

Chatbot-Augmented Flipped and Case-Based Learning to Enhance Linguistic and Clinical Communication in EMI Contexts

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Abstract

This study investigated the effectiveness of a chatbot-augmented flipped and case-based learning framework in enhancing students' linguistic and clinical communication competence in English as a medium of instruction (EMI) healthcare education contexts. It employed an explanatory sequential mixed-methods design involving 18 students enrolled in an Occupational English Test (OET)-based speaking course. Quantitative data were collected through pre- and post-test assessments to examine students' performance improvement, while qualitative data obtained through a questionnaire were used to explore students' learning experiences, perceptions, and challenges during the implementation of the instructional framework. The instructional framework comprised three phases: foundational knowledge development, chatbot-assisted guided and case-based conversational practice, and case-based role-play and reflection activities. The study findings reveal statistically significant improvements in the students' linguistic and clinical communication performance following the intervention. The integration of structured guidance, interactive communication practice, and immediate feedback positively contributed to the students' learning outcomes, confidence, and engagement. However, several challenges were also identified regarding the chatbot interaction, including lack of natural conversation ability, technical limitations, contextual relevance issues, and cognitive-linguistic demands. Overall, this study highlights the pedagogical potential of integrating chatbot-supported practice and flipped case-based learning to support communication-oriented instruction in EMI healthcare education and OET preparation contexts.

Introduction

English as a medium of instruction (EMI) is increasingly being implemented into medical education and healthcare worldwide, requiring students to develop effective English communication skills for both academic and professional purposes [1]. In EMI contexts, healthcare students are expected to demonstrate not only linguistic competencies in regard to grammar, vocabulary, and fluency but also clinical communication competencies in terms of empathy, clarity, and patient-centered interaction. However, research indicates that many nonnative-English-speaking students experience difficulties in understanding English medical terminology, accurately expressing ideas in English, and effectively communicating in English in healthcare situations. Alanazi and Curle [1] have found that limited vocabulary and lack of familiarity with disciplinary language hinder students' understanding and classroom communication in EMI settings.

These challenges become critical in professional healthcare communications, in which accuracy, empathy, and clarity are essential for patient care and clinical interaction [2, 3]. Various studies have revealed that traditional EMI instruction often separates linguistic learning from authentic clinical communication practice, limiting students' opportunities to develop integrated communication competence. Alanazi and Curle [1] have emphasized that lack of appropriate teaching materials and professional communication training are barriers to the success of EMI medical programs. Nguyen [4] has noted that medical English classes are often delivered by lecturers who lack sufficient medical communication knowledge, resulting in limited integration between language learning and authentic clinical scenarios. Therefore, an innovative pedagogical framework is necessary to support meaningful speaking practice in EMI healthcare education.

In response to these challenges, recent studies have increasingly explored the use of generative artificial intelligence (AI) technologies, such as chatbots, in language learning across writing, speaking, listening, and reading. Artificial intelligence chatbots may function as adaptive scaffolds, interactive partners, feedback providers, and affective support tools, though their dominant pedagogical assets vary by the language skill at

hand. In writing, chatbots primarily operate as revision assistants and idea scaffolds, strengthening lexical diversity, syntactic complexity, and structural coherence through iterative feedback cycles [5, 6]. In speaking, they function as conversational rehearsal partners and low-anxiety simulators, enhancing students' willingness to communicate, confidence, and fluency through repeated dialogue practice [7, 8]. For listening, chatbots serve as interactive decoding assistants and personalized tutors, offering immediate feedback and adaptive input to promote comprehension and learner autonomy [9, 10]. In reading, they act as instructional facilitators and comprehension explainers, supporting vocabulary clarification, anxiety reduction, and active reading strategies [11, 12]. Collectively, this four-skill synthesis demonstrates that chatbots typically operate as supplementary cognitive and affective scaffolds rather than autonomous instructors.

Flipped learning is a key pedagogical approach that shifts knowledge acquisition to the pre-class phase and reserves in-class time for higher-order practice. In this model, students independently engage with foundational content before class, while classroom sessions focus on applying knowledge through analytical and communicative tasks. Kardipah et al. [13] have shown that academic performance and learning outcomes can be improved significantly using flipped learning by promoting active engagement and deeper understanding. Within flipped education contexts, chatbot interaction can play a crucial role in the pre-class stage by enabling learners to rehearse lexical and structural patterns, preparing them for more complex communicative activities during class. As Jeon and Lee [14] have suggested, in-class activities should go beyond repetition by incorporating analytical reflection, peer negotiation of meaning, and corrective feedback to enhance communicative competence. This approach improves speaking and writing skills by reallocating direct instruction to out-of-class videos, which "provide students with rich opportunities to practice listening, speaking, and writing through group activities in class" [15]. It also supports active learning and promotes the development of higher-order thinking skills. However, despite its potential, flipped learning is rarely integrated with AI in a structured and purposeful manner, highlighting a critical gap in current pedagogy.

Meanwhile, case-based learning is an active, learner-centered pedagogical approach that utilizes either real-life or hypothetical scenarios to challenge students to apply their knowledge toward finding practical solutions [16], allowing them to navigate the complexities of authentic professional situations by correlating practice with scientific theory [17]. The model enhances students' conceptual understanding by engaging them in real-world situations or simulations that are closely aligned with the subject matter [18]. When integrated within a flipped classroom framework, it promotes independent learning and autonomy by shifting foundational content to pre-class preparation, thereby dedicating valuable in-class time to interactive, high-level cognitive tasks such as collaborative problem-solving [19]. This combination is particularly well suited for meaningful healthcare communication practice, as it provides authentic scenarios for verbal interaction and role-plays that help students not only improve their linguistic mastery but also cultivate the critical thinking and decision-making capabilities essential for their future professional roles [16, 17, 20].

Despite the growing body of research on AI in language education, a significant gap exists in the absence of a pedagogically grounded model that systematically integrates AI chatbots, flipped and case-based learning, and clinical communication within a unified framework. Recent studies have tended to examine AI, case-based, or flipped learning in isolation, with limited attention given to how these elements can be combined to support linguistic and clinical communication competence.

This study aimed to address this gap by implementing a chatbot-augmented flipped and case-based learning framework that systematically integrates AI chatbot technology, flipped pedagogy, and authentic clinical

communication practice in Occupational English Test (OET)-based speaking instruction within an EMI healthcare education context to examine the framework's effectiveness in improving students' linguistic and clinical communication competencies and to collect the students' perceptions of the framework. The research questions are as follows:

1. To what extent does a chatbot-augmented flipped and case-based learning framework enhance students' linguistic competence in OET speaking?
2. To what extent does the framework improve students' clinical communication competence in OET speaking?
3. What are students' perceptions of the integrated AI chatbot as a tutor and conversation partner?

Methodology

Research Design

This research work adopted an explanatory sequential mixed methods design to evaluate an EMI healthcare learning model combining an AI chatbot with a flipped and case-based approach. Mixed methods research enables the integration of quantitative and qualitative data to examine complex educational phenomena [21], making it suitable for capturing both learning outcomes and underlying processes. In this study, the quantitative phase employed a one-group pre-test–post-test design to assess improvements in students' linguistic and clinical communication competencies. The qualitative phase that followed used open-ended questionnaires to explore students' experiences with and perceptions of the integrated framework. Overall, this explanatory sequential design allowed for the collection of qualitative findings to explain and support the quantitative results.

Participants

The participants were drawn from a population of approximately 50 first-year medical students at an EMI institution in Indonesia that adopts the OET framework. A purposive sample of 18 beginner-level students (Band E), identified through an entry OET test, was selected for the study because they required structured support to strengthen their English communication skills in clinical contexts.

Framework Description

The chatbot-augmented flipped and case-based framework comprised the following three phases: pre-class, chatbot-integrated practice, and in-class activities. In the pre-class phase, students developed a foundational understanding (C2) of linguistics and clinical knowledge through self-paced learning and AI-based quizzes that provided immediate feedback.

In the second phase, chatbot-integrated practice supported progression from application to analysis. Students first read a case presented on a cue card. Then, they applied their existing knowledge using a chatbot created on edcafe.ai as a structured practice tool (scaffolding) to construct responses based on the cue card. The chatbot—referred to as Dr. OET Speaking—required the students to interpret clinical scenarios, make communicative decisions, adjust responses, and respond appropriately in real-time interactions (Table 1).

Table 1
Comparison: Chatbot as Structured Practice Tool Versus Chatbot as Conversational Partner

Features	Chatbot as Structured Practice Tool/Tutor	Chatbot as Conversational Partner
Core Function	Acts as a systematic guide for gradual, step-by-step learning.	Acts as a simulation partner for real-world professional interactions.
Interaction Style	Focuses on repetition and imitation of specific OET cue cards.	Focuses on unscripted role-play, requiring the user to initiate and end dialogue.
Feedback Mechanism	Strict and corrective; often prevents moving to the “next step” until pronunciation is accurate.	Fluid and natural; emphasizes conversational flow and professional communication.
Primary Focus	Building foundational habits, “training the tongue,” and mastering sentence structures.	Applying skills to clinical scenarios.
Preparation Level	Provides the necessary vocabulary and structure required for complex speech.	Provides direct practice for professional duties, such as interacting with a patient.
Engagement	Designed as habit-forming and essential for memory retention.	Designed as challenging but realistic, requiring more independent thought.
Prompt	“Read the attached OET cue card and guide me to practice.”	“Read the attached cue cards and be my conversational partner. You take a role as a patient. I will be a doctor. Make sure your questions are in line with the patient’s task in the cue card. Can we start?”

The AI chatbot used in this study—referred to as Dr. OET Speaking—was designed to function as both a structured practice tool and a conversational partner for healthcare students. As a practice tool, it provided step-by-step guidance through repetition and structured responses based on OET cue cards, supporting the development of foundational skills, such as intelligibility, pronunciation, and sentence construction. It also delivered brief, criterion-based feedback aligned with OET Clinical Communication Criteria. As a conversational partner, the chatbot simulated real-world doctor–patient interactions and encouraged unscripted communication, requiring learners to initiate, maintain, and conclude dialogues. In this role, it emphasized clarity of meaning and conversational flow, facilitating the application of clinical communication skills in context.

The chatbot was tailored for Band E–D learners and incorporated learning strategies such as slow pacing, one idea per turn, repetition, and self-correction. Each session concluded with reflection and revision tasks to support continuous improvement of linguistic and clinical communication competencies.

During the in-class phase, students role-played with a classmate, received instructor feedback, produced role-play videos, and engaged in reflective activities, supporting evaluation. Overall, the framework demonstrated a clear progression from understanding to application, analysis, and evaluation, ultimately enhancing students’ linguistic and clinical communication competencies.

Data Collection Procedure and Instrument

This study employed a one-group pre-test–post-test design to examine the effectiveness of the chatbot-augmented flipped and case-based learning model in improving students’ linguistic and clinical communication competencies in OET-based speaking tasks. The intervention was conducted over seven weeks, comprising one week for the pre-test, five weeks for the treatment, and one week for the post-test.

Students’ pre- and post-test results were assessed using an OET-based speaking rubric encompassing both linguistic dimensions (i.e., fluency, intelligibility, grammar, vocabulary, and appropriateness of language) and clinical communication dimensions (i.e., relationship building, information gathering, information giving, structure provision, and understanding of patient perspectives). The students’ role-playing performances in pre- and post-tests were independently evaluated by two trained raters to ensure objectivity. After the post-test, students were given a questionnaire to identify their level of confidence and their perception of the use of the chatbot as a tutor and conversational partner in enhancing their speaking skills.

To ensure content validity, the assessment rubric was aligned with established OET speaking criteria, reflecting both linguistic accuracy and clinical communication competence. The learning tasks and role-play scenarios were designed to closely mirror authentic OET contexts. Inter-rater reliability was established through the use of two trained raters who independently scored all performances.

This study complied with standard ethical guidelines in educational research. Official permission to conduct the research was obtained from the head of the undergraduate medical study program prior to implementation. The approval ensured that the study complied with institutional regulations and academic research procedures. In addition, all participants were informed of the purpose of the study and voluntarily participated throughout the research process. Identifying information was removed from the dataset to protect learners’ confidentiality and anonymity. Finally, the use of chatbot technology was implemented in a supportive learning context, ensuring that it enhanced, rather than replaced, human instruction.

Quantitative data were analyzed using paired sample t-tests to determine the statistical significance of differences between pre- and post-test scores. Effect sizes were calculated to assess the magnitude of the intervention’s impact. Qualitative data from student reflections and responses were thematically analyzed using NVivo to better understand learners’ experiences and to triangulate the quantitative findings.

Results

This study investigated the effectiveness of a chatbot-augmented flipped and case-based learning framework in improving students’ linguistic and clinical communication competencies in OET speaking within EMI healthcare education. The research specifically examined the extent to which the integration of chatbot-assisted guided practice, conversational interaction, and collaborative case-based activities supported students’ linguistic development and clinical communication performance. In addition, it explored students’ perceptions of the integration of the chatbot as both a tutor and conversational partner in supporting communication-oriented learning experiences.

A. Learning Model’s Impact on Linguistic Competence

A paired sample t-test was conducted to examine the effect of the learning model on the students’ linguistic competence. The analysis compared the participants’ pre- and post-test scores to determine whether significant improvement occurred after the intervention.

Table 2
Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Linguistic	12.6389	18	2.62794	0.61941
	Post_Linguistic	18.6944	18	3.35690	.79123

Table 3
Paired Sample Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre_Clinical - Post_Clinical	-6.05556	2.08559	0.49158	-7.09269	-5.01842	-12.319	17	0.000

The mean score increased by 6.05 points—from 12.63 in the pre-test to 18.69 in the post-test. A paired-samples t-test revealed a statistically significant improvement ($t = -12.319$, $p < .001$), indicating that the observed gain exceeded the significance threshold of $\alpha = 0.05$. These findings demonstrate that the intervention resulted in a significant enhancement in students' performance.

B. Learning Model's Impact on Clinical Competence

A paired sample t-test was used to evaluate the impact of the intervention on students' clinical communication competence. The pre- and post-test scores were compared to identify changes in participants' clinical performance after implementation of the learning model.

Table 4
Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Clinical	12.8333	18	2.92052	0.68837
	Post_Clinical	19.0000	18	3.38683	0.79828

Table 5
Paired Sample Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre_Clinical - Post_Clinical	-6.16667	3.47681	0.81949	-7.89565	-4.43769	-7.525	17	0.000

The mean score increased by 6.16 points—from 12.83 in the pre-test to 19.00 in the post-test. A paired sample t-test indicated that this improvement was statistically significant ($t = -7.525$, $p < 0.001$), with the p-value well below the established significance level ($\alpha = 0.05$). These results provide strong evidence that the intervention led to a meaningful and statistically significant improvement in students' performance.

C. Students' Perceptions

The following qualitative findings explore the students' perceptions of the AI chatbot's integration as both a structured practice tutor and conversational partner in communication-oriented learning activities. The results are organized into four main themes, covering the perceived benefits and challenges of the chatbot as a guided practice tool and a conversation partner.

1. Perceived Benefits of the Chatbot as a Structured Practice Tool/Tutor

The analysis of the participants' responses revealed four key themes regarding the chatbot's effectiveness as a structured speaking practice tool, as follows: (1) structured guidance and clarity, (2) organization and confidence development, (3) progressive skill development, and (4) feedback for improvement.

Structured Guidance and Clarity

The most frequently reported benefit was the chatbot's step-by-step structure, which provided clear guidance for practicing speaking skills. Participants emphasized that the structured sequence of prompts enabled them to systematically organize their thoughts and respond more effectively in clinical communication contexts.

"The step-by-step guidance was very helpful because it helped me organize my ideas, practice medical vocabulary, and understand how to respond clearly in different situations." (P17)

"The most helpful aspect was the clear and step-by-step practice structure ... This made it easier for me to understand how to build good answers and use English in a more organized and academic way." (P11)

These findings indicate that structured scaffolding plays a crucial role in supporting learners' ability to construct meaningful and context-appropriate responses.

Organization and Confidence Development

The participants also highlighted that the structured nature of the chatbot conversations guided them in forming clearer sentences and delivering explanations more confidently.

"It helped me practice speaking gradually, organize my ideas clearly, and improve my confidence when explaining medical information in English." (P5)

"The structured steps helped me practice speaking in an organized way ... and improve my responses." (P10)

This result suggests that structured practice not only enhances linguistic organization but also reduces hesitation and increases communicative confidence.

Progressive Skill Development

Participants reported improvements in vocabulary usage, sentence construction, and the ability to deliver complete responses related to clinical tasks, such as describing symptoms, diagnoses, and treatment.

"It helped me understand how to build sentences, use appropriate medical vocabulary, and organize my responses more clearly." (P3)

These findings demonstrate that the chatbot supported incremental learning, allowing the students to progressively develop both linguistic and clinical communication skills.

Feedback for Improvement

Finally, the participants acknowledged that the feedback provided by the chatbot helped them identify weaknesses in their language skills and refine their pronunciation and overall speaking ability.

"The feedback was very helpful and helped me identify areas where I need to improve my speaking skills." (P1)

Although mentioned less frequently than the other themes here, feedback was a critical component in facilitating continuous improvement and self-regulated learning.

Overall, the results indicate that the chatbot's structured design significantly enhanced the participants' speaking development by providing clear guidance, improving response organization, building confidence, and supporting gradual skill acquisition. The integration of structured prompts and feedback created an effective learning environment for the development of both linguistic and clinical communication competencies.

2. Perceived Challenges of the Chatbot as a Structured Practice Tool/Tutor

The analysis of the participants' responses identified four main categories of challenges in using the chatbot as a structured speaking practice tool, as follows: (1) technical and input-related issues, (2) instruction and context comprehension difficulties, and (3) limitations in maintaining natural conversation.

Technical and Input-Related Issues

The participants reported several technical barriers that affected the effectiveness of chatbot interaction, including unstable internet connections, device-related problems, and inaccuracies in voice input recognition, which occasionally resulted in irrelevant or mismatched responses.

"Sometimes the voice input did not capture my speech accurately, so the response from the chatbot did not always match what I actually said." (P7)

"Sometimes the website glitches or the internet connection is bad, so the voice note doesn't get recorded properly." (P1)

These findings indicate that technical reliability remains a critical factor influencing the usability of chatbot-based learning tools.

Instruction and Context Comprehension

Participants also experienced difficulty understanding complex or lengthy instructions and feedback, particularly when unfamiliar vocabulary was used. In some cases, chatbot responses were perceived as overly formal or slightly misaligned with the intended context.

"Sometimes I found it difficult to understand some instructions or questions, especially when the vocabulary was unfamiliar." (P17)

"The chatbot's responses sometimes felt too formal or slightly different from the context I had in mind." (P11)

These results suggest that adaptive language complexity and clearer instructional design are necessary for chatbot interactions.

Limitations in Maintaining Natural Conversation

Another key challenge was the perceived lack of natural speech in the chatbot interactions. While the structured format supported learning, some participants found it less reflective of authentic communication, particularly in clinical settings.

"The practice sometimes felt too structured and not very natural, so it was a little different from real conversations with patients." (P4)

"Practicing with a chatbot cannot completely replace real interaction with people." (P10)

This finding indicates that chatbot-based practice should complement, rather than replace, real human interaction in the development of communicative competence.

Overall, while the chatbot provided structured and supportive practice, issues related to input accuracy, vocabulary retrieval, instructional clarity, and conversational authenticity could affect students' experiences and learning outcomes.

3. Perceived Benefits of the Chatbot as a Conversational Partner

The analysis of participants' responses identified four key themes regarding the chatbot's effectiveness as a conversational partner, as follows: (1) practice environment, (2) real-time interaction and fluency development, (3) immediate feedback, and (4) communication skill enhancement.

Practice Environment

The participants emphasized that the chatbot provided a safe, flexible, and continuous practice environment through the simulation of realistic doctor–patient interactions. This environment enabled them to engage in repeated speaking practice without external pressure.

"The chatbot gave me a safe and flexible environment for practice and helped me maintain a conversation in English." (P11)

"The chatbot allowed continuous practice and conversation, so I could practice explaining medical information in English." (P13)

These findings indicate that the chatbot effectively created an accessible and low-anxiety learning space for sustained speaking practice.

Real-Time Interaction and Fluency Development

A dominant theme was the opportunity to engage in real-time interaction, which supported spontaneous responses, faster thinking, and improved speaking fluency. The participants highlighted that the chatbot's conversational nature closely resembled real-life communication.

"It helped me improve my fluency and confidence when explaining medical information in English." (P5)

"It allowed me to respond to questions and develop my speaking fluency. It also helped me think faster when answering in English." (P10)

"The chatbot could simulate patient–doctor conversations ... in a more realistic clinical situation." (P13)

This finding suggests that real-time conversational engagement is a critical factor in enhancing fluency and communicative readiness.

Immediate Feedback

The participants also recognized the value of immediate feedback provided during interaction. Quick responses allowed learners to adjust their answers and refine their speaking performance in real time.

"Interactive conversation and immediate feedback help me a lot." (P6)

"Practicing real conversation and getting responses quickly are beneficial for me." (P17)

Although mentioned only briefly by participants, feedback remains an important mechanism supporting continuous improvement.

Communication Skill Development

Finally, the chatbot contributed to the development of broader clinical communication skills, including asking questions, providing explanations, giving advice, and responding to patient concerns. The simulated interaction enabled learners to practice these skills in context.

"It helped me practice responding to questions and expressing my ideas in English ... improving my communication skills." (P7)

"I could practice explaining medical conditions and responding to patient concerns directly." (P14)

These findings highlight the chatbot's role in bridging linguistic competence and clinical communication performance.

Overall, the results indicate that as a conversational partner, the chatbot facilitated authentic, interactive, and context-rich speaking practice, leading to improvements in students' English-language fluency, confidence, and clinical communication skills. The combination of real-time interaction, continuous practice, and immediate feedback created an effective learning environment that supported their linguistic development and practical communication competence in EMI medical contexts.

4. Perceived Challenges of the Chatbot as a Conversational Partner

The analysis also identified four major categories of challenges related to using the chatbot as a conversational partner, as follows: (1) lack of natural conversational flow, (2) technical and accuracy issues, (3) response content limitations, and (4) fluency-related cognitive demands.

Lack of Natural Conversational Flow

The primary challenge participants reported was the perceived lack of naturalness in chatbot interactions compared with real human conversations. Participants indicated that maintaining a smooth conversational flow required additional effort and that the chatbot was limited in its ability to facilitate authentic emotional expression.

"The conversation sometimes felt less natural than speaking with a real person ... it required more effort to maintain the flow of communication." (P4)

"It could be harder to practice real emotional responses and natural interaction." (P5)

These findings suggest that while the chatbot supports structured practice, it may not fully replicate the complexity of human interaction.

Technical and Accuracy Issues

Participants also reported technical barriers, including unstable internet connections, voice input inaccuracies, and occasional misinterpretation of user input. At times, these issues resulted in responses that did not align with the intended meaning.

"Sometimes the chatbot misunderstood my voice input or gave responses that were slightly different from the context." (P7)

"Web error or poor signal ... voice note did not input correctly." (P1)

These results highlight the importance of system reliability and input accuracy in ensuring effective interaction.

Response Content Limitations

Another challenge involved the nature of the chatbot's responses, which were sometimes perceived as too long, overly general, or not reflective of real clinical situations. This issue required learners to mentally adapt or imagine realistic contexts during practice.

"Some responses were too long ... or did not fully reflect real-life situations." (P4 & P11)

"I needed to imagine the real clinical situation." (P13)

These findings indicate that while the chatbot responses provide useful input, their contextual authenticity may be further improved.

Fluency and Cognitive Load

Participants also reported challenges related to maintaining fluency while simultaneously processing language. They often required additional time to retrieve appropriate vocabulary, construct sentences, and formulate responses, particularly in a clinical context.

"One challenge was maintaining fluency while thinking about the correct medical terms." (P14)

"I needed more time to think about the correct vocabulary or sentence structure before responding." (P2)

These findings suggest that real-time conversational demands impose cognitive load, especially for learners at lower proficiency levels.

Overall, the challenges associated with using a chatbot as a conversational partner reflected a combination of interactional limitations, technical constraints, and cognitive demands. While the chatbot effectively supported structured and interactive speaking practice, issues related to natural conversation, response accuracy, contextual relevance, and real-time language processing highlight areas for further refinement and pedagogical support.

Discussion

This study focused on the effectiveness of the proposed chatbot-augmented flipped and case-based learning model in enhancing students' linguistic and clinical communication competence. The significant quantitative improvements and positive perceptions the participants noted suggest that the integration of structured guidance, real-time interaction, and immediate feedback play an important role in supporting students' learning outcomes. Simultaneously, several challenges—including lack of natural-sounding conversation, technical limitations, and cognitive load—indicate that the implementation requires further refinement. These findings will be discussed in this section in relation to relevant theoretical perspectives, previous studies, and their implications for instructional design, AI integration, and future research in EMI healthcare education.

The significant improvement in the students' performance suggests that the chatbot-augmented flipped and case-based learning model successfully promoted active and meaningful learning experiences among the participating EMI healthcare students. In the first phase, the students were introduced to the structure of the OET speaking task, including clinical conversational patterns, commonly used healthcare vocabulary, and relevant grammatical expressions, to build a foundational understanding before communication practice. After this preparation stage, the chatbot functioned as a guided practice tool that provided structured exercises and immediate feedback to strengthen students' familiarity with linguistic and clinical communication expressions. Subsequently, it acted as a conversational partner that enabled students to engage in interactive communication practice based on an uploaded case in a low-anxiety environment before participating in classroom activities. During in-class sessions, role-plays allowed students to apply their language and clinical communication skills in authentic healthcare contexts. This model aligns with learner-centered and deep learning principles that emphasize active engagement, reflection, interaction, and contextualized communication practice.

Previous research has highlighted the important role of AI chatbots in supporting speaking and communication practice in language learning. Several studies indicate that AI chatbots can function as conversational partners, automated assessors, and structured rehearsal tools that facilitate the development of fluency, pronunciation, grammar, confidence, and willingness to communicate. Empirical and quasi-experimental research papers have demonstrated that chatbot-mediated speaking practice can significantly improve learners' oral performance, particularly when they engage in simulated dialogues supported by immediate feedback [8, 22, 23]. These findings support those of the present study, in which the chatbot was used not only as a guided practice tool but also as a conversational partner before classroom interaction.

In addition, previous studies have consistently reported positive affective outcomes from chatbot-assisted learning. Learners tend to experience reduced speaking anxiety and increased confidence when interacting with chatbots in low-pressure learning environments [7, 24, 25]. Furthermore, improvements in learner engagement and willingness to communicate are more evident when chatbot activities are integrated into structured instructional designs such as flipped learning models [14, 26, 27]. Similar patterns were observed in the present study, in which students completed structured pre-class preparation through chatbot-guided activities before participating in collaborative case discussions and role-plays in class.

However, despite these positive outcomes, the findings also reveal several challenges the participants experienced with the chatbot-assisted learning. During the conversational partner phase, students experienced challenges associated with natural conversation, response accuracy, contextual relevance, and real-time language processing. Several students perceived that chatbot interactions were occasionally less natural or flexible than human communication, particularly when handling complex clinical responses or extended conversations. At times, technical constraints and delays in processing responses also disrupted communication flow and reduced interaction authenticity. These findings suggest that while chatbots can effectively support speaking practice and communication rehearsal, further refinement in conversational design, contextual understanding, and pedagogical integration remains necessary. These findings are consistent with those of previous studies reporting similar problems with chatbot interactions, including inaccurate speech recognition, irrelevant responses, technical dependency, and limited conversational authenticity [7, 23, 24].

In the guided practice phase, students occasionally faced limited vocabulary retrieval and difficulties understanding chatbot responses, which affected interaction efficiency and learning flow. Likewise, during the conversational partner phase, the participants perceived the chatbot interaction as less natural and flexible compared with human communication, particularly when handling complex clinical situations or extended conversations. These findings align with those of previous studies reporting robotic conversational patterns, system latency, and limited contextual adaptability in AI-mediated interaction [25, 28, 29]. In addition, previous research has highlighted that lengthy or advanced AI-generated responses may increase learners' cognitive load and require teacher scaffolding [8]. Therefore, while chatbot-assisted learning offers considerable pedagogical potential, the present research work highlights the importance of effective instructional design and teacher facilitation to support meaningful communication practice in EMI healthcare education contexts.

Main Contribution

These findings are consistent with those of previous studies emphasizing the effectiveness of chatbot-assisted speaking practice in language learning. However, the present study extends the existing literature in several important ways. While previous research primarily positioned chatbots as conversational partners, this study integrated a chatbot as a guided practice tool that introduced linguistic and clinical communication patterns and as a conversational partner that facilitated interactive rehearsal before classroom activities. In addition, the study combined chatbot-assisted learning with flipped and case-based learning within authentic OET speaking instruction, creating a more structured and contextualized learning framework for EMI healthcare education.

Furthermore, this research simultaneously developed linguistic competence and clinical communication competence—two aspects that previous studies often examined separately. This integration of AI-supported learning into authentic OET-based communication tasks demonstrates how chatbot technology can support meaningful, contextualized, and professionally relevant communication practice in EMI healthcare settings.

Therefore, this study contributes to the growing body of research on AI-assisted language learning by offering a more comprehensive instructional framework that combines structured preparation, interactive communication practice, and authentic clinical learning experiences.

Theoretical Contributions

The present study provides several theoretical contributions to the growing literature on AI-assisted language learning, flipped learning, and EMI healthcare education. First, it expands the pedagogical role of AI chatbots by conceptualizing them as both conversational partners and guided practice tools that support learners' gradual preparation before interactive communication. This dual-role framework provides a more comprehensive understanding of how chatbots can facilitate both foundational language development and communicative rehearsal within structured learning environments.

Furthermore, the study contributes to the integration of flipped learning and case-based learning theories in OET-based healthcare communication instruction. By combining pre-class AI-supported preparation with in-class collaborative case discussions and role-plays, the research demonstrates how learner-centered and deep learning principles can be operationalized in EMI healthcare contexts. The findings reinforce the importance of authentic, contextualized, and interaction-focused learning experiences in developing both linguistic and clinical communication competence.

Therefore, the study offers a theoretical foundation for designing AI-supported instructional frameworks that integrate structured preparation, interactive practice, and authentic professional communication tasks.

Implications

The study findings have several important implications for EMI healthcare education and AI-assisted language learning. First, they highlight the importance of combining structured preparation with interactive communication practice in developing students' linguistic and clinical communication competence. Here, students first learned the OET speaking structure, clinical conversational patterns, vocabulary, and grammatical expressions before engaging in the chatbot-guided practice and conversational interactions. This staged learning process appears to have supported the students' readiness and confidence to participate in collaborative classroom activities. Second, the findings demonstrate AI chatbots' potential to create flexible and low-anxiety learning environments that encourage independent practice and active participation. The integration of chatbot-assisted learning within flipped and case-based learning frameworks illustrates that AI technology can effectively support authentic and contextualized communication practice in healthcare education. Finally, the results indicate that teachers should balance technological support with teacher facilitation, collaborative interaction, and authentic classroom communication activities.

Limitations

This study has several limitations that may provide directions for future research. First, it involved only one class of 18 students, limiting the findings' generalizability to broader EMI healthcare education contexts. In addition, the relatively short duration—seven weeks, including the pre- and post-test phases—may not have fully captured the long-term impact of the learning model on the participants' linguistic and clinical communication development. Therefore, future studies are recommended to involve larger and more diverse participant groups and conduct

longitudinal investigations to examine the sustainability of learning outcomes, students' adaptation to AI-supported learning environments, and the long-term development of communication confidence and professional readiness across different educational settings.

Conclusion

This study aimed to investigate the effectiveness of a chatbot-augmented flipped and case-based learning framework in enhancing students' linguistic and clinical communication competence in EMI contexts. The findings demonstrate that the integration of structured guidance, interactive communication practice, and immediate feedback significantly contributed to the participants' learning outcomes, as reflected in their performance improvements and positive perceptions of the integrated framework. These results suggest that the chatbot-augmented flipped and case-based learning model has considerable potential to support communication-oriented learning in EMI healthcare education. Nevertheless, several challenges, including lack of conversational naturalness, technical constraints, and cognitive-linguistic demands, indicate that the implementation of AI-assisted learning environments requires further refinement and pedagogical support to maximize its effectiveness.

Future studies could expand the implementation of the instructional framework to various disciplines and educational contexts beyond healthcare education. The integration of chatbot-assisted learning, flipped learning, and case-based activities may also be explored in other EMI programs or communication-oriented courses to examine such frameworks' adaptability and effectiveness in various learning environments. Furthermore, future research could compare different AI tools, chatbot designs, or instructional approaches to identify the most effective strategies to support communication-focused learning in higher education contexts.

Abbreviations

AI

Artificial Intelligence

EMI

English as a Medium of Instruction

OET

Occupational English Test

EMP

English for Medical Purposes

WTC

Willingness to communicate

HOTS

Higher-order thinking skills

CBL

Case-based learning

Dr. OET Speaking

An AI chatbot developed for this study and used as both a structured practice tool and a conversational partner in OET speaking instruction

Declarations

Availability of data and materials

The corresponding author will provide the datasets analyzed during the current study upon reasonable request.

Clinical trial number: not applicable.

Declarations

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Ethics, Consent to Participate, and Consent to Publish declarations:

Ethics statement

Permission to conduct the study and collect research data at the Faculty of Medicine, President University, was granted by the Medical Study Program, Faculty of Medicine, President University, through Letter No. 079/SKR/II/2026/FK-Presuniv, dated 12 February 2026. The permission was issued in response to Research Permit Letter No. 961/UN39.6.SPs/LT/2026, dated 9 February 2026, from the Graduate School of Universitas Negeri Jakarta. The collected data were used solely for academic and research purposes in accordance with the approved research title and objectives. A copy of the permission letter and its acceptance is available here-
<https://drive.google.com/drive/folders/1DCUW6V48NiDP1oSnUdVtYTCsr9LB70zL?usp=sharing>

Accordance/Ethical Guidelines Statement

All procedures involving human participants were conducted in accordance with the applicable institutional requirements and ethical principles for research involving human participants. Participants' privacy, anonymity, and confidentiality were maintained throughout the data collection, analysis, and reporting processes.

Informed Consent to Participate

Informed consent was obtained from all individual participants included in this study prior to their participation. Participants were informed about the purpose of the study, the voluntary nature of their participation, the procedures involved, and their right to withdraw from the study at any time without any academic consequences.

Consent to Publish: Not applicable

The manuscript does not contain any identifiable personal information, images, recordings, or individual participant data requiring consent for publication.

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Figures

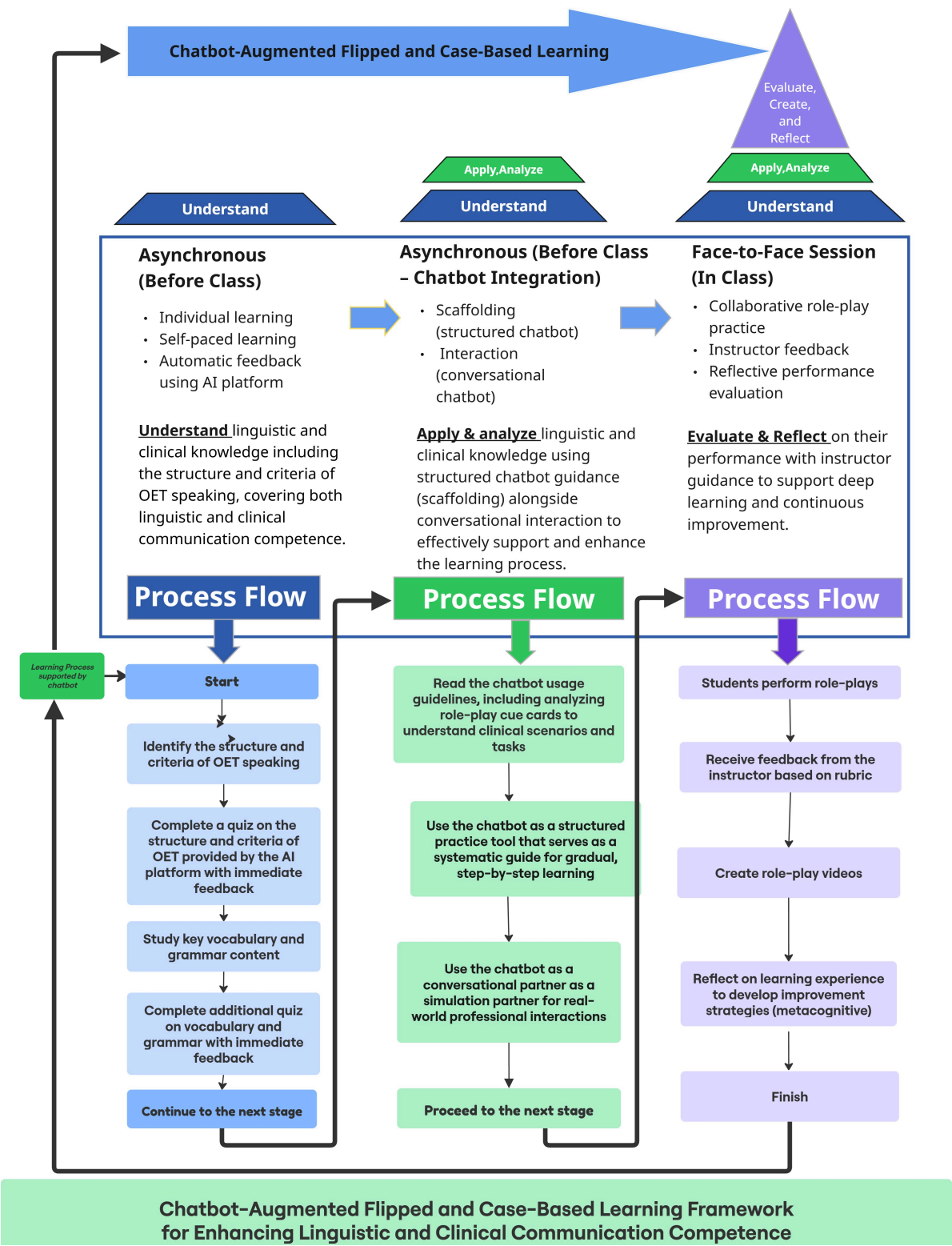


Figure 1

Diagram 1:

Chatbot-Augmented Flipped and Case-Based Framework

Supplementary Files

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- [AnExampleofpracticewithchatbotasaconversationalpartnerbyAnin.pdf](#)
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