulkan melalui tes *pre-test* dan *post-test* kemampuan *pronunciation*, kemudian dianalisis menggunakan perangkat lunak SPSS 25 melalui uji validitas, reliabilitas, normalitas, dan *paired-samples t-test*. Hasil penelitian menunjukkan adanya peningkatan kemampuan *pronunciation* yang signifikan setelah penerapan aplikasi *ELSA Speak*, yang dibuktikan oleh perbedaan skor sebelum dan sesudah perlakuan. Temuan ini memperluas implementasi pembelajaran berbasis *artificial intelligence* pada konteks *Madrasah Aliyah*, yang masih relatif terbatas dalam penelitian sebelumnya. Dengan demikian, aplikasi *ELSA Speak* dapat menjadi alternatif media pembelajaran yang efektif untuk meningkatkan akurasi pengucapan, menyediakan umpan balik yang objektif dan bersifat *real-time*, mengurangi kecemasan berbahasa, serta mendorong kemandirian belajar siswa dalam pembelajaran bahasa Inggris.

Kata Kunci: *ELSA Speak, Pronunciation, Artificial Intelligence, Pembelajaran Bahasa Inggris, Madrasah Aliyah.*

ABSTRACT

This study aimed to examine the effectiveness of the *ELSA Speak* application in improving the English pronunciation skills of students at MA An-Nidhomiyah. The study was motivated by the persistent challenges in students' pronunciation accuracy, which are influenced by first language (L1) interference, limited opportunities for individualized feedback, and low self-confidence during oral communication when conventional teaching methods are employed. A quantitative approach was adopted using a quasi-experimental design with a *One-Group Pre-test/Post-test Design*. The population consisted of all students at MA An-Nidhomiyah during the 2025–2026 academic year, while the sample comprised 27 eleventh-grade students selected through *purposive sampling*. Data were collected using pre-test and post-test pronunciation assessments and analyzed with SPSS 25 through validity, reliability, normality, and *paired-samples t-test* analyses. The findings revealed a statistically significant improvement in students' pronunciation performance following the implementation of the *ELSA Speak* application, as evidenced by significant differences between the pre-test and post-test scores.

This study provides empirical evidence regarding the effectiveness of artificial intelligence-assisted pronunciation instruction within the context of an Islamic senior secondary school (Madrasah Aliyah), a setting that remains underrepresented in previous studies. The findings suggest that ELSA Speak has the potential to serve as an effective instructional medium by providing objective real-time feedback, enhancing pronunciation accuracy, reducing foreign language anxiety, and promoting greater learner autonomy in English language learning. Furthermore, the results offer practical implications for integrating AI-assisted learning into English pronunciation instruction at the secondary education level.

Keywords: *ELSA Speak, Pronunciation, Artificial Intelligence, English Language Learning, Madrasah Aliyah.*

INTRODUCTION

English has become the dominant lingua franca in international communication, education, science, and professional environments, making mastery of English an essential competency for students in the twenty-first century. Consequently, the Indonesian education system includes English as a compulsory subject to prepare learners for global interaction. Among the four language skills, speaking is widely regarded as the most visible indicator of communicative competence because it reflects learners' ability to express ideas effectively in real situations. Nevertheless, successful oral communication depends not only on vocabulary and grammatical knowledge but also on accurate pronunciation, as unclear pronunciation may reduce intelligibility and lead to communication breakdowns (Adnyani, 2021; Metruk, 2024). Therefore, improving pronunciation has become one of the primary concerns in contemporary English language teaching.

Despite its importance, pronunciation remains one of the most challenging aspects of learning English for Indonesian learners because many English phonemes are absent from their first language. Differences in sound systems frequently cause learners to transfer native-language pronunciation patterns into English, resulting in inaccurate articulation, stress placement, and intonation (Adnyani, 2021). These linguistic difficulties are often accompanied by psychological barriers, particularly speaking anxiety, which discourages students from actively participating in classroom communication and practicing oral skills (Rama et al., 2024). Previous studies have also shown that insufficient pronunciation competence negatively affects learners' confidence and willingness to communicate, thereby limiting opportunities to improve their overall speaking performance (Permatasari & Lubis, 2024). These findings indicate that pronunciation instruction should address both linguistic accuracy and learners' psychological readiness.

In many Indonesian secondary schools, pronunciation instruction is still dominated by conventional teaching approaches such as the Listen and Repeat technique, where feedback depends entirely on teachers' auditory judgment. This situation often limits students' opportunities to receive immediate, individualized, and objective correction, particularly in classrooms with large numbers of learners and limited instructional time. Recent educational developments suggest that integrating digital technology and Artificial Intelligence (AI) into English language teaching can overcome these limitations by providing automatic feedback, personalized practice, and continuous learning opportunities beyond classroom hours (Silalahi et al., 2025). Moreover, various digital media, including educational TikTok content and English Pronunciation IPA applications, have demonstrated positive contributions to improving learners' pronunciation accuracy and motivation to practice independently (Sari et al., 2024;

Idayani et al., 2025). These developments indicate that technology-assisted learning offers promising alternatives to traditional pronunciation instruction.

Among the available AI-based applications, ELSA Speak has received considerable attention because it utilizes Automatic Speech Recognition (ASR) technology to evaluate learners' speech and provide instant corrective feedback on segmental and suprasegmental aspects of pronunciation. Previous studies consistently report that the application significantly improves learners' pronunciation accuracy, speaking confidence, and autonomous learning habits by allowing repeated practice with objective evaluation (Permatasari & Lubis, 2024; Pham & Pham, 2025; Sun, 2023). Furthermore, a recent systematic literature review confirmed that Mobile-Assisted Language Learning (MALL) supported by ASR technology has become an effective approach for enhancing pronunciation instruction across diverse educational settings (Metruk, 2024). However, existing studies have primarily focused on university students, general EFL learners, or community-based learning environments, while empirical evidence regarding the effectiveness of ELSA Speak among students in Indonesian Islamic senior high schools remains limited. This gap highlights the need to investigate whether the application can effectively improve the pronunciation ability of eleventh-grade students at MA An-Nidhomiyah, who experience unique learning characteristics within an integrated general and religious education context.

Although numerous studies have demonstrated the positive contribution of digital technology to English pronunciation learning, empirical findings also reveal that most innovations have been implemented in higher education or short-term training programs. Research on ELSA Speak has predominantly involved university students (Pham & Pham, 2025), while studies on other digital applications have focused on improving pronunciation through English Pronunciation IPA or community-based learning media such as TikTok educational content (Idayani et al., 2025; Sari et al., 2024). Likewise, investigations concerning Artificial Intelligence (AI) integration in English learning have generally emphasized teacher innovation and classroom implementation rather than examining students' learning outcomes in secondary education (Silalahi et al., 2025). Consequently, evidence regarding the effectiveness of AI-assisted pronunciation instruction for students in Islamic senior high schools remains relatively limited, particularly in classrooms characterized by different academic and religious learning demands.

Another important issue concerns the pedagogical characteristics of Islamic secondary schools, where students simultaneously undertake general academic subjects and religious education. Such learning conditions reduce opportunities for intensive oral practice because classroom time is distributed across various subjects, while teachers often prioritize reading comprehension and grammar to meet curriculum requirements. As a result, individualized pronunciation feedback is rarely provided, allowing pronunciation errors to persist throughout the learning process. Recent studies have confirmed that Automatic Speech Recognition (ASR) technology enables learners to receive immediate and objective corrective feedback, thereby facilitating independent practice outside formal classroom sessions (Sun, 2023; Metruk, 2024). Nevertheless, the effectiveness of this technological approach has not been sufficiently investigated within Islamic school contexts, creating an important research opportunity.

The present study also addresses a theoretical gap identified in previous literature. Existing studies have primarily reported improvements in pronunciation accuracy after using digital applications but have provided limited discussion regarding their implementation in educational environments with distinctive institutional characteristics. Furthermore, previous investigations have rarely examined whether students with limited exposure to English outside

school can effectively utilize AI-based applications as autonomous learning tools (Permatasari & Lubis, 2024; Pham & Pham, 2025). Therefore, the novelty of this research lies not only in evaluating the effectiveness of ELSA Speak in improving pronunciation achievement but also in extending its application to students at an Islamic senior high school, thereby enriching empirical evidence concerning the implementation of Artificial Intelligence in Indonesian secondary English education.

Based on the identified research gaps, this study aims to examine the effectiveness of the ELSA Speak application in improving the English pronunciation ability of eleventh-grade students at MA An-Nidhomiyah. Specifically, the study investigates whether the integration of Artificial Intelligence through Automatic Speech Recognition technology significantly enhances students' pronunciation performance after classroom intervention. The findings are expected to contribute to the growing body of literature concerning AI-assisted English language learning, particularly in secondary education settings where empirical evidence remains scarce. In addition, this research is anticipated to provide practical recommendations for English teachers seeking innovative, technology-supported strategies to improve students' oral communication competence in Indonesian Islamic schools.

RESEARCH METHOD

This study employed a quantitative approach using a quasi-experimental method with a one-group pre-test–post-test design to examine the effectiveness of the ELSA Speak application in improving students' English pronunciation. The research was conducted at MA An-Nidhomiyah during the 2025–2026 academic year. The population comprised all students enrolled at the school, while the sample consisted of 27 eleventh-grade students selected through purposive sampling. The participants were chosen based on predetermined criteria, including observable pronunciation difficulties, frequent first-language interference during English oral production, and relatively high levels of speaking anxiety identified through preliminary classroom observations and teacher recommendations. In this study, the independent variable was the implementation of the ELSA Speak application, whereas the dependent variable was students' pronunciation accuracy, encompassing both segmental features (individual speech sounds) and suprasegmental features such as stress and intonation. The selection of AI-assisted pronunciation learning as the intervention was informed by previous educational practices demonstrating that digital pronunciation platforms provide immediate feedback and individualized practice opportunities, thereby supporting learners in improving pronunciation accuracy across diverse educational contexts (Hadi et al., 2024; Rahmawati et al., 2026).

Data were collected using a pronunciation performance test administered before and after the intervention. The assessment materials consisted of a standardized list of English words and a short reading passage representing common pronunciation challenges encountered by Indonesian learners. Students' pronunciation was evaluated automatically through the Automatic Speech Recognition (ASR) technology embedded in the ELSA Speak application and subsequently verified by the English teacher using the same scoring rubric to maintain scoring consistency. The integration of AI-based pronunciation assessment and teacher verification was intended to enhance the reliability of the evaluation process, reflecting recent educational practices that combine automated speech analysis with teacher supervision to provide more accurate pronunciation assessment (Rahmawati et al., 2026). The instrument assessed pronunciation accuracy, word stress, intonation, fluency, and overall intelligibility. Prior to implementation, the instrument underwent content validity evaluation by English

language education experts, while its internal consistency was examined using Cronbach's Alpha. Students' performance was then classified into four achievement categories: excellent, good, fair, and poor, according to the predetermined assessment criteria.

The research procedure consisted of three consecutive stages. First, a pre-test was administered to determine students' initial pronunciation proficiency. Second, students participated in a series of guided learning sessions using the ELSA Speak application, during which they practiced pronunciation independently, completed structured speaking exercises, received immediate AI-generated corrective feedback, and discussed learning difficulties with the teacher at the end of each session. This learning procedure is consistent with recent community-based pronunciation training programs that emphasize repetitive practice, instant corrective feedback, and continuous learner engagement through digital pronunciation technologies (Hadi et al., 2024; Rahmawati et al., 2026). The intervention was implemented across several classroom meetings with equal instructional duration to ensure consistent learning opportunities for all participants. Finally, a post-test employing assessment materials equivalent to those used in the initial test was conducted to measure learning gains after the intervention. The collected data were analyzed using IBM SPSS Statistics version 25 through descriptive statistics, instrument validity and reliability testing, a normality test as a prerequisite for parametric analysis, and a paired-samples t-test with a significance level of 0.05 to determine whether the use of the ELSA Speak application produced a statistically significant improvement in students' English pronunciation.

RESULTS AND DISCUSSION

Results

The collected data were analyzed sequentially, beginning with instrument testing before hypothesis testing was conducted. Instrument quality was evaluated through validity and reliability analyses to ensure that the pronunciation test was appropriate for measuring students' pronunciation performance. The results of the instrument validity test are presented in Table 3. As shown in Table 1, all pronunciation test items fulfilled the required validity criteria because each obtained correlation coefficient exceeded the critical value ($r_{count} > r_{table}$), indicating that every item was suitable for data collection.

Table 1. Results of Instrument Validity Test

Item	r_{count}	r_{table}	Decision
1.	0.671	0.381	Valid
2.	0.724	0.381	Valid
3.	0.758	0.381	Valid
4.	0.696	0.381	Valid
5.	0.735	0.381	Valid
6.	0.701	0.381	Valid
7.	0.769	0.381	Valid
8.	0.713	0.381	Valid
9.	0.687	0.381	Valid
10.	0.742	0.381	Valid

The instrument consistency was subsequently examined using Cronbach's Alpha, and the findings are summarized in Table 4. Based on Table 2, the pronunciation instrument obtained a Cronbach's Alpha coefficient of 0.914, exceeding the recommended minimum value of 0.70. These results indicate that the instrument demonstrated high internal consistency and was therefore suitable for the subsequent stages of data collection.

Table 2. Results of Reliability Test

Reliability Index	Value
<i>Cronbach's Alpha</i>	0.914
Number of Items	10
Reliability Category	Very High

Following instrument testing, descriptive statistics and data distribution were examined before conducting the hypothesis test. Students completed both a pre-test and a post-test using equivalent pronunciation assessment materials. The descriptive statistics are presented in Table 3. As presented in Table 3, the mean score increased from 61.74 in the pre-test to 83.11 in the post-test, while the standard deviation remained relatively stable across both measurements.

Table 3. Descriptive Statistics of Students' Pronunciation Scores

Test	N	Mean	SD	Minimum	Maximum
<i>Pre-test</i>	27	61.74	8.56	48	75
<i>Post-test</i>	27	83.11	6.42	71	95

Prior to inferential analysis, the assumption of normality was evaluated using the Shapiro–Wilk test, and the results are reported in Table 4. Based on Table 4, the significance values for both the pre-test and post-test exceeded the 0.05 threshold, indicating that the score distributions met the assumption of normality. Consequently, the dataset fulfilled the prerequisite for applying parametric statistical analysis through the paired-samples t-test.

Table 4. Results of Normality Test (*Shapiro–Wilk*)

Variable	Statistic	Sig.	Decision
<i>Pre-test</i>	0.964	0.174	Normal
<i>Post-test</i>	0.972	0.312	Normal

After confirming the assumption of normality, hypothesis testing was conducted using a paired-samples t-test to compare students' pronunciation performance before and after the implementation of the ELSA Speak application. The statistical output is presented in Table 5. As shown in Table 5, the analysis produced a significance value of 0.000 ($p < 0.05$), indicating a statistically significant difference between the two sets of scores. In addition, the observed mean difference between the pre-test and post-test scores was 21.37 points.

Table 5. Results of the *Paired-Samples t-Test*

Variable	Mean Difference	t	df	Sig. (2-tailed)
Pre-test – Post-test	21.37	15.624	26	0.000

The statistical findings presented in Table 5 complete the hypothesis-testing procedure conducted in this study. The paired-samples t-test output provides the numerical comparison between the two measurement occasions based on the selected significance level. The complete presentation of instrument testing, descriptive statistics, assumption testing, and hypothesis testing demonstrates the sequence of quantitative analyses performed using IBM SPSS Statistics version 25. These results provide the empirical basis for the discussion presented in the following section.

Discussion

The findings of this study demonstrate that the implementation of the ELSA Speak application significantly improved students' English pronunciation performance after the instructional intervention. This improvement indicates that Artificial Intelligence (AI) supported by Automatic Speech Recognition (ASR) provides immediate and individualized corrective feedback, enabling learners to recognize and revise pronunciation errors more effectively than conventional teacher-centered approaches. The present findings are consistent with those reported by Khalizah and Damanik (2024), who found that ELSA Speak encouraged learners with low motivation to actively improve their pronunciation through personalized feedback. Likewise, Yani et al. (2025) reported that the integration of ELSA Speak in vocational schools successfully optimized students' speaking and pronunciation skills by creating more structured and technology-assisted learning experiences. Therefore, the significant improvement observed in this study confirms that AI-based pronunciation instruction is capable of facilitating more effective oral language development in secondary education contexts.

The effectiveness of ELSA Speak can be explained through its capacity to deliver objective, continuous, and real-time pronunciation assessment. Unlike conventional classroom practice, where corrective feedback is often delayed and limited by instructional time, ASR technology immediately identifies pronunciation inaccuracies at both segmental and suprasegmental levels, allowing students to repeatedly refine their speech production. Similar conclusions were reported by Pardosi and Enda (2025), who demonstrated that speech recognition technology provides accurate pronunciation evaluation and supports more efficient language practice through automated feedback. Furthermore, Hsu (2026) found that combining shadowing activities with Automatic Speech Recognition significantly enhanced learners' pronunciation accuracy and speaking fluency, indicating that repeated digital practice strengthens articulatory competence. These findings suggest that the improvement achieved by students at MA An-Nidhomiyah resulted not merely from increased practice frequency but also from the quality of individualized feedback generated by intelligent learning technology.

Beyond improving pronunciation accuracy, the findings also indicate that AI-assisted learning positively influenced students' psychological readiness to communicate in English. Many learners initially experienced hesitation when producing unfamiliar sounds because they were concerned about making mistakes in front of classmates. Through independent practice using ELSA Speak, students were able to repeat pronunciation exercises privately until they achieved satisfactory performance, thereby reducing communication anxiety and increasing confidence. This interpretation is supported by Sepniwati et al. (2025), who identified foreign

language anxiety as one of the principal barriers preventing students from actively participating in oral communication. Similarly, Purnama et al. (2026) reported that learners perceived AI pronunciation tools as effective learning partners because they provided non-judgmental feedback, encouraged repeated practice, and strengthened students' confidence in producing accurate pronunciation. Consequently, the present findings reinforce the argument that technological innovation contributes not only to linguistic improvement but also to learners' emotional preparedness for oral communication.

The present study further demonstrates that the integration of Artificial Intelligence promotes greater learner autonomy during English learning. Students became more actively involved in monitoring their own progress because the application continuously displayed performance indicators and personalized recommendations for improvement. This finding supports Hamer et al. (2022), who argued that digital learning platforms encourage self-regulated learning by providing learners with greater control over their learning process. Similar evidence was reported by Salsabila et al. (2025), who concluded that technology-assisted language applications substantially increase students' learning motivation, while Shahana et al. (2025) found that interactive digital media improved learners' pronunciation achievement through continuous engagement. In a broader context, Abimanto and Mahendro (2023) emphasized that AI-based learning technologies create more adaptive and personalized instructional environments, whereas Zebua et al. (2026) demonstrated that intelligent digital English learning platforms effectively support students' oral communication competence in secondary schools. Collectively, these findings indicate that the effectiveness of ELSA Speak extends beyond pronunciation correction by fostering independent learning habits that are essential for sustainable language development.

The findings of this study also provide important theoretical implications for the integration of Artificial Intelligence into English language instruction. The significant improvement in students' pronunciation performance suggests that AI-based learning should not be viewed merely as a technological innovation but as a pedagogical tool capable of complementing teachers' instructional roles. Unlike conventional pronunciation instruction that relies heavily on classroom interaction, ELSA Speak enables continuous learning through immediate feedback and repeated self-practice, thereby extending learning opportunities beyond scheduled class hours. This interpretation is consistent with Abimanto and Mahendro (2023), who argued that AI technology promotes more adaptive and learner-centered instruction, as well as Purnama et al. (2026), who reported that learners perceived AI pronunciation tools as effective learning partners for strengthening pronunciation competence. Therefore, the present findings support the growing perspective that technology-assisted instruction should be integrated into English learning as a complement to, rather than a replacement for, teachers' professional expertise.

Another noteworthy finding concerns the development of students' independent learning behavior throughout the intervention. Repeated exposure to individualized feedback encouraged learners to monitor their own pronunciation progress, identify recurring errors, and independently determine appropriate learning strategies. This pattern reflects the principles of self-regulated learning, in which students gradually assume greater responsibility for evaluating and improving their own performance. Similar conclusions were reported by Hamer et al. (2022), who found that digital learning platforms significantly strengthened learner autonomy, while Salsabila et al. (2025) demonstrated that technology-based language applications increased students' motivation and persistence during learning activities. Likewise, Yani et al. (2025) emphasized that integrating ELSA Speak into classroom

instruction enhanced students' engagement and encouraged more consistent pronunciation practice. These findings indicate that the educational value of ELSA Speak extends beyond improving pronunciation accuracy by fostering sustainable learning habits that remain beneficial after formal instruction has ended.

The present study also contributes to the existing body of literature by extending previous findings into a different educational setting. Earlier studies predominantly investigated university students, vocational schools, or community-based learning programs (Khalizah & Damanik, 2024; Yani et al., 2025; Purnama et al., 2026), whereas empirical evidence from Islamic senior high schools has remained limited. The positive outcomes observed in this research demonstrate that Automatic Speech Recognition technology can be effectively implemented in schools where students divide their academic time between general education and religious learning. These findings are further supported by Hsu (2026), who demonstrated that combining shadowing with Automatic Speech Recognition significantly improved learners' pronunciation and speaking fluency, and by Zebua et al. (2026), who reported that digital English learning platforms effectively strengthened oral communication skills among secondary school students. Consequently, the present research expands the applicability of AI-assisted pronunciation learning and provides additional empirical evidence for educational contexts that have received relatively limited scholarly attention.

Despite the encouraging findings, several limitations should be acknowledged when interpreting the results of this study. The research employed a one-group pre-test/post-test design with a relatively limited number of participants from a single institution, which may restrict the generalizability of the findings to broader educational contexts. Future studies are therefore encouraged to involve larger samples, multiple schools, and control groups to obtain more comprehensive evidence regarding the effectiveness of AI-assisted pronunciation instruction. In addition, further investigations may compare different AI-based pronunciation platforms, such as ELSA Speak, EnglishCentral, and other Automatic Speech Recognition applications, to determine their relative effectiveness in improving pronunciation accuracy, speaking fluency, learner motivation, and communication confidence. Such studies will contribute to a more comprehensive understanding of how intelligent educational technologies can support sustainable English language learning in Indonesian secondary education.

CONCLUSION

The findings of this study indicate that the integration of the ELSA Speak application into English pronunciation instruction provides meaningful pedagogical value in improving students' oral production within the context of an Islamic senior secondary school. Rather than merely demonstrating score improvement, the results suggest that artificial intelligence-assisted pronunciation practice creates a more individualized learning environment through immediate and objective feedback on both segmental and suprasegmental features of speech. These findings also address the research gap identified in the introduction by extending the implementation of AI-supported pronunciation learning beyond university settings to Madrasah Aliyah students, a context that has received limited scholarly attention. Consequently, this study contributes to the growing body of knowledge on technology-enhanced language learning by providing empirical evidence that AI-based pronunciation support can complement classroom instruction while promoting greater learner autonomy and communicative confidence.

From a practical perspective, the findings imply that the integration of AI-powered pronunciation applications can serve as a complementary instructional strategy for English teachers, particularly in educational settings where opportunities for individualized speaking

practice remain limited. The collaboration between teachers and intelligent digital learning tools should therefore be viewed as a balanced instructional model in which technology supports repetitive pronunciation practice, while teachers continue to facilitate interaction, motivation, and meaningful language use. Furthermore, these findings provide a reference for schools and curriculum developers seeking to incorporate AI-assisted learning into English language instruction without replacing the essential pedagogical role of educators. Future research is recommended to employ larger and more diverse samples, include control groups or longitudinal research designs, compare different AI-based pronunciation platforms, and investigate broader dimensions of speaking performance, including fluency, intelligibility, communicative competence, and long-term learning retention, to strengthen the evidence regarding the effectiveness of AI-supported pronunciation instruction across various educational contexts.

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