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CHATGPT-ASSISTED SPEAKING ACTIVITIES TO IMPROVE MATHEMATICS EDUCATION STUDENTS' SPEAKING SKILLS: A CLASSROOM ACTION RESEARCH

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Abstract: The rapid advancement of artificial intelligence (AI) has created new opportunities to enhance English language learning, particularly in developing students' speaking skills through interactive and technology-assisted environments. This classroom action research aimed to: (1) investigate the effect of ChatGPT-assisted speaking activities on the speaking performance of Mathematics Education students, and (2) explore students' perceptions of using ChatGPT in speaking practice. The study employed the Kemmis and McTaggart model of Classroom Action Research, conducted in two cycles with 35 second-semester students of Class A1 in the Mathematics Education Study Program during the 2025 academic year. Data were collected through speaking tests, classroom observations, questionnaires, and field notes. Findings revealed a continuous improvement in speaking performance from the preliminary study (M=58.40) to Cycle I (M=69.15) and Cycle II (M=81.37), with notable gains in pronunciation, grammar, vocabulary, fluency, and comprehension. Observation results showed increased classroom participation (from 65% to 88%) and confidence (from 60% to 85%). Questionnaire responses demonstrated positive perceptions of ChatGPT across ease of use (M=4.42), usefulness (M=4.58), motivation (M=4.47), and confidence (M=4.53). The study concludes that ChatGPT-assisted speaking activities effectively enhance students' speaking competence and create a supportive learning environment. Integrating generative AI into EFL speaking instruction offers a promising pedagogical approach, particularly for non-English-major students.

Keywords: *ChatGPT; Artificial Intelligence; Classroom Action Research; speaking skills; EFL learners; mathematics education students.*

INTRODUCTION

In the era of globalization and digital transformation, English speaking competence has become an essential skill for academic, professional, and international communication. The ability to communicate effectively in English enables university students to participate in global academic communities, access international knowledge and resources, and engage in cross-cultural interactions. Consequently, higher education institutions are increasingly expected to equip students with effective English communication skills that respond to the demands of twenty-first-century academic and professional environment (Chang & Heng, 2021; Qamariah, 2025; Yang & Chano, 2025).

Although English is often associated with language-related disciplines, students from non-English majors, including Mathematics Education programs, also require English communication skills for academic and professional purposes. Mathematics Education students may encounter international journals, conferences, collaborative projects, and educational resources that require the use of English. Their future professional and academic activities may also require them to explain mathematical concepts, present research findings, participate in academic discussions, and

communicate with broader educational communities in English. Therefore, developing speaking competence is relevant not only to English-major students but also to future mathematics educators who may need to communicate discipline-specific knowledge in English (Panjaitan, 2025).

Among the four language skills, speaking is widely recognized as a demanding skill for English as a Foreign Language (EFL) learners because it requires learners to formulate and communicate meaning in real time. Students may experience difficulties in expressing ideas orally because of limited vocabulary, insufficient grammatical knowledge, pronunciation problems, and limited confidence (Isaacs & Harding, 2017; Kruk, 2022; Levis, 2023; Nation, 2001; Navidinia, 2019). In classroom settings, fear of making mistakes and perceived speaking apprehension may further discourage learners from participating actively in oral communication. EFL learners may also have limited opportunities to use English spontaneously beyond the classroom, which can constrain the development of fluency and confidence in spoken communication (Bárkányi, 2025; Huang & Kakham, 2026; Kirkpatrick et al., 2025; Styrkina, 2026). These challenges suggest the need for instructional environments that provide learners with repeated opportunities to produce spoken English, receive feedback, and gradually develop confidence in communicating.

In response to these challenges, technology-enhanced language learning has increasingly explored the use of artificial intelligence (AI) to expand opportunities for language practice. Recent advances in generative AI have enabled conversational systems to produce contextually relevant responses and interact with learners in ways that can support individualized and interactive language practice (Wang & Yan, 2022). In language education, AI-supported environments may provide opportunities for learners to practice language beyond limited classroom interaction, obtain feedback, and engage in repeated communicative activities. These affordances are particularly relevant to speaking instruction, where sustained opportunities for language production and interaction are essential for developing communicative competence (Cotton et al., 2024; Kohnke & Zou, 2025)(Cotton et al., 2024; Crompton et al., 2024; Dwivedi et al., 2023; Luke & Kohnke, 2024). Among these technologies, ChatGPT has emerged as one of the most popular generative AI applications capable of simulating human-like conversations and supporting language learning activities (Bin-hady et al., 2023; Hayashi & Sato, 2023; Horn, 2024; Niyozov et al., 2023; Solak & Revolutionizing, 2024; Songsiengchai, 2025).

Among generative AI applications, ChatGPT has attracted substantial attention in language education because of its conversational and interactive affordances. ChatGPT can generate contextually relevant responses, provide explanations, respond to learner prompts, and support simulated dialogues and role-play activities. In language learning, these functions can be used to create additional opportunities for vocabulary development, grammatical practice, conversational interaction, and speaking preparation. For learners who have limited opportunities to communicate in English outside the classroom, ChatGPT may function as an accessible conversational partner that supports repeated practice and learner-directed interaction (Aljohani, 2026; Kohnke & Zou, 2025; Tlili et al., 2026).

Recent empirical studies also have further consolidated the potential of AI-assisted tools in language education. In a comprehensive systematic review, confirmed that ChatGPT offers significant affordances for language learning, including personalized feedback, interactive conversation practice, and learner autonomy, while also acknowledging challenges such as accuracy and ethical considerations (Aljohani, 2026; Lo, 2023). Similarly, Huang (2025) found that AI-assisted learning environments significantly enhanced student engagement and speaking performance among Chinese middle school students, with learners demonstrating greater willingness to communicate through repeated AI-mediated interactions. Kim (2025) reported that AI-supported language learning activities contributed to the development of both listening and speaking skills, particularly by reducing communication apprehension and fostering self-regulated learning. In the Indonesian context, Santoso et al. (2025) investigated the impact of Talkpal.AI on vocational high school students' speaking skills and found that AI-powered conversational practice led to measurable improvements in fluency and confidence. Furthermore, Sakina et al. (2026) examined project-based learning approaches for English speaking within the Merdeka Curriculum, highlighting the growing emphasis on innovative, technology-integrated pedagogical strategies in Indonesian EFL classrooms. These recent findings

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collectively underscore the relevance of AI-assisted speaking instruction and provide a strong empirical foundation for the present study.

Despite the growing body of research on AI-assisted language learning, most existing studies have focused on English-major students or general EFL learners. Limited attention has been given to the implementation of ChatGPT-assisted speaking activities among students from Mathematics Education programs, whose language learning needs differ from those of language majors (Azadnia, 2024; Dilzhan, 2024). Moreover, there remains a lack of empirical evidence regarding how AI-supported speaking practices influence the speaking performance of Mathematics Education students in the Indonesian EFL context (Rossydi et al., 2026).

Considering the importance of English-speaking competence, the challenges faced by EFL learners, and the increasing integration of AI technologies in education, further investigation is needed to examine the effectiveness of ChatGPT-assisted speaking activities for Mathematics Education students. Therefore, this study aims to investigate the impact of ChatGPT-assisted speaking activities on students' speaking performance and explore their perceptions of using ChatGPT as a learning partner in speaking classes.

Recent research has provided increasing evidence that AI-mediated interaction can support second and foreign language learning, particularly by expanding opportunities for communicative practice and learner interaction. Studies of AI-supported speaking have reported improvements in speaking performance, willingness to communicate, and learners' affective experiences. For example, Fathi et al. (2024) found that AI-mediated interaction supported the development of EFL learners' speaking skills and willingness to communicate, while Zhang et al. (2024) reported that an AI-speaking assistant was associated with increased enjoyment and willingness to communicate and reduced speaking anxiety. Other research has shown that conversational generative AI can influence willingness to communicate, speaking anxiety, and self-perceived communicative competence, although the outcomes may vary according to the type and modality of the AI system used (Wang et al., 2024). More recent studies have similarly highlighted the potential of AI-powered conversation tools to support L2 speaking development and reduce barriers to oral communication (Ding & Yusof, 2025). Collectively, these studies suggest that the value of AI for speaking instruction lies not merely in providing automated responses but in expanding opportunities for interaction, repeated language production, feedback, and learner engagement.

Despite these advances, an important issue remains unresolved concerning how conversational generative AI can be systematically integrated into classroom-based speaking instruction for students in discipline-specific, non-English-major programs. Existing studies have predominantly examined AI-supported speaking through experimental or quasi-experimental designs, surveys, or general EFL contexts, providing valuable evidence about learning outcomes and learner perceptions. However, less attention has been given to the iterative pedagogical process through which AI-supported speaking activities are implemented, observed, reflected upon, and refined across classroom-action-research cycles. This issue is particularly relevant for Mathematics Education students, whose English learning needs include communicating discipline-specific ideas rather than developing general English proficiency alone. In the Indonesian higher education context, further empirical evidence is therefore needed on how ChatGPT-supported speaking activities can be systematically implemented and progressively refined to support the speaking development of non-English-major students.

Based on the research gap and the proposed contribution, this study addresses the following research questions: (1) How does students' speaking performance develop across the implementation of ChatGPT-assisted speaking activities in a Mathematics Education classroom? (2) How do Mathematics Education students perceive the use of ChatGPT-assisted speaking activities in terms of ease of use, usefulness, motivation, and confidence?

The novelty of the present study lies not simply in applying ChatGPT to EFL speaking instruction or in focusing on Mathematics Education students, but in the combination of population, pedagogical design, and research methodology. The study implements ChatGPT-assisted speaking activities as an iterative classroom intervention tailored to the communicative needs of Mathematics Education students. Using a Classroom Action Research framework, the study documents how speaking activities are implemented, observed, and refined across successive cycles. In addition, the study combines performance-based speaking assessment with classroom observations, learner

perceptions, and reflective field evidence. This design provides a process-oriented account of how ChatGPT can be integrated into discipline-specific speaking instruction for non-English-major students in an Indonesian higher education context.

The study is expected to contribute to the growing literature on generative AI in English language education by providing classroom-based evidence from a non-English-major higher education context. Practically, the findings may inform English lecturers about ways of designing and refining ChatGPT-assisted speaking activities for students with discipline-specific academic needs. Pedagogically, the study may also illustrate how generative AI can be incorporated as a supplementary conversational resource to provide additional opportunities for speaking practice, interaction, and learner reflection. Rather than positioning ChatGPT as a replacement for teacher-led instruction, the study conceptualizes it as a pedagogical resource that can complement classroom interaction and support repeated opportunities for language production.

METHOD

This study employed Classroom Action Research (CAR) to improve Mathematics Education students' speaking skills through ChatGPT-assisted speaking activities. Classroom Action Research is a reflective process conducted by teachers or lecturers to improve teaching practices and enhance students' learning outcomes within their own classrooms. According to (Kemmis et al., 2014), action research is a cyclical process involving planning, action/implementing, observation, and reflection to bring about improvements in educational practice. The research was conducted in two cycles, with each cycle consisting of four meetings. The second cycle was designed based on the reflection and evaluation of the first cycle in order to achieve better learning outcomes. The research procedure can be illustrated as follows:

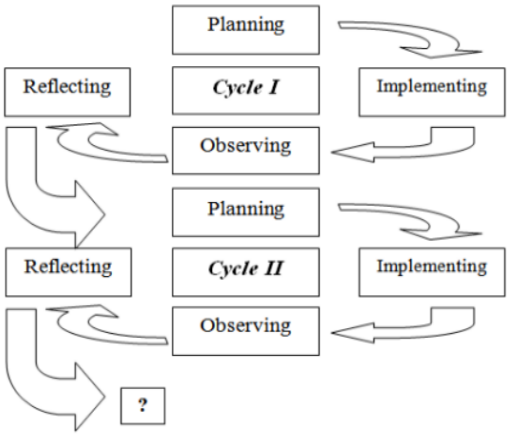


Figure 1. *The procedure of classroom action research (Kemmis et al, 2014)*

Cycle I. Planning. During the planning stage, the researcher identified students' speaking difficulties through preliminary classroom observations. Based on the identified problems, lesson plans, speaking materials, assessment rubrics, observation sheets, and ChatGPT-assisted speaking activities were prepared. The researcher also designed learning tasks that focused on daily conversations and basic communicative interactions to encourage students to practice speaking in English.

Implementing. In the implementing stage, the planned instructional activities were carried out in the classroom. Students were introduced to ChatGPT and guided on how to use it as a conversational partner for speaking practice. They participated in various speaking activities, including self-introduction, daily conversation, and simple question-and-answer sessions. ChatGPT was utilized to provide opportunities for interactive communication and speaking practice.

Observing. During the observation stage, the researcher monitored students' participation, engagement, confidence, and speaking performance throughout the learning activities. Observation sheets and field notes were used to document students' responses, classroom interactions, and difficulties encountered during the implementation process. Students' speaking performances were also assessed using the speaking rubric.

Reflecting. After completing Cycle I, the researcher analysed the observation results, speaking scores, and classroom notes to evaluate the effectiveness of the implemented activities. The reflection revealed that although students showed increased participation and confidence, some still experienced difficulties in vocabulary

use, fluency, and expressing ideas spontaneously. Therefore, modifications and improvements were planned for Cycle II.

Cycle II. 1. Planning. Based on the reflection results from Cycle I, the researcher revised the lesson plans and learning activities. More challenging speaking tasks were designed to provide greater opportunities for students to practice speaking. Additional support was also provided to help students expand their vocabulary and improve fluency when discussing academic topics related to mathematics.

Implementing. The revised learning activities were implemented in Cycle II. Students engaged in more advanced speaking practices, including mathematical topic discussions, problem-solving explanations, presentation practice, and interactive speaking activities using ChatGPT. The activities encouraged students to explain mathematical concepts and communicate their ideas more confidently in English.

Observing. The researcher continued observing students' participation, confidence, interaction, and speaking performance during the implementation of Cycle II. Data were collected through observation sheets, field notes, and speaking assessments to identify improvements compared to Cycle I.

Reflecting. At the end of Cycle II, the researcher evaluated all collected data to determine the effectiveness of the intervention. The reflection indicated that students demonstrated significant improvement in speaking performance, particularly in fluency, vocabulary use, confidence, and classroom participation. Since the predetermined success criteria had been achieved, the action research was concluded after Cycle II.

The study was conducted in the Speaking course of the Mathematics Education Study Program during the 2025 academic year. The participants were 35 second-semester students enrolled in Class A1. The participants were selected because they were experiencing difficulties in English speaking performance, particularly in pronunciation, fluency, vocabulary use, and self-confidence. Preliminary classroom observations indicated that many students were reluctant to speak English due to anxiety, limited vocabulary, and fear of making mistakes. Therefore, the implementation of ChatGPT-assisted speaking activities was expected to provide more opportunities for speaking practice in a supportive learning environment.

This study employed several instruments to collect both quantitative and qualitative data, including speaking tests, observation sheets, questionnaires, and field notes. These instruments were used to evaluate the effectiveness of ChatGPT-assisted speaking activities and to explore students' perceptions of the learning process. According to (Brown, 2004), the use of multiple instruments enables researchers to obtain comprehensive and reliable data regarding students' language performance and classroom experiences. Therefore, the combination of tests and non-test instruments in this study was intended to provide a holistic understanding of students' speaking development throughout the implementation of the action research.

The speaking test was administered individually to each student. In the preliminary study, at the end of Cycle I, and at the end of Cycle II, students were asked to deliver a two-to-three-minute monologue on a given topic. For the preliminary study and Cycle I, topics focused on daily conversations and self-introduction (e.g., "Describe your daily routine," "Introduce yourself and your hobby"). For Cycle II, topics were related to mathematics education (e.g., "Explain how to solve a quadratic equation," "Describe the importance of mathematics in daily life"). Students were given five minutes of preparation time before their speaking performance. Each student's performance was audio-recorded and assessed by two trained raters using an analytic scoring rubric.

The primary instrument was a speaking test administered at the preliminary stage, at the end of Cycle I, and at the end of Cycle II. Students' speaking performance was assessed using an analytic scoring rubric consisting of five components: pronunciation, grammar, vocabulary, fluency, and comprehension. In addition, observation sheets were used to monitor students' participation, confidence, interaction, and engagement during classroom activities. A questionnaire employing a five-point Likert scale was distributed at the end of the study to investigate students' perceptions of ChatGPT-assisted speaking practice in terms of ease of use, usefulness, motivation, and confidence. Furthermore, field notes were utilized to document important classroom events, students' responses, and reflections throughout the implementation process. The use of these instruments allowed the researcher to triangulate the data and enhance the credibility of the research findings (Burns, 2019).

Students' speaking performance was assessed

using an analytic scoring rubric adapted from Brown (2004) and Hughes (2003). The rubric consisted of five components: pronunciation, grammar, vocabulary, fluency, and comprehension. Each component was scored on a scale of 1 to 5, with the following descriptors:

Table 1. *Scoring rubrics of speaking*

Component	Score 5 (Excellent)	Score 3 (Adequate)	Score 1 (Poor)
Pronunciation	Native-like, clear, and accurate pronunciation with appropriate stress and intonation	Some errors in pronunciation but generally understandable	Frequent errors that hinder comprehension
Grammar	Accurate use of complex grammatical structures with minimal errors	Some grammatical errors but meaning is clear	Frequent grammatical errors that impede communication
Vocabulary	Wide range of vocabulary used appropriately and precisely	Adequate vocabulary for basic communication	Limited vocabulary that restricts expression
Fluency	Smooth, natural speech with no hesitation	Some hesitation and pauses but maintains communication	Frequent pauses and broken speech
Comprehension	Full understanding of questions and ability to respond appropriately	Adequate comprehension with occasional clarification needed	Difficulty understanding and responding to questions

The total speaking score was calculated by summing the scores of the five components, resulting in a maximum score of 25, which was then converted to a 100-point scale. To ensure inter-rater reliability, two trained raters independently assessed all speaking performances, and the final score was the average of the two raters' scores. Inter-rater reliability was calculated using Pearson's correlation coefficient, yielding a correlation of $r = 0.85$, indicating a high level of agreement between raters.

The implementation of ChatGPT-assisted speaking activities followed a structured procedure. Students were introduced to ChatGPT (OpenAI, GPT-4 model) during the first meeting of Cycle I. Each student was provided with a personal account and guided on how to use the platform for speaking practice. The activities were designed as follows:

Conversation Simulation: Students engaged in five-to-ten-minute conversations with ChatGPT on given topics. Students were instructed to speak aloud while typing their responses to ChatGPT, simulating a real-time conversation. This allowed students to practice pronunciation and fluency while receiving immediate written responses from ChatGPT.

Role-Play Activities: Students participated in role-play scenarios where ChatGPT acted as a conversation partner (e.g., interviewer, customer, tourist). Students were given specific roles and asked to respond to ChatGPT's prompts.

Instant Feedback: After each conversation, ChatGPT provided corrective feedback on grammar, vocabulary, and sentence structure. Students were encouraged to note the feedback and apply it in subsequent conversations.

The ChatGPT activities were conducted both inside the classroom (during the first 30 minutes of each 90-minute session) and outside the classroom (as homework assignments). Students were required to complete at least two ChatGPT conversations per week. The duration of each conversation ranged from 10 to 15 minutes. A conversation log was maintained by each student to document their ChatGPT interactions.

Data collected from this study were analyzed using both quantitative and qualitative approaches.

The speaking test scores were analysed using descriptive statistics, including mean scores and standard deviations, to determine the improvement in students' speaking performance across the three stages (preliminary study, Cycle I, and Cycle II). To assess the statistical significance of the improvement, paired-sample t-tests were conducted to compare the mean scores between stages (preliminary vs. Cycle I, Cycle I vs. Cycle II, and preliminary vs. Cycle II). The t-tests were performed using SPSS version 26.0, with a significance level set at $p < 0.05$. Effect sizes (Cohen's d) were also calculated to determine the magnitude of the improvement.

Questionnaire data were analysed by calculating the mean and standard deviation for each dimension (ease of use, usefulness,

motivation, and confidence). A mean score of 3.00 and above was interpreted as a positive perception, while scores below 3.00 were considered negative perceptions.

Observation data and field notes were analysed using thematic analysis following the procedures outlined by Braun and Clarke (2006). The analysis involved six phases: (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. The themes identified from the field notes included increased confidence, reduced speaking anxiety, improved vocabulary development, and enhanced speaking practice opportunities.

RESULTS AND DISCUSSION

Improvement of students' speaking performance

The effectiveness of ChatGPT-assisted speaking activities was primarily measured through speaking tests administered during the preliminary stage, Cycle I, and Cycle II. Students' speaking performance was evaluated based on five speaking components: pronunciation, grammar, vocabulary, fluency, and comprehension.

Table 3. *Students' speaking scores across cycles*

Stage	Mean Score	SD
Preliminary Study	58.40	8.72
Cycle I	69.15	7.54
Cycle II	81.37	6.83

The findings indicate a continuous improvement in students' speaking performance across the research cycles. The mean score increased from 58.40 in the preliminary study to 69.15 in Cycle I, representing an improvement of 10.75 points. Furthermore, the mean score increased to 81.37 in Cycle II, indicating that the students achieved the predetermined success criteria.

To provide a clearer visual representation of the improvement, the mean speaking scores across the three stages are presented in Figure 4, while the improvement across the five speaking components is illustrated in Figure 5.

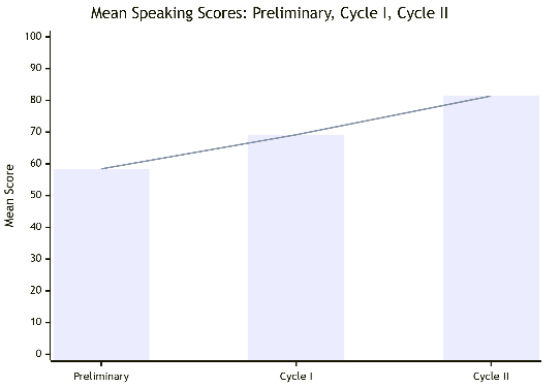


Figure 2. *Improvement of students' mean speaking scores across stages*

To determine whether the observed improvements were statistically significant, paired-sample t-tests were conducted. The results revealed a significant improvement from the preliminary study to Cycle I ($t(34) = 6.85$, $p < 0.001$, Cohen's $d = 1.16$), from Cycle I to Cycle II ($t(34) = 7.42$, $p < 0.001$, Cohen's $d = 1.25$), and from the preliminary study to Cycle II ($t(34) = 12.34$, $p < 0.001$, Cohen's $d = 2.08$). These findings confirm that the improvements in students' speaking scores were statistically significant and had large effect sizes (Cohen's $d > 0.80$).

The improvement was evident across all speaking components. Students demonstrated better pronunciation, more accurate grammatical structures, richer vocabulary use, greater fluency, and improved comprehension when expressing their ideas in English. The findings suggest that regular interaction with ChatGPT provided students with additional opportunities to practice speaking and develop confidence in oral communication.

The percentages presented in Table 4 represent the proportion of students who demonstrated each indicator during the observation period. The indicators were rated by the observer using a checklist, where a student was considered to have demonstrated the behaviour if it was observed in at least three out of four meetings in each cycle.

Observation data were collected throughout the implementation of the action research to examine students' participation and engagement during speaking activities.

Table 4. *Students' classroom participation*

Indicator	Cycle I	Cycle II
Active Participation	65%	88%
Speaking Confidence	60%	85%
Classroom Interaction	68%	90%
Learning Engagement	70%	92%

Percentages represent the proportion of students who demonstrated the observed behaviour during each cycle (n = 35).

The observation data presented in Table 4 indicate a consistent increase in students' classroom participation across the two cycles. To provide a clearer visual comparison, the observation results are illustrated in Figure 6. The figure compares the proportion of students who demonstrated each indicator in Cycle I and Cycle II, highlighting the magnitude of improvement in active participation, speaking confidence, classroom interaction, and learning engagement.

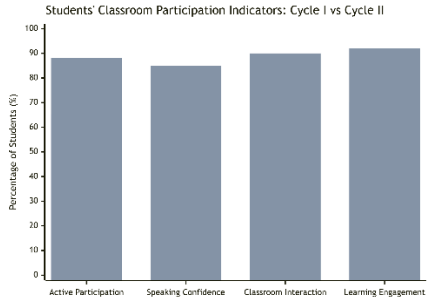


Figure 3. *Students' classroom participation indicators in cycle I and cycle II*

As shown in Figure 3, all four indicators increased from Cycle I to Cycle II. Active participation rose from 65% to 88%, speaking confidence from 60% to 85%, classroom interaction from 68% to 90%, and learning engagement from 70% to 92%. The most substantial improvement was observed in classroom interaction (+22%), suggesting that ChatGPT-assisted activities encouraged students to communicate more actively with peers and the lecturer. These findings indicate that the intervention not only improved individual speaking performance but also fostered a more interactive and engaged classroom environment.

Table 5. *Students' perceptions of ChatGPT-assisted speaking activities*

Dimension	Mean Score	SD
Ease of Use	4.42	0.58
Usefulness	4.58	0.52
Motivation	4.47	0.61
Confidence	4.53	0.55

Scores are based on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), n = 35.

The questionnaire results presented in Table 5 show that students held positive perceptions of ChatGPT-assisted speaking activities across all four dimensions. To illustrate the relative strength of each dimension, the mean scores are visualized in Figure 7. The figure also includes a reference line at 3.00, which represents the threshold for positive perception.

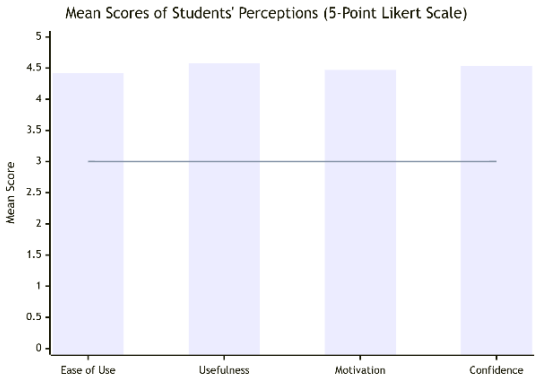


Figure 4. *Students' perceptions of ChatGPT-assisted speaking activities*

Figure 4 shows that all four dimensions exceeded the positive perception threshold of 3.00. Usefulness obtained the highest mean score (M = 4.58), followed by confidence (M = 4.53), motivation (M = 4.47), and ease of use (M = 4.42). The relatively narrow range of scores (4.42–4.58) suggests that students perceived ChatGPT as consistently beneficial across all measured aspects. The high score in usefulness indicates that students valued ChatGPT primarily as a practical tool for improving their speaking skills, while the high score in confidence suggests that the tool also contributed to reducing speaking anxiety and building self-assurance.

Field notes results

Field notes were analysed to identify recurring themes related to students' experiences during the implementation of the intervention. The analysis revealed four major themes: (1) Increased Confidence: Students gradually became more confident in expressing their ideas in English. By Cycle II, many students were willing to speak voluntarily and participate actively in classroom discussions. (2) Reduced Speaking Anxiety: The use of ChatGPT helped reduce students' anxiety because they could practice speaking in a supportive environment. Students reported feeling less afraid of making mistakes when interacting with ChatGPT. (3) Improved Vocabulary Development: Students frequently encountered new vocabulary during conversations with ChatGPT. As a result, they expanded their vocabulary repertoire and became more capable of expressing mathematical concepts in English. (4) Enhanced Speaking Practice Opportunities: Students indicated that ChatGPT provided

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unlimited opportunities for speaking practice both inside and outside the classroom. This additional exposure contributed to the improvement of their speaking fluency and communication skills.

The findings of this study suggest that the implementation of ChatGPT-assisted speaking activities contributed to the improvement in speaking performance among Mathematics Education students.

The improvement was evident from the increase in students' mean speaking scores from the preliminary study to Cycle II. This finding suggests that integrating generative artificial intelligence into speaking instruction can provide learners with meaningful opportunities to practice English in a more interactive and supportive environment. The continuous interaction with ChatGPT enabled students to engage in communicative activities beyond the limitations of traditional classroom practice, thereby facilitating greater language exposure and oral production.

This finding is consistent with Aljohani (2026), who concluded in a systematic review that ChatGPT offers significant affordances for language learning, including personalized feedback and interactive conversation practice. Similarly, Huang (2025) found that AI-assisted learning environments enhanced student engagement and speaking performance among Chinese middle school students. The present study extends these findings to the Indonesian higher education context, demonstrating that similar benefits can be achieved with university-level Mathematics Education students.

One notable finding of the present study is the improvement in students' speaking fluency. During the preliminary stage, many students frequently paused, hesitated, and struggled to maintain conversations in English. However, after participating in ChatGPT-assisted speaking activities, students became more capable of expressing ideas continuously and responding spontaneously during discussions. This finding is consistent with the study conducted by (Santoso et al., 2025), who investigated the impact of Talkpal.AI on vocational high school students' speaking skills and found that AI-powered conversational practice led to measurable improvements in fluency and confidence. Similarly, (Brime, 2025) reported that AI-powered tools enhanced EFL learners' speaking skills, particularly in terms of fluency and willingness to communicate.

The findings also revealed substantial improvement in students' vocabulary use. Through regular interactions with ChatGPT, students were exposed to new words, expressions, and sentence patterns related to both daily communication and mathematical topics. As a result, they became more confident in expressing their ideas using a wider range of vocabulary. This result supports the findings of (Kusmayanti, 2025), who found that SPEAK UP® helped Indonesian EFL learners develop their vocabulary and improve their speaking skills. Similarly, (Askhatova, 2020) emphasized the importance of vocabulary and spoken grammar in teaching spontaneous speaking skills, which aligns with the present study's finding that expanded vocabulary contributed to students' ability to express mathematical concepts in English.

Another significant outcome of this study was the enhancement of students' speaking confidence. Observation data and questionnaire responses indicated that students gradually became more willing to communicate in English throughout the intervention. Many students initially expressed anxiety about making grammatical and pronunciation mistakes; however, the non-judgmental nature of ChatGPT allowed them to practice speaking without fear of negative evaluation. This finding aligns with the study of (Kim, 2025), which found that AI-supported speaking and listening activities reduced communication apprehension and increased learners' willingness to communicate. Kim argued that virtual conversational partners create psychologically safe learning environments where learners feel more comfortable experimenting with language.

The reduction of speaking anxiety observed in this study also supports previous findings in the literature. Students reported feeling less nervous when interacting with ChatGPT compared to speaking directly with peers or lecturers.

This result is comparable to the findings reported by (Kitjaroonchai & Naltan, 2025), who discovered that AI-based language learning tools contributed to lower levels of foreign language anxiety among university students. Their study emphasized that learners perceived AI as a supportive learning companion rather than an evaluator, allowing them to focus more on communication than on avoiding mistakes. It has similarly found that AI conversational bots reduced speaking anxiety among Pakistani ESL undergraduates, suggesting that the anxiety-reducing affordances of AI are consistent across

different cultural and educational contexts (Raza et al., 2026).

The improvement in classroom participation found in this study further highlights the pedagogical value of ChatGPT-assisted learning. During Cycle II, students demonstrated greater engagement in discussions, presentations, and problem-solving activities conducted in English. This finding is supported by the research of (Huang, 2025), who found that AI-assisted learning environments increased students' active participation and engagement through personalized interaction and immediate support. Wang et al. (2024) also noted that conversational generative AI can positively influence willingness to communicate, speaking anxiety, and self-perceived communicative competence.

The present study also contributes to the growing literature on English language learning among non-English-major students. Most previous studies have focused on English majors or general EFL learners, whereas this study specifically investigated Mathematics Education students. Similar findings were reported by (Abdul & Busayo, 2025), who explored the use of MathGPTPro in enhancing secondary school students' cognitive proficiency in mathematics, highlighting the potential of AI tools to support discipline-specific learning. (Azadnia, 2024) also noted that ChatGPT-assisted language learning has been increasingly applied in L2 pedagogy, though research on non-English-major students remains limited.

Furthermore, the positive perceptions expressed by students in the questionnaire indicate that ChatGPT was viewed as an accessible and useful learning tool. Students appreciated its ease of use, immediate responses, and ability to provide unlimited speaking practice opportunities. These findings corroborate the study conducted by (Yan & Jieqiong, 2024), which reported that students generally perceive ChatGPT feedback as valuable for their learning. (Lo, 2023) similarly highlighted both the opportunities and challenges of ChatGPT in education, noting that while the tool can enhance engagement and provide personalized learning experiences, careful implementation and guidance are essential.

While this study provides valuable insights into the effectiveness of ChatGPT-assisted speaking activities, several limitations should be acknowledged. First, the study employed a Classroom Action Research design without a control group, which limits the ability to attribute the observed improvements solely to the ChatGPT intervention. Other factors, such as increased practice time, the novelty effect of using new technology, and enhanced student motivation, may have contributed to the improvements. Second, the sample size was relatively small (n = 35) and limited to one class of Mathematics Education students in a single institution, which restricts the generalizability of the findings to other contexts or populations. Third, the study was conducted over a relatively short period (two cycles with four meetings each), preventing the examination of long-term retention of speaking skills. Fourth, the assessment of speaking performance relied on test scores and observation data, which may not fully capture the complexity of speaking competence. Future research with larger samples, control groups, longer intervention periods, and more comprehensive assessment methods is needed to further validate the effectiveness of ChatGPT-assisted speaking activities.

The findings of this study align with and extend previous research on AI-assisted language learning. Aljohani (2026), in a systematic review, concluded that ChatGPT offers significant affordances for language learning, including personalized feedback and interactive conversation practice. The present study provides empirical support for these affordances in the context of speaking instruction for non-English-major students. Similarly, Huang (2025) found that AI-assisted learning environments enhanced student engagement and speaking performance among Chinese middle school students. The present study extends these findings to the Indonesian higher education context, demonstrating that similar benefits can be achieved with university-level Mathematics Education students. Kim (2025) reported that AI-supported speaking activities reduced communication apprehension and fostered self-regulated learning. This study corroborates these findings, as students reported increased confidence and willingness to communicate after participating in ChatGPT-assisted activities.

However, unlike previous studies that focused primarily on English-major students (Kitjaroonchai & Naltan, 2025) or general EFL learners (Brime, 2025), the present study specifically targeted Mathematics Education students, who have distinct academic needs and linguistic backgrounds. This focus represents a unique contribution to the literature, as it demonstrates that AI-assisted speaking activities can be effectively adapted to support discipline-

specific communication in English, an area that has received limited attention in previous research.

The findings of this study can be understood through the lens of theories of second language acquisition and AI-assisted learning. The improvement in fluency observed in this study aligns with the principles of language production emphasized by (Brown, 2004) , who posited that meaningful output practice plays a crucial role in language development. The reduction in speaking anxiety observed in this study is consistent with (Macintyre & Macgillivary, 2023) theory of language anxiety, which emphasizes the role of supportive learning environments in reducing affective barriers to communication. Furthermore, Kohnke et al. (2023) emphasized the importance of personalized, interactive learning experiences in AI-enhanced language teaching.

ChatGPT's non-judgmental nature provided a psychologically safe environment for speaking practice, allowing students to experiment with language without fear of negative evaluation. Furthermore, Kohnke and Zou's (2025) framework for AI-enhanced language teaching emphasizes the importance of personalized, interactive learning experiences. ChatGPT's ability to provide instant feedback and adapt to individual learners' needs aligns with this framework, suggesting that generative AI tools can effectively support the principles of learner-centered pedagogy.

Hence, the findings suggest that ChatGPT-assisted speaking activities constitute an effective instructional strategy for improving speaking performance among Mathematics Education students. The integration of artificial intelligence into speaking instruction not only enhanced students' linguistic competence but also increased their confidence, motivation, participation, and willingness to communicate. These findings provide further evidence that AI technologies can serve as valuable pedagogical tools in EFL classrooms, particularly for non-English-major students who require additional opportunities to practice English communication in meaningful and supportive learning environments.

CONCLUSION

This Classroom Action Research aimed to improve the speaking skills of Mathematics Education students through ChatGPT-assisted speaking activities. The findings indicate that the implementation of these activities successfully enhanced students' speaking performance across two cycles, with significant improvements observed in pronunciation, grammar, vocabulary, fluency, and comprehension. The mean speaking score increased from 58.40 in the preliminary study to 69.15 in Cycle I and 81.37 in Cycle II, with paired-sample t-tests confirming the statistical significance of these improvements ($p < 0.001$, large effect sizes). In addition, students demonstrated increased classroom participation (from 65% to 88%) and confidence (from 60% to 85%), as observed during the learning process.

Beyond the quantitative gains, students expressed positive perceptions of ChatGPT as a learning tool, particularly in terms of its usefulness ($M = 4.58$), confidence-building ($M = 4.53$), and motivational impact ($M = 4.47$). The qualitative analysis of field notes revealed that ChatGPT provided a supportive, non-judgmental environment that reduced speaking anxiety and encouraged autonomous practice. These findings suggest that ChatGPT can serve as a valuable pedagogical tool for EFL instruction, especially for non-English-major students who require additional opportunities to practice speaking in a low-anxiety setting.

Based on the findings of this study, the following practical recommendations are offered for English lecturers, curriculum developers, and institutional policymakers:

Integration of AI Tools into Speaking Instruction: English lecturers are encouraged to integrate ChatGPT or similar generative AI tools into speaking courses as a supplementary resource for conversation practice. The structured implementation model used in this study—including conversation simulation, role-play, and instant feedback—can serve as a practical guide for classroom practice.

Provision of Structured Guidelines: Students should be provided with clear guidelines, conversation topics, and expectations for using ChatGPT outside the classroom. A conversation log or journal can help students track their progress and reflect on their learning.

Discipline-Specific Content: For students in non-English majors such as Mathematics Education, the speaking topics should be tailored to their academic needs. This study demonstrates that mathematical topics can be effectively used to engage students in meaningful English communication.

Institutional Support: Educational institutions are encouraged to provide access to AI tools and training for both lecturers and students to ensure

effective and ethical implementation of AI-assisted language learning.

This study acknowledges several limitations, including the small sample size (n = 35), the absence of a control group, and the relatively short intervention period. Future research is recommended to:

Conduct large-scale experimental or quasi-experimental studies with control groups to establish causal relationships and validate the effectiveness of ChatGPT-assisted speaking activities.

Investigate the long-term effects of AI-assisted speaking practice on learners' speaking proficiency and retention.

Compare the effectiveness of ChatGPT with other AI-powered tools (e.g., Talkpal.AI, ELSA Speak) to identify the most effective platforms for different learning contexts.

Examine the impact of ChatGPT-assisted speaking activities on various demographic groups, including students from different academic disciplines, proficiency levels, and cultural backgrounds.

Explore the integration of AI-assisted speaking activities with other pedagogical approaches, such as project-based learning and collaborative learning, to create blended learning environments that maximize student engagement and speaking development.

Despite these limitations, the present study provides empirical evidence that ChatGPT-assisted speaking activities constitute an effective and promising instructional strategy for enhancing speaking competence among Mathematics Education students. The findings offer valuable insights into how generative AI technologies can be harnessed to create supportive, interactive, and meaningful language learning experiences in higher education contexts.

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