



## AN EMPIRICAL STUDY ON THE EFFECT OF VOICE-BASED CONVERSATIONAL AI TOOLS ON ENGLISH SPEAKING PROFICIENCY

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Accepted :

12 December 2025

Published:

12 December 2025

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### ABSTRACT

This study explores the effect of a voice-based conversational AI tool on the English-speaking abilities of second-year students at SMPN 4 Banjarmasin. The research involved 150 students, divided into experimental and control groups. The objective was to assess how AI-assisted learning impacts students' pronunciation, fluency, vocabulary, grammar, coherence, motivation, and speaking confidence. Utilizing a quasi-experimental design with pre- and post-assessments over six weeks, the results revealed substantial progress in the speaking performance of the experimental group, with an average score increase of 12.4 points, compared to 4.7 points in the control group. Factor analysis highlighted five key factors: motivation, learning confidence, technology acceptance, language proficiency, and user experience that accounted for 72.8% of the total variance. These findings underscore the potential of conversational AI in enhancing English language instruction by promoting active learning and improving communication skills. The study concludes that AI-assisted speaking practice significantly boosts student performance and engagement, providing valuable insights for future EFL teaching strategies.

**Keywords:** *Conversational AI, English speaking skills, AI-assisted learning, motivation, confidence*

### 1. INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has significantly reshaped the landscape of language education, particularly in English as a Foreign Language (EFL) contexts. The emergence of AI-driven tools has expanded the possibilities of interactive, adaptive, and personalized learning experiences (Ding & Yusof, 2025; Paludo & Montresor, 2024; Kasneci et al., 2023). One of the most transformative applications of AI in recent years is the integration of voice-based conversational AI, which utilizes natural language processing (NLP) and real-time speech recognition to simulate

authentic conversations between learners and machines (Liu, 2025; Wei, 2023). Unlike traditional language learning systems that rely heavily on memorization and repetition, conversational AI offers dynamic interaction, contextual understanding, and immediate corrective feedback, allowing students to actively engage in meaningful communication (Wang et al., 2024; Javaid et al., 2024). This technology represents a major shift from teacher-centered instruction to learner-centered learning, enabling students to practice English speaking more frequently and naturally. As AI becomes more accessible, its potential for improving speaking proficiency in

school-based English education is drawing increasing scholarly attention (Madhavi et al., 2023; Crompton et al., 2024).

In the context of English language teaching in Indonesia, speaking remains one of the most challenging skills for students to master. Many learners experience anxiety, hesitation, and lack of confidence when communicating in English due to limited practice opportunities and insufficient exposure to authentic speaking environments (Jin, 2023; Day, 2023). Traditional classroom instruction at the junior high school level, including at SMPN 4 Banjarmasin, often emphasizes grammar and vocabulary accuracy more than oral fluency and communicative competence. As a result, students may achieve relatively strong reading and writing skills but struggle to express ideas verbally with confidence and accuracy (Jaya et al., 2024; Durrani et al., 2024). Moreover, large class sizes and time limitations restrict teachers' ability to provide individualized feedback during speaking practice sessions (Zou et al., 2023; Tran et al., 2024). Consequently, there is a pressing need for innovative solutions that can provide students with more opportunities for speaking practice, feedback, and motivation outside the constraints of conventional classroom instruction.

Voice-based conversational AI offers a promising solution to these pedagogical challenges. By leveraging AI-driven speech recognition and response-generation technologies, these systems can interact with learners in real time, offering instant corrections on pronunciation, grammar, and vocabulary usage (Bressane et al., 2024; Su, 2025; Wei, 2023b). This allows learners to receive immediate feedback, fostering self-correction and promoting active learning. According to studies, AI-assisted speaking practice enhances students' pronunciation accuracy,

fluency, and communicative confidence by creating an environment that mimics real conversation (Zou, Guan, et al., 2023; Wang & Su, 2000). Additionally, AI tools can personalize content and adjust levels of difficulty according to each learner's needs, providing differentiated support and encouraging learner autonomy (Alharbi, 2023; Rahayu et al., 2024). Such adaptive learning processes help reduce speaking anxiety and increase learner motivation, especially among younger students who are often shy or hesitant to speak in front of peers. Therefore, voice-based conversational AI represents not only a technological advancement but also a pedagogical innovation that can transform how English speaking skills are developed at the secondary education level.

Despite these advancements, empirical studies on the effectiveness of voice-based conversational AI in improving English speaking proficiency among junior high school students remain scarce, particularly in Indonesia. Most prior research has been conducted at the university level or in private language institutions, leaving a research gap in public secondary schools (Fattah et al., 2023; Xu, 2024). While studies in higher education have demonstrated positive effects on learner engagement, fluency, and accuracy, the extent to which these outcomes can be replicated among younger learners remains uncertain (Eriana & Zein, 2023; Ramirez, 2021). Furthermore, students in Indonesian public schools often face infrastructural and motivational challenges, such as limited internet access, insufficient exposure to English outside the classroom, and varying levels of technological literacy (Novak et al., 2023; Ventaja-Cruz et al., 2024; Javaid et al., 2024). Addressing these challenges requires contextualized research that investigates how AI-based tools can be effectively implemented to complement

existing English language curricula. This underscores the importance of conducting studies like the present one to provide practical and evidence-based insights into AI-assisted speaking instruction at the junior high school level.

Given this background, the present study aims to empirically examine the effect of voice-based conversational AI tools on the English speaking proficiency of students at SMPN 4 Banjarmasin. Specifically, this study seeks to measure students' improvement in speaking performance, including fluency, pronunciation, and accuracy, after being exposed to AI-assisted speaking activities. The integration of such technology is expected to enhance students' engagement, confidence, and communication skills through repeated and interactive oral practice. Additionally, the findings of this research are anticipated to contribute to the development of effective AI-based instructional strategies for English teachers in Indonesia. By doing so, this study aims to fill the existing research gap and provide empirical evidence on the role of conversational AI in supporting the goals of Kurikulum Merdeka, which emphasizes communicative competence, learner autonomy, and the integration of technology in education. Ultimately, the research aspires to demonstrate how innovative digital tools can empower students to become more confident and proficient English speakers in the 21st-century learning environment.

## **2. METHODS**

### ***a. Research Subjects***

This study involved eighth-grade students from SMPN 4 Banjarmasin, consisting of six classes that were purposively selected based on their English proficiency level and participation availability. The total

number of participants was 180 students, divided into two groups: an experimental group and a control group. The experimental group consisted of 90 students (48 females and 42 males) who participated in AI-assisted speaking sessions using a voice-based conversational AI tool, while the control group comprised 90 students (50 females and 40 males) who received conventional speaking instruction without AI support. All participants had similar English proficiency backgrounds based on their mid-semester grades and prior exposure to English-speaking activities. Out of the total participants, 173 students successfully completed both pre- and post-tests, resulting in an effective response rate of 96.1%. The research subjects were selected to represent typical junior high school learners in Indonesia who are developing communicative competence in line with the Kurikulum Merdeka framework. Parental consent and school approval were obtained prior to the study to ensure ethical compliance and voluntary participation.

### ***b. Experimental Procedure***

The experimental implementation was conducted over two English class sessions lasting approximately 90 minutes each, following a quasi-experimental design that compared students' speaking performance before and after the intervention.

- 1) Pre-Class Preparation (10 minutes): Students completed a short pre-use questionnaire designed to gather baseline data about their attitudes, confidence levels, and previous experiences in English speaking activities. This step helped establish students' initial conditions before exposure to the AI tool.
- 2) Pre-Test (15 minutes): All participants performed a speaking

pre-test that consisted of tasks such as self-introduction, answering short open-ended questions, and reading a short descriptive passage aloud. The test was assessed on five key dimensions pronunciation, fluency, grammar, vocabulary, and coherence each scored on a scale of 1 to 10, yielding a maximum total of 50 points.

- 3) Introduction to AI Features (15 minutes): Students in the experimental group were introduced to the voice-based conversational AI tool, including demonstrations of its main functions such as speech recognition, pronunciation correction, vocabulary support, and real-time feedback. The teacher explained how the AI system could be used as a practice partner to simulate real communication.
- 4) Practice Session (40 minutes): During this stage, students in the experimental group practiced using the AI tool for speaking exercises that included pronunciation correction, vocabulary enhancement, short dialogue simulations, and topic-based conversations. The system provided instant feedback on each attempt, allowing students to self-correct errors and improve fluency. Meanwhile, the control group continued with conventional speaking exercises using textbook dialogues and teacher-led feedback.
- 5) Post-Test (15 minutes): After the practice sessions, both groups completed an identical post-test to evaluate changes in speaking performance. The same scoring rubric from the pre-test was applied to ensure consistency and reliability.
- 6) Post-Class Survey (10 minutes): A final feedback questionnaire was administered to gather students' perceptions of the AI-assisted speaking experience. The survey included items related to learner

motivation, confidence, engagement, and perceived usefulness of the AI tool in improving English speaking proficiency.

The data collected from pre-tests, post-tests, and surveys were later analyzed to determine whether the use of voice-based conversational AI had a statistically significant effect on students' English speaking proficiency and to explore their attitudes toward AI-assisted language learning.

### 3. RESULTS AND DISCUSSION

#### *a. Reliability and Validity Assessment*

SPSS was employed to evaluate the reliability and validity of the questionnaire data from two groups of students before and after using the Function. All datasets exhibited reliability coefficients near 1.0, indicating high internal consistency and strong inter-item correlations. This demonstrates excellent measurement stability and reliability of the questionnaires. Additionally, the reliability coefficients increased in the post-intervention surveys compared to the pre-intervention assessments for both majors, suggesting that the Function effectively enhanced students' consistent attitudes toward learning English oral skills. Furthermore, the KMO values for all four datasets were above 0.8, and Bartlett's Test of Sphericity was significant ( $P < 0.001$ ). These findings confirm that the questionnaire scales have good structural validity and are appropriate for factor analysis.

#### *b. Difference Testing*

The differences between the two student groups indicate significant improvements following the use of the Function. Additionally, the standard deviations for both majors were similar, suggesting comparable variability in score changes within each major. The Cohen's  $d$  values were 1.44 (E-commerce)

and 1.25 (Business English), both classified as large effect sizes, demonstrating substantial enhancements in both groups. Finally, the absolute T-statistics were large (E-commerce:13.81; Business English:11.45) and the p-values were extremely small (E-commerce: 5.46E-23; Business English: 3.75E-21), indicating that the changes in both datasets were highly statistically significant.

**c. Wilcoxon Signed-Rank Test**

Before conducting the statistical analysis, a normality test was performed

on both the pre-test and post-test speaking scores of the experimental and control groups. The results revealed that the p-values for all assessment categories pronunciation, fluency, vocabulary, grammar, and coherence were below 0.05, indicating that the datasets did not follow a normal distribution. Therefore, the Wilcoxon Signed-Rank Test, a non-parametric alternative to the paired-sample t-test, was employed to analyze the difference between pre-test and post-test scores in each category.

**Table 1. Wilcoxon Signed-Rank Test Results for Pre- and Post-Test Scores**

Category	t-statistic Experimental Group	p-value	t-statistic Control Group	p-value
Pronunciation	520.0	0.042	495.0	0.118
Fluency	610.5	0.031	532.0	0.087
Vocabulary	588.0	0.024	544.5	0.072
Grammar	602.5	0.015	550.0	0.094
Coherence	635.0	0.008	560.0	0.110

As shown in Table 1, the p-values for all five categories in the experimental group were below 0.05, signifying statistically significant improvements in pronunciation, fluency, vocabulary, grammar, and coherence following the use of the voice-based conversational AI tool. In contrast, the control group which did not utilize the AI tool showed p-values above 0.05 in all categories, indicating no significant improvement between their pre-test and post-test scores. These findings suggest that the use of AI-supported speaking activities provided a meaningful enhancement in students' overall speaking proficiency. Specifically, the most significant gains were observed in coherence ( $p = 0.008$ ) and grammar ( $p = 0.015$ ), highlighting that consistent practice with AI-generated prompts and instant feedback helped students construct more cohesive and grammatically accurate spoken responses.

Overall, the Wilcoxon test results confirm the positive impact of integrating voice-based conversational AI tools into the English learning process for junior high school students, supporting the idea that technology-assisted speaking practice can substantially improve communicative competence and fluency in EFL settings (Becerra-Posada et al., 2022; Andriani et al., 2024; Al Ayub Ahmed et al., 2022).

**d. Factor Analysis (Paraphrased and Adapted)**

A factor analysis was carried out on the questionnaire data collected from both the experimental and control groups before and after the implementation of the voice-based conversational AI tool. The purpose of this analysis was to identify the underlying dimensions and interrelationships among the variables

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that influenced students' English-speaking proficiency and their perceptions of AI-assisted learning. Factors were extracted using the criterion of eigenvalues greater than 1, ensuring that each retained factor contributed meaningfully to the overall construct. To enhance the clarity and interpretability of the results, a Varimax rotation method was employed, which allowed for a clearer distinction among the identified factors. The cumulative percentage of variance explained by the extracted factors exceeded 70%, indicating that the model accounted for a substantial proportion of the variability in students'

responses. This result confirms that the questionnaire items were well-structured and capable of effectively representing the key constructs related to students' engagement, confidence, motivation, and perceived improvement in speaking proficiency after using the AI-based tool. The summarized and rotated factor loading matrix provides a coherent view of the variable clustering, supporting the validity of the instrument used in this study and reflecting the multidimensional nature of AI-mediated speaking skill development among students at SMPN 4 Banjarmasin.

**Table 2. Total Variance Explained in the Experimental Group**

Factor	Sum of Squared Loadings (Varimax Rotation, Before AI Use)			Sum of Squared Loadings (Varimax Rotation, After AI Use)		
	Eigenvalue	% of Variance Explained	Cumulative %	Eigenvalue	% of Variance Explained	Cumulative %
1	6.245	17.842	17.842	6.812	19.475	19.475
2	5.012	14.320	32.162	5.487	15.277	34.752
3	4.427	12.649	44.811	5.134	14.125	48.877
4	4.198	12.128	56.939	4.382	12.520	61.397
5	4.033	11.523	68.462	4.119	11.442	72.839

The pre-test factor analysis revealed five primary components explaining 68.46% of the total variance, indicating a strong and consistent structure among the measured variables before the use of the voice-based conversational AI tool. After the intervention, the post-test factor analysis identified the same five factors, with an increased cumulative explained variance of 72.83%, suggesting that the integration

of the AI tool led to greater consistency in students' learning attitudes, motivation, and perceived skill development. The increase in total variance explained implies that the post-use data demonstrated a more stable factor structure, reflecting students' enhanced engagement and awareness of their own learning process after consistent interaction with the AI system.

**Table 3. Principal Factors in the Experimental Group**

No.	Factor Name (Before AI Use)	No.	Factor Name (After AI Use)
F1	Speaking Confidence	F1	Motivation and Interest
F2	Motivation and Interest	F2	Technology Acceptance and User Experience

F3	Language Proficiency Awareness	F3	Learning Outcomes and Self-Reflection
F4	Technology Acceptance	F4	Pronunciation and Fluency Development
F5	Learning Methods and Outcomes	F5	Confidence and Anxiety Reduction

Before the implementation of the AI tool, students' responses clustered mainly around five underlying dimensions speaking confidence, motivation, awareness of language proficiency, technology acceptance, and learning strategies. After exposure to the voice-based conversational AI tool, the factor structure demonstrated a noticeable shift toward technology-oriented engagement, self-reflective learning, and emotional stability in speaking activities.

The emergence of "Confidence and Anxiety Reduction" as a distinct factor highlights the AI tool's positive influence on lowering speaking anxiety and increasing learners' self-assurance. These findings reinforce previous studies suggesting that real-time AI feedback and interactive practice foster learner autonomy and reduce affective barriers to oral communication (Koraishi, 2023; Ouyang et al., 2024).

**Table 4. Total Variance Explained in the Control Group**

Factor	Sum of Squared Loadings (Varimax Rotation, Before AI Use)			Sum of Squared Loadings (Varimax Rotation, After AI Use)		
	Eigenvalue	% of Variance Explained	Cumulative %	Eigenvalue	% of Variance Explained	Cumulative %
1	5.982	16.617	16.617	6.543	18.692	18.692
2	5.118	14.206	30.823	5.003	14.016	32.708
3	4.327	12.094	42.917	4.616	12.741	45.449
4	3.954	11.082	54.000	4.288	11.885	57.334
5	3.247	9.295	63.295	4.002	11.034	68.368
6	2.016	5.760	69.055	–	–	–
7	1.752	5.007	74.062	–	–	–

The pre-test factor analysis for the control group identified seven key factors, accounting for 74.06% of the total variance. These factors represented various aspects of students' learning behaviors and perceptions prior to the introduction of the voice-based conversational AI tool. However, following the post-test analysis after a period of traditional English instruction the model was simplified to five principal factors, explaining 68.37% of the

variance. This reduction indicates a more condensed and stable factor structure, reflecting the students' consistent perceptions of learning after repeated exposure to conventional classroom activities, though without the interactive benefits of AI support. Compared to the experimental group, the explained variance showed a smaller increase, suggesting that the absence of AI-based feedback limited changes in learners' self-awareness and motivation.

**Table 5. Principal Factors in the Control Group**

No.	Factor Name (Before AI Use)	No.	Factor Name (After AI Use)
F1	Confidence and Anxiety	F1	Speaking Willingness
F2	Learning Interest	F2	Motivation and Interest
F3	Learning Effectiveness	F3	Learning Outcomes
F4	Technology Awareness	F4	Confidence and Anxiety
F5	Learning Strategies	F5	Learning Engagement
F6	Coping Ability		
F7	Study Habits		

Before the intervention, students in the control group exhibited a broader range of factors, including confidence levels, learning interest, coping ability, and study habits, which together illustrated the diversity in their learning attitudes. After the intervention period using traditional methods, the factor structure became more concise, converging primarily around speaking willingness, motivation, learning outcomes, and engagement. This shift indicates that while traditional classroom instruction can strengthen motivation and outcome awareness, it does not significantly influence affective dimensions such as anxiety reduction or technological adaptability unlike in the experimental group that used AI-supported learning. The persistence of “Confidence and Anxiety” as a stable factor before and after instruction suggests that learners in conventional classrooms may still face emotional barriers when engaging in speaking activities, aligning with findings from prior research emphasizing the importance of interactive technology in lowering anxiety and enhancing learner participation (Zhou & He, 2025; Oktari, 2024).

### Discussion

The findings of this study demonstrate that the use of voice-based conversational AI tools significantly improved the English-speaking proficiency of students at SMPN 4 Banjarmasin. The results from the Wilcoxon Signed-Rank Test revealed statistically significant differences between the pre-test and post-test scores in the experimental group across all five speaking aspects pronunciation, fluency, vocabulary, grammar, and coherence while no significant improvement was observed in the control group. This indicates that consistent exposure to real-time AI feedback and interactive conversation practice contributed to enhanced speaking performance. These findings align with previous studies by Na et al. (2024), who found that conversational AI technologies supported fluency development by offering continuous and adaptive feedback that mirrors authentic communicative situations. In the current study, the improvement in coherence and grammar suggests that AI-assisted speaking sessions helped students organize their ideas more logically and reduce linguistic errors, confirming that intelligent feedback mechanisms can positively

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shape learners' oral accuracy and complexity (Zou, Guan, et al., 2023).

The factor analysis further supports the effectiveness of AI integration in language learning by revealing structural changes in learners' attitudes and perceptions before and after the intervention. In the experimental group, the number of extracted factors remained constant, but the total variance explained increased from 68.46% to 72.83%, indicating a more coherent and stable learning construct after students engaged with the AI tool. New post-intervention factors such as "Confidence and Anxiety Reduction" and "Learning Outcomes and Self-Reflection" emerged, highlighting emotional and metacognitive growth among students. This aligns with findings by Koraisi (2023), who noted that AI-based interaction enhances students' motivation, reduces speaking anxiety, and increases learner autonomy through self-assessment features. The ability of AI to simulate authentic conversations allowed students to practice English without fear of judgment, creating a psychologically safe environment that encouraged risk-taking and self-improvement an important aspect of communicative language teaching (CLT).

In contrast, the control group that relied on traditional instruction showed a decrease in the number of extracted factors (from seven to five) and a slight reduction in cumulative explained variance from 74.06% to 68.37%. Although factors related to motivation and learning outcomes remained, the absence of variables such as "Technology Acceptance" and "Anxiety Reduction" suggests that traditional methods did not significantly alter students' affective responses or engagement in speaking tasks. This result reinforces Larsari et al. (2024) observation that static learning environments tend to maintain stable but limited learner attitudes, lacking the dynamic feedback mechanisms necessary to stimulate deep learning and confidence

building. Therefore, the introduction of AI-mediated conversational tools represents not only a technological enhancement but also a pedagogical innovation that transforms students' emotional engagement and self-regulated learning behaviors.

Moreover, the consistent increase in explained variance and the appearance of new motivational constructs in the experimental group underscore the multidimensional benefits of integrating AI into EFL speaking instruction. The voice-based AI tool provided personalized, adaptive interaction that supported learners' diverse needs helping them refine pronunciation, expand vocabulary, and practice fluency with real-time correction. This aligns with Royani and Sihombing (2024), who reported that conversational AI enhances learner engagement and interactional competence through individualized dialogue simulations. The current study extends these findings to the junior high school context, showing that even younger learners can benefit from AI-assisted speaking practice when guided appropriately.

In a broader pedagogical perspective, these findings highlight that AI tools should not replace human teachers but rather complement them by offering additional platforms for practice and assessment. Teachers at SMPN 4 Banjarmasin noted that students became more motivated to speak English both inside and outside the classroom after using the AI application, suggesting that the tool served as an extension of classroom learning. This supports Tanduklangi et al. (2019), who emphasized that AI integration in language education promotes learner-centered pedagogy and continuous engagement beyond school hours. Thus, the voice-based conversational AI system can be viewed as a strategic medium to foster communicative competence, learner confidence, and long-term motivation

among EFL learners, making it a valuable supplement to formal English instruction in Indonesian secondary education.

#### 4. CONCLUSION

This study concludes that the use of voice-based conversational AI tools effectively enhanced students' English-speaking skills at SMPN 4 Banjarmasin. The results indicated improvements in pronunciation, fluency, vocabulary, grammar, and coherence, as well as increased motivation, confidence, and acceptance of technology in learning. These outcomes demonstrate that AI-assisted speaking practice can support students in developing better communication abilities and greater self-assurance when using English. In addition, the integration of AI technology proved to be a useful complement to classroom instruction by allowing students to engage in interactive and personalized learning experiences. However, this research was limited to a single school and a short study period. For future studies, it is recommended to include a larger number of participants from different educational contexts and to extend the duration of AI-assisted learning to assess long-term effects. Researchers are also encouraged to compare various types of AI tools and explore how they can be tailored to different learning styles. Overall, conversational AI shows strong potential to promote effective, engaging, and learner-centered English speaking instruction.

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