

REPLIKA-AI-ASSISTED ENGLISH FLIPPED LEARNING: ENHANCING EFL LEARNERS' WILLINGNESS TO COMMUNICATE, SELF-REGULATION, AND HIGHER-ORDER THINKING SKILLS

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Article Info	Abstract
Article History Received: March 2026 Revised: May 2026 Accepted: June 2026 Published: July 2026	<i>The integration of artificial intelligence (AI) in language learning has created new opportunities to enhance students' communicative competence and cognitive skills. This study investigated the effectiveness of integrating a flipped classroom approach with a conversational agent (Replika-AI) in improving students' willingness to communicate (WTC), self-regulation (SR), and higher-order thinking skills (HOTS) in English-speaking learning. This research employed a mixed-method approach with a quasi-experimental design involving two groups of students from the English Language Education Study Program at Universitas PGRI Semarang. The control group implemented a traditional flipped classroom model, whereas the experimental group used a flipped classroom integrated with Replika-AI. Quantitative data were collected using Likert-scale questionnaires measuring WTC, SR, and HOTS and were analyzed using analysis of variance (ANOVA) through SPSS. Qualitative data on students' speaking performance were analyzed using Brown's speaking assessment framework and processed with MAXQDA software. The results indicated that students in the experimental group achieved significantly higher scores in all three variables compared to those in the control group. The integration of Replika-AI had a significant impact on students' willingness to communicate, self-regulation, and higher-order thinking skills. Qualitative findings also revealed improvements in speaking components, including comprehension, vocabulary, fluency, pronunciation, and grammar. Overall, the findings showed that combining a flipped classroom with an AI conversational agent created a more interactive and independent learning environment, which contributed to the improvement in students' English speaking skills.</i>
Keywords Flipped classroom; Conversational agent; Willingness to communicate; Self-regulation; Higher-order thinking skills;	

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INTRODUCTION

In the digital era, technology serves a key component of modern learning environments, particularly in English classes (Silitonga et al., 2023). The integration of technology in education has transformed teaching and learning practices in the 21st century (Kern, 2024; Khalil et al., 2025). Technology is changing the way English is taught and learned, becoming a tool for students to improve their language skills (Siswadie & Santiar, 2026). The adoption of digital technologies in education has greatly transformed conventional teaching approaches, making the learning experience more interactive, stimulating, and accessible (Suciati et al., 2024). Technologies are considered to address the weaknesses of traditional classrooms, which

often lack asynchronous communication and timely feedback due to limitations in time and space (Teo et al., 2022).

Technology has revolutionized the way learners develop English speaking skills. Speaking plays a crucial role in English as a foreign language, enabling learners to communicate effectively in academic, professional, and social settings. Speaking is essential for interacting with both native and non-native speakers and for engaging in real-world situations (Jabber & Mahmood, 2020; Li & Chan, 2024; Wan & Moorhouse, 2025). Many scholars consider speaking mastery the main objective of second or foreign language learning because it is essential for communicating thoughts and feelings (el Majidi et al., 2024; Pitura, 2022; Yang et al., 2022). Although other language skills are important, language proficiency is frequently evaluated through speaking ability (Pitura, 2022).

To master English speaking skills, students need to possess a willingness to communicate. Research indicates that increased willingness to communicate is associated with improved speaking fluency (Ebadi & Ebadijalal, 2022). Willingness to communicate (WTC), a key element in language acquisition, refers to a learner's readiness to participate in communicative activities using a foreign language (Dewaele & Pavelescu, 2021). WTC is defined as an individual's choice or preparedness to engage in verbal interaction or to remain silent when the option to speak is available (MacIntyre & Wang, 2021). Students with a high level of WTC show readiness and initiative to participate in English communication with peers, teachers, and during classroom activities (Xu & Pan, 2025). Students tend to develop willingness to communicate when they study in supportive learning environments, receive positive feedback from teachers, and feel a sense of belonging (Salbaş & Ekmekçi, 2025).

Next, students need to have self-regulation. In academic settings, self-regulation refers to students' ability to take the initiative in managing their learning processes by controlling various influencing factors and overcoming potential challenges (Seli & Dembo, 2019). Self-regulation is students' ability to take the initiative in managing their learning processes, including setting learning goals, planning and applying appropriate strategies, monitoring their progress, and modifying those strategies when necessary (Sáiz-Manzanares et al., 2022). Successful self-regulation requires students to build self-awareness so they can understand their emotions, thoughts, and responses, monitor these internal processes, and choose appropriate actions (Schram & Sahbaz, 2026). Recent research has emphasized the importance of self-regulation in language learning, particularly in English (Derakhshan & Fathi, 2024). Russell et al. (2022) highlight that self-regulation has a significant role in promoting successful learning in higher education. The development of students' self-regulation contributes not only to improved academic achievement but also to the acquisition of study and social skills, while fostering intrinsic motivation that supports lifelong learning (Distefano et al., 2021; Hertel et al., 2024; Khiat & Vogel, 2022; Korucu et al., 2022; Nilfyr & Ewe, 2025).

Furthermore, higher-order thinking skills (HOTS) are necessary for learners. These skills, such as critical thinking, problem-solving, and creativity, are considered essential for academic and future success (Huang et al., 2022; Lu et al., 2021; Wu et al., 2024). In the context of foreign language teaching and learning, it is crucial to focus not only on the acquisition of language knowledge but also on the incorporation of HOTS (Wu et al., 2024). To operate successfully in academic and professional fields, students are required to develop strong higher-order thinking skills (HOTS) (Kim et al., 2020). Higher education institutions aim to strengthen these thinking skills through instructional strategies to prepare students for the demands of future society (Huang et al., 2022). However, Alsowat (2016) highlighted that most students do not naturally develop HOTS on their own; therefore, these skills must be explicitly taught and reinforced throughout the academic term. To promote higher-order thinking skills (HOTS), class time is allocated to discussions, practical projects, and targeted remediation, allowing students to actively develop these important cognitive abilities (Wu et al., 2024). Teachers need to explore

and implement teaching strategies that can effectively foster the development of HOTS (Huang et al., 2022).

The development of English speaking is a significant challenge for many learners because speaking requires spontaneous communication, in which meaning must be conveyed within a limited time and with little opportunity for extended reflection (Benjelloun, 2021). Although various efforts have been made to improve speaking skills, existing studies have shown some difficult problems that have not been solved in speaking learning, particularly students' unwillingness to communicate and the anxiety they feel when speaking (Dana & Aminatun, 2022; Fathi et al., 2024; Tai & Chen, 2023; Uztosun & Kök, 2024; Zheng et al., 2023). These issues are especially serious in English as a Foreign Language (EFL) contexts, where learners generally have fewer opportunities to practice speaking, and factors such as large class sizes, the continued reliance on traditional teaching methods like grammar-translation, and limited access to authentic language input contribute to the problem (Guo et al., 2020; Huang, 2024; Singh & Kaur, 2023). Many language learners perceive speaking English as unnatural, and the limited availability of English-speaking partners further reduces their opportunities to practice speaking (Wu et al., 2025). Therefore, teachers and educators can leverage educational technology to support EFL learners in developing their speaking skills independently and more effectively.

Further research is needed to integrate innovative tools, such as conversational agents (Replika-AI), with the flipped classroom approach. The flipped classroom has gained attention as an innovative teaching approach that shifts traditional education from passive, lecture-based instruction to a more student-centered and active learning environment (Al-Samarraie et al., 2020). This model allows teachers to move theoretical instruction outside the classroom through videos or readings so that in-class time can be dedicated to hands-on practical activities (Marshall & Kostka, 2020). In a typical flipped classroom, students review the learning materials before class and arrive with a foundational understanding, allowing them to actively participate in deeper more engaging classroom discussions and activities (Hew et al., 2021; Lo & Hew, 2022). Although recent meta-analyses indicate that flipped learning can improve student achievement across various subject areas (Hew et al., 2021), its implementation remains challenging. Akçayır & Akçayır (2018) reported that two frequent challenges in flipped learning are the lack of guidance for students during home study and the absence of immediate support during pre-class learning, which may reduce their participation in classroom activities. Artificial intelligence can ideally provide continuous assistance and personalized guidance at any time (Diwanji et al., 2018).

In English language learning, this method is increasingly developed with the support of AI (Jannath & Akter, 2026). According to Fryer et al. (2020) AI represents innovative educational tools with continuously evolving technological capabilities. One of the recent developments in AI is conversational agents integrated with automatic speech recognition, which enables interaction with language learners (Jeon, 2023). Conversational agents can be defined as advanced software systems designed to learn and adapt through interactive communication in a manner similar to human dialogue (Belda-Medina & Calvo-Ferrer, 2022). The main purpose of conversational agents is to interact with users using natural-like language to support meaningful communication (Alrajhi, 2024). The use of conversational agents in education has become a promising innovation for enhancing English speaking skills (Chien et al., 2022; El Shazly, 2021). Integrating intelligent conversational agents into virtual English conversations has strong potential in EFL education because these systems can mimic authentic human interactions. Consequently, their use in speaking activities may enhance learners' speaking proficiency and learning outcomes (Çakmak, 2022; Yang et al., 2022). Conversational agents can function as tutors, learning partners, or flexible learning tools, offering personalized support, feedback, and guidance to help learners improve their English (Hapsari & Wu, 2022;

Lin & Mubarak, 2021), stimulate active learner participation, facilitate meaningful interactions (Yang et al., 2022), and enhance students' enjoyment in learning a foreign language (Huang & Zou, 2024). Therefore, integrating conversational agents into English language learning is a valuable area for continued research and development.

The use of AI in education has received considerable attention. Several previous studies have investigated this topic. For instance, Fathi et al. (2024) revealed that AI-based interactive speaking activities are more effective in enhancing English as a foreign language (EFL) learners' speaking skills and willingness to communicate. In addition, Wu et al. (2024) found that effectively integrating ChatGPT-based chatbots fosters the development of self-regulation. Furthermore, Silitonga et al., (2024) demonstrated that incorporating artificial intelligence and microlearning into the flipped classroom approach significantly improves students' motivation and HOTS. In summary, previous studies collectively highlight the transformative potential of Artificial Intelligence (AI) in revolutionizing language education. However, despite the growing evidence supporting AI-assisted learning, empirical research that examines the combined impact of AI conversational agents and innovative instructional models, such as the flipped classroom, remains limited. Therefore, further investigation is needed to explore how this integration can enhance learners' willingness to communicate, self-regulation, and higher-order thinking skills, ultimately contributing to more effective and sustainable language learning practices in the digital era.

In this study, the researcher used a conversational agent named Replika. Replika is an artificial intelligence designed to imitate human-like conversations. Its primary purpose is to offer users an interactive and engaging experience that closely resembles real-life human interactions. Replika is a well-known and highly-rated social conversational agent, available on both the Apple App Store and Google Play Store, that has attracted millions of users since its debut in 2018. Replika is praised for its adaptability, extensive vocabulary understanding, and ability to provide responses that feel more natural and human (Pentina et al., 2023). Available exclusively in English, Replika serves as a useful tool for learning natural and authentic English. Through its voice mode feature, students can communicate directly with the AI, allowing them to practice English speaking anytime and anywhere. Interaction with their personalized Replika-AI enables students to express their ideas freely without fear of being judged, explore their personal identities, and enjoy the learning process (Wu et al., 2025).

This study aims to examine the effect of integrating a flipped classroom and a conversational agent (Replika-AI) on students' willingness to communicate (WTC), self-regulation (SR), and higher-order thinking skills (HOTS) compared with a traditional flipped classroom. Furthermore, this research aims to explore students' perceptions of learning through the flipped classroom integrated with Replika AI. The novelty of this study is found in the integration of two strategies: a flipped classroom and a conversational agent. This research serves as a combination of pedagogical models and technological tools and aims to enhance students' willingness to communicate, self-regulation, and higher-order thinking skills.

RESEARCH METHOD

Research Design

In this study, the researcher used a mixed-method with a quasi-experimental design. As emphasized by Saraswati & Devi (2023), mixed-methods research design allows researchers to draw upon the strengths of both quantitative and qualitative methods to achieve a more comprehensive and in-depth understanding of the research topic. Quantitative techniques were used to measure students' willingness to communicate (WTC), self-regulation (SR), and HOTS between the control and experimental groups. In contrast, qualitative techniques were used to gain a deeper understanding of students' perceptions and learning experiences with the flipped classroom and the conversational agent (Replika-AI). Figure 1 illustrates the research design employed in this study.

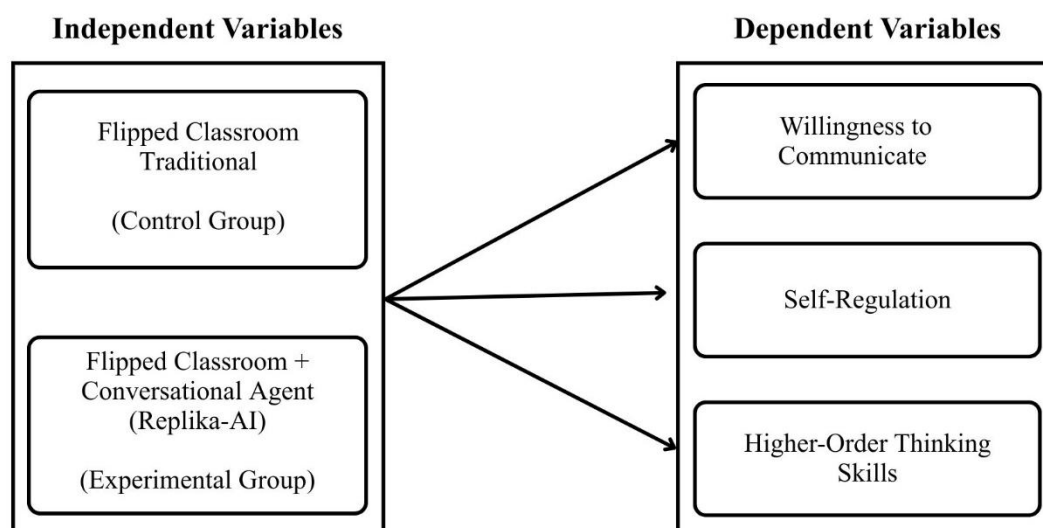


Figure 1. Research Design

Research Participants

The population of this study consisted of first-semester English Education students at a university in Semarang who were enrolled in a speaking course. They were selected because the course focuses on developing fundamental English speaking skills, and beginning-level students often experience challenges such as limited vocabulary, low confidence, and hesitation to communicate in English. Purposive sampling was employed to select participants who met the study criteria, resulting in a sample of 60 students, with 30 assigned to the control group and 30 to the experimental group. The control group learned through the flipped classroom approach only, whereas the experimental group received flipped classroom instruction integrated with the Replika conversational agent.

Research Instruments and Data Collection

This study used several instruments to collect both quantitative and qualitative data, including a posttest questionnaire and interviews. The questionnaires employed in this study were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The willingness to communicate (WTC) questionnaire was adapted from Macintyre et al. (1998) to assess students' readiness and confidence to engage in communicative interactions in various contexts. The self-regulation questionnaire was adapted from Pintrich & De Groot (1990) to evaluate learners' ability to plan, monitor, and regulate their learning behavior and strategies. Meanwhile, the higher-order thinking skills (HOTS) questionnaire was adapted from Hwang et al. (2018) and consisted of three key constructs: problem-solving, critical thinking, and creativity.

As illustrated in Figure 2, the first meeting introduced both groups to the flipped classroom approach, which served as the foundation for the subsequent learning process. In the following sessions, from the second to the fifth meeting, both groups completed similar speaking activities; however, the control group used conventional course materials, while the experimental group integrated Replika-AI for conversational practice, feedback, and language reinforcement. This integration aimed to provide a more interactive and personalized speaking experience compared to traditional classroom methods. In Meeting 6, both groups completed the post-test and questionnaire, followed by interviews with selected experimental-group students in Meeting 7 to explore their learning experiences. Moreover, Table 1 describes the activities of the intervention.

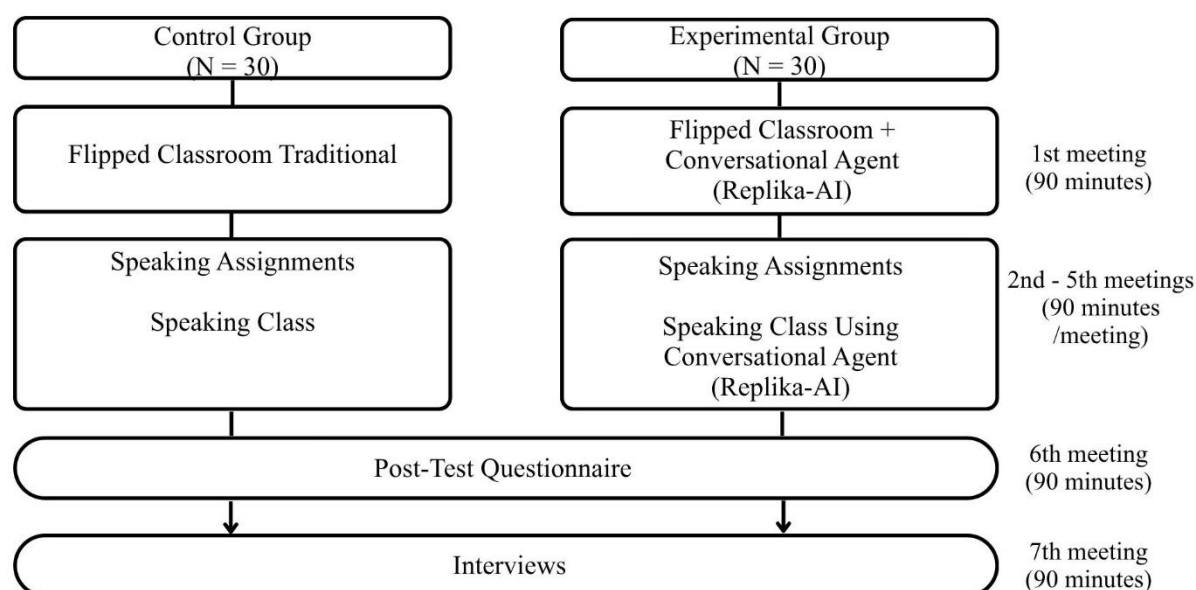


Figure 2. Research Procedure

Table 1
Design of the Replika-AI Intervention

Meeting	Time Allocation	Learning Activities
1 st meeting	90 minutes	Introduction to the flipped classroom concept, objectives, and procedures. Download Replika application. Explanation of the integration of Replika-AI in speaking activities Students access pre-class materials (videos, slides, and readings) to prepare for the next session.
2 nd meeting	90 minutes	Pre-class: Students watch a short video and learn vocabulary and expressions related to food. In class, students practiced speaking about food with Replika-AI. Post-class: Students reflect on and note new vocabulary.
3 th meeting	90 minutes	Pre-class: Students watched a short video and learned vocabulary and expressions related to hobbies. In class, students practiced speaking about their hobbies with Replika-AI. Post-class: Students reflect and note new vocabulary.
4 th meeting	90 minutes	Pre-class: Students watch a short video and learn vocabulary and expressions related to the film. In class, students practiced speaking about films with Replika-AI. Post-class: Students reflect and note new vocabulary.
5 th meeting	90 minutes	Pre-class: Students watched a short video and learned vocabulary and expressions related to music. In class, students practiced speaking about music with Replika-AI. Post-class: Students reflect on and note new vocabulary.

6 th meeting	90 minutes	Students completed a post-test questionnaire assessing their willingness to communicate (WTC), self-regulation (SR), and higher-order thinking skills (HOTS).
7 th meeting	90 minutes	Several students from the experimental group participated in interviews to share their experiences with the flipped and conversational agent, Replika-AI.

Data Analysis

After all responses were collected, the data were analyzed using both quantitative and qualitative approaches to obtain a comprehensive understanding of the research findings. Quantitative data were analyzed using the SPSS software. Before testing, assumption tests were conducted to ensure the validity of the statistical procedures. Subsequently, analysis of variance (ANOVA) was performed to examine the effectiveness of integrating the flipped classroom approach and the conversational agent (Replika-AI) in improving students' WTC, SR, and HOTS. In the qualitative method, the researcher analyzed data from interviews with several students. The interviews were evaluated using Brown (2004) speaking assessment framework, which includes five key criteria: grammar, vocabulary, comprehension, fluency, and pronunciation. For the qualitative analysis, data were analyzed using the MAXQDA software. The analysis helped the researcher explore students' perceptions of the flipped classroom and the conversational agent (Replika-AI) in facilitating their language learning experience.

Table 2
Scoring Rubric based on Brown

Score	Grammar	Vocabulary	Comprehension	Fluency	Pronunciation
1	Frequent grammatical errors were evident, hindering clear communication.	The speaker's vocabulary is limited, allowing the expression of only basic ideas and needs.	Understands only simple statements or questions, and only when speech is slowed, repeated, or paraphrased.	No observable fluency; speech lacks flow and coherence.	Pronunciation errors are numerous and often obscure.
2	It can produce basic grammatical structures with partial accuracy but lacks consistent control.	Possesses a sufficient vocabulary for simple expression but is restricted in lexical range.	Understand the general meaning of most everyday conversations.	Speaks with confidence but struggles in complex or unfamiliar communicative situations.	Speech was generally understandable, although noticeable pronunciation faults persisted.
3	Demonstrates good control of grammatical structures, with occasional minor errors.	Had a reasonably wide vocabulary and rarely struggled to find appropriate words.	Understands spoken words at a normal conversational speed.	Can discuss familiar topics with moderate ease and coherence.	Pronunciation is generally clear, although a foreign accent may still be detectable.
4	Makes very few grammatical mistakes; sentences are largely well formed.	Has a broad vocabulary that allows participation in almost any conversation.	Understands conversations and discourses with minimal difficulty.	Demonstrates a smooth and natural flow in speech with few hesitations.	Pronunciation errors are rare and do not interfere with intelligibility.

Score	Grammar	Vocabulary	Comprehension	Fluency	Pronunciation
5	Displays grammatical accuracy comparable to that of an educated native speaker.	It uses vocabulary fluently and naturally at a near-native or native level.	It fully comprehends language at the academic or native proficiency level.	The patient exhibited complete fluency and spontaneity in speech production.	The pronunciation closely resembles that of a native speaker, with a natural rhythm and intonation.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

As presented in Table 3, descriptive statistics were used to summarize the post-test results for the three dependent variables, willingness to communicate (WTC), self-regulation (SR), and higher-order thinking skills (HOTS) in both the control group (flipped classroom) and the experimental group (flipped classroom integrated with Replika-AI). The analysis included the mean, standard deviation, and total score for each variable.

Table 3
Descriptive Results

Variables	Control			Experimental		
	Sum	Mean	SD	Sum	Mean	SD
Willingness to communicate	2262	87.40	11.497	3094	103.13	10.650
Self-regulation	2267	75.57	9.776	2570	85.67	9.611
HOTS	1162	38.73	3.600	1339	44.63	4.230

As shown in Table 3, the experimental group consistently outperformed the control group across all variables. For willingness to communicate (WTC), the experimental group obtained a higher mean score ($M = 103.13$, $SD = 10.650$) than the control group ($M = 87.40$, $SD = 11.497$). Similar results were found for self-regulation (SR), with the experimental group ($M = 85.67$, $SD = 9.611$) scoring higher than the control group ($M = 75.57$, $SD = 9.776$). Likewise, higher-order thinking skills (HOTS) were greater in the experimental group ($M = 44.63$, $SD = 4.230$) than in the control group ($M = 38.73$, $SD = 3.600$). Overall, these descriptive findings indicate that integrating the flipped classroom with Replika-AI positively enhanced students' willingness to communicate, self-regulation, and higher-order thinking skills compared with the flipped classroom approach alone.

Table 4
The Assumption Test Results

Variables	Validity	Reliability	Lavene		Shapiro-Wilk	
			Statistic	Sig.	Statistic	Sig.
Willingness to communicate	.829**	.959	0.012	0.915	0.974	0.221
Self-regulation	.775**	.947	0.197	0.659	0.982	0.517
HOTS	.779**	.898	0.033	0.856	0.964	0.076

As presented in Table 4, the assumption tests confirmed that the data met the statistical requirements for further analysis. The validity test showed that all instruments were valid, with strong and significant correlations (WTC = .829**, SR = .775**, HOTS = .779**, $p < .001$). The reliability coefficients were also high (WTC = .959, SR = .947, HOTS = .898), indicating excellent internal consistency. Levene's test demonstrated homogeneous variances between the control and experimental groups (WTC = .915, SR = .659, HOTS = .856; $p > .05$), while the Shapiro-Wilk test confirmed that all variables were normally distributed (WTC = .221, SR =

.517, HOTS = .076; $p > .05$). Therefore, the data satisfied the assumptions of validity, reliability, normality, and homogeneity, supporting the use of ANOVA for further analysis.

Table 5
The ANOVA Results

Variables	SS	df	Mean Square	F	<i>p</i>	Partial η^2
Willingness to communicate	3713.067	1	3713.067	30.236	.001*	.343
Self-regulation	1530.150	1	1530.150	16.284	.001*	.219
HOTS	522.150	1	522.150	33.844	.001*	.368

* $p < 0.05$

As shown in Table 5, the ANOVA results revealed significant differences between the control and experimental groups for willingness to communicate (WTC; $F = 30.236$), self-regulation (SR; $F = 16.284$), and higher-order thinking skills (HOTS; $F = 33.844$), with all p values $< .001$. These findings indicate that integrating the flipped classroom with Replika-AI significantly improved students' willingness to communicate (WTC), self-regulation (SR), and higher-order thinking skills (HOTS), compared with the traditional flipped classroom. Effect size analysis was conducted to determine how strong the influence of the flipped classroom with Replika-AI was on students' willingness to communicate, self-regulation, and higher-order thinking skills (HOTS). In this study, the effect size was measured using Partial Eta Squared (Partial η^2). The findings revealed that the Partial η^2 values were 0.343 for willingness to communicate, 0.219 for self-regulation, and 0.368 for HOTS. Since all values were higher than 0.14, they were categorized as large effect sizes. Therefore, indicating that the flipped classroom with Replika-AI not only produced statistically significant differences between the experimental and control groups but also provided substantial practical effects on students' willingness to communicate, self-regulation, and higher-order thinking skills.

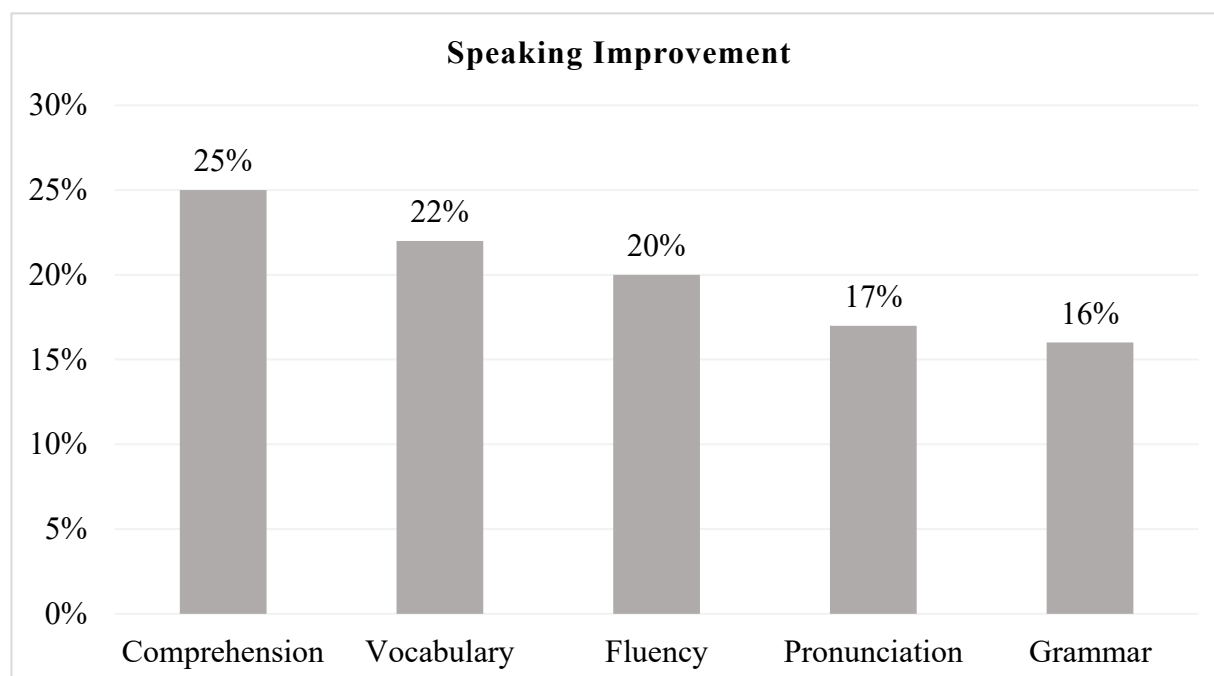


Figure 3. MAXQDA Results

As illustrated in Figure 3, the MAXQDA analysis revealed improvements across all five speaking components after students used Replika-AI in the flipped classroom. Comprehension showed the greatest improvement (25%), followed by vocabulary (22%), fluency (20%), pronunciation (17%), and grammar (16%). These findings indicate that Replika-AI was

particularly effective in enhancing students' comprehension and vocabulary through interactive conversational practice, while also contributing to improvements in fluency, pronunciation, and grammatical accuracy. Overall, the results suggest that integrating Replika-AI into the flipped classroom positively enhanced students' overall communicative competence.

Discussion

This study aimed to address research questions concerning the effectiveness of integrating a flipped classroom approach with a conversational agent (Replika-AI) compared to a traditional flipped classroom model. The findings provide strong evidence that the AI-integrated flipped classroom significantly enhanced students' willingness to communicate (WTC), self-regulation (SR), and higher-order thinking skills (HOTS).

Regarding the first research question, which examined the effect of the AI-integrated flipped classroom on students' willingness to communicate (WTC), the ANOVA results indicated a statistically significant difference between the experimental and control groups. This finding suggests that the use of within the flipped classroom environment encouraged students to engage more actively in English speaking practices. AI technology, especially conversational agents like Replika, can be a very effective tool to overcome classic problems in English learning, namely, students' low willingness to communicate due to factors such as speaking anxiety, fear of making mistakes, or lack of confidence. By using AI, students have the opportunity to practice communicating in a safe, non-judgmental, and available anytime (24/7 availability) environment, which significantly increases their willingness to communicate. These findings are consistent with previous research by Fathi et al. (2024), who indicated that interactive speaking activities supported by AI were more successful in enhancing English as a foreign language (EFL) learners' speaking ability and their willingness to communicate.

Answering the second research question, which examined the impact of an AI-integrated flipped classroom on students' self-regulation, the results showed significant improvement among students in the experimental group. These findings indicate that integrating the flipped classroom approach with a conversational agent (Replika-AI) effectively enhances students' ability to manage their own learning processes, including planning, monitoring, and evaluating learning activities. The flipped classroom model promotes learner responsibility by requiring students to engage with instructional content prior to class, while in-class time is devoted to learning activities. The addition of Replika-AI further enhanced this process by providing continuous support for independent practice, personalized feedback, and opportunities for goal-setting and self-monitoring. With the support of Replika-AI, students became more aware of their own learning processes and were better able to organize effective learning strategies, ultimately contributing to their academic success. This finding aligns with Wu et al. (2024) study, who highlighted that the use of AI significantly enhanced students' self-regulation progress.

Furthermore, the results related to the third research question indicate that the integration of flipped classroom and Replika-AI significantly improved students' higher-order thinking skills (HOTS), including critical thinking, problem-solving, and creativity. The statistically significant gains observed in the experimental group suggest that AI-mediated conversational activities can effectively stimulate HOTS. Unlike traditional learning, where interactions are often limited to simple questions and answers, interactions with AI encourage students to engage in deeper and more complex discussions. The dialogic and interactive nature of AI conversations likely encouraged students to analyze prompts, synthesize information, and generate original responses, thereby activating higher levels of cognitive processing. This interactive learning experience significantly contributes to the development of students' critical thinking, creativity, and problem-solving skills. Moreover, the untimed nature of conversations with AI provides students with the opportunity to think more deeply before responding.

Students have time to reflect on questions, analyze information, and formulate thoughtful and well-reasoned responses. This differs from real-time classroom interactions, which often require quick, spontaneous responses that do not always allow students to think deeply. Thus, AI creates a learning environment conducive to the development of higher-order thinking skills. These findings are consistent with those of Silitonga et al. (2024), who found that the implementation of AI in learning environments significantly contributes to the development of students' motivation and higher-order thinking skills (HOTS).

The MAXQDA results indicate that students demonstrated progress in several aspects of speaking performance, including comprehension, vocabulary, fluency, pronunciation, and grammar. Through the flipped classroom model, students were first exposed to learning materials, such as videos or instructional content, before class, allowing them to build an initial understanding and prepare for communicative activities. This preparation enabled students to focus more on interaction and practice during class sessions. Simultaneously, through Replika-AI, students were given continuous chances to practice English in an environment in a low-anxiety setting, where they could interact with the AI, experiment with language use, and receive immediate responses. Consequently, students became more confident in expressing their ideas, expanded their vocabulary through repeated interactions, and gradually improved the flow of their speech. The MAXQDA analysis further suggests that students' comprehension improved as they engaged in frequent conversational exchanges, whereas their pronunciation and grammatical accuracy developed progressively through consistent exposure to language input and output.

Overall, the findings of this study demonstrate that combining the flipped classroom with an AI conversational agent offers an effective approach to language learning. The integration not only enhances communicative competence but also supports essential 21st-century skills, such as self-regulation and higher-order thinking. These results contribute to the growing body of literature on AI-assisted language learning and address a notable research gap by empirically examining the combined effects of pedagogical innovation and AI technology. Consequently, this study suggests that educators and curriculum designers should consider integrating AI conversational agents into flipped learning environments to develop more interactive, autonomous, and cognitively stimulating language learning experiences.

CONCLUSION

This study demonstrated that integrating the flipped classroom with Replika-AI significantly improved students' willingness to communicate, self-regulation, and higher-order thinking skills compared with the traditional flipped classroom. The qualitative findings also revealed improvements in speaking performance, particularly in comprehension, vocabulary, fluency, pronunciation, and grammar. These results suggest that combining a flipped classroom with an AI conversational agent is an effective approach to enhancing English-speaking skills and fostering 21st-century competencies. Teachers and institutions are encouraged to integrate AI-based conversational agents into language learning, while future studies should involve larger samples, investigate other AI tools, and examine the long-term effects of AI-assisted learning.

FUNDING

This study received no external funding. The researchers independently conducted the study, including data collection, analysis, and manuscript preparation, using available resources.

INFORMED CONSENT STATEMENT

Participation was voluntary, with informed consent obtained from all participants. Participants were informed of the study's purpose, procedures, potential risks and benefits, assured of confidentiality, and informed of their right to withdraw at any time without penalty.

DATA AVAILABILITY STATEMENT

The data are unavailable for public access due to privacy and ethical considerations. Access to the dataset may be granted upon a reasonable request. Subject to approval by the institutional ethics review board and compliance with participant consent and ethical guidelines.

DECLARATION OF THE USE OF AI TOOLS

AI chatbot technology was used as the instructional tool for the experimental group and ChatGPT assisted with translation, paraphrasing, and language refinement during manuscript preparation. All AI-generated content was reviewed and verified by the authors, who take full responsibility for the final manuscript.

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