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Teaching foreign language with conversational AI: Teacher-student-AI interaction

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Abstract

This study investigated the usage of conversational artificial intelligence (CAI) to support learners in foreign language classrooms. It employed Google Assistant and focused on the interactions between the teacher, learners, and CAI, as well as the teacher's collaboration with CAI. Using social network and content analyses of two 50-minute language classes and group interviews, this study revealed that the teacher and CAI played a significant role during classroom interactions. The teacher employed various talk moves to facilitate interactions between the students and CAI. There were several instances of collaboration between the teacher and CAI during classroom facilitation. This study highlights the implications of the collaboration between human teachers and CAI in classrooms for teaching foreign languages and suggests avenues for future research.

Introduction

In 2022, OpenAI developed and launched the Chat Generative Pre-Trained Transformer (ChatGPT), a language model capable of generating human-like responses to text inputs. ChatGPT, with its easy access and intuitive use of natural language, has become the center of discussion on implications for education, as well as the concerns and expectations regarding artificial intelligence (AI) in classrooms. Owing to concerns of cheating and plagiarism by students, and inaccuracy in AI produced information, some US schools have recently blocked access to ChatGPT on school computers (Elsen-Rooney, 2023). By contrast, some have argued that completely banning it in schools is not realistic and instead asserted that teachers should incorporate it as an effective teaching tool (Roose, 2023).

Controversial debates on ChatGPT usage have made AI seem like a new phenomenon in education. However, AI has long been explored as a tool for enhancing education, with the earlier focus being on development of rule-based intelligent tutoring systems (Blair et al., 2007; Leelawong & Biswas, 2008). Recently, the considerable increase in investments in AI has generated educational applications with greater potential by advancing AI technology, such as machine learning, neural networks, natural language processing, and advanced image processing (Zawacki-Richter et al., 2019), and increased access to commercially available AI devices. A systematic review confirms this by highlighting an increase in the number of published papers exploring AI usage for personalized intelligent teaching, assessment and evaluation, smart schools, and remote education, since 2015 (L. Chen et al., 2020). Among varying definitions of AI driven by its evolving nature and extensive application across multidisciplinary fields (X.

Chen et al., 2020), in this study, we define conversational AI (CAI) as a system that mimics human conversational abilities in text or voice.

CAI systems have been increasingly adopted in language education to provide interactive communication opportunities (Fryer et al., 2019; Hapsari & Wu, 2022). Researchers have acknowledged several challenges in current language classrooms, including limited opportunities to engage in authentic communication with native speakers (Alharbi, 2015; Jo, 2008; Terhune, 2016) and foreign language anxiety (Teimouri et al., 2019). Language learners can improve their speaking and writing skills and gain confidence to communicate in foreign languages through interactions with CAI. Increasing interest in CAI's potential has led to reviews on overall trends in research on AI in language learning (Liang et al., 2021), aggregation of the results of studies that examined the usefulness of AI from the perspective of technological, pedagogical, and social affordances (Huang et al., 2021), and identification of the roles played by AI and teachers (Ji et al., 2023). However, to the best of our knowledge, no empirical studies have analyzed classroom interactions in CAI-integrated language classrooms. Consequently, our understanding of the interactions between various actors in CAI-integrated language classrooms and how teachers facilitate language learning while collaborating with CAIs remains limited. Specifically, little is known about how CAI affects discourse and interaction patterns in language classrooms. Therefore, this study investigates the incorporation of CAI into foreign language classrooms and answers the following research questions:

1. How do language learners, teachers, and CAI interact in a CAI-integrated language classroom?
2. How do language teachers facilitate interactions in a CAI-integrated language classroom?

Literature Review

Sociocultural Perspectives in Language Learning

Vygotsky's sociocultural theory emphasizes the crucial role of social interaction and cultural context in cognitive development (Vygotsky & Cole, 1978). Accordingly, learning and development are inherently social processes that occur through collaboration with more knowledgeable individuals. Building on this theory, Lantolf (2006) argued for the importance of mediation and internalization in second language acquisition. Lantolf acknowledged the shared construction of knowledge through interactions in sociocultural contexts, imitation as a process of internalization, and feedback as a dialogic process.

While Vygotsky's sociocultural theory emphasizes the social nature of cognitive development, interaction theory (Chapelle, 2005; Li, 2018; Long, 1996) focuses on the critical role of communicative interaction in second language acquisition. Interaction theory posits that language learners' collaborative efforts to interact and communicate with other speakers are crucial to language learning. Similarly, Long's (1996) interaction hypothesis theory emphasizes the importance of engaging in the negotiation of meaning during instances of communication breakdown. Through these interactive exchanges, learners gain awareness of the discrepancy between their language production and that of native speakers; this stimulates their attention toward new vocabulary and linguistic structures. Furthermore, the process of negotiating meaning allows learners to receive feedback from interlocutors, thereby prompting adjustments to their language production.

These theoretical perspectives have influenced how researchers investigate interactions in language classrooms. From a sociocultural perspective, investigating classroom interactions during language learning is critical because learners' acquired knowledge and skills are inseparable from their continuous engagement in recurrent context-specific learning interactions (Hall, 2010). Previous studies have demonstrated that language teachers' interactions with students play a critical role in shaping classroom discourse and creating opportunities for learning (Thoms, 2014), as well as influencing classroom dynamics, student engagement, and participation (Smit et al., 2022), which significantly impacts student learning and development in the second language learning context. For instance, Smit et al. (2022) investigated the dynamics of questioning and response patterns between language students and teachers. Their findings highlight the substantial impact of such interactions on the level of student engagement and participation in the language classroom, emphasizing the importance of teachers' understanding and effective responses

to learner utterances.

Analytic Approaches to Classroom Interaction

Research on classroom interactions has focused on both online and in-person learning environments. While some studies have investigated the evolution of online learning communities and student interactions during discussions (e.g., Wu & Nian, 2021), others have examined interaction dynamics in traditional classrooms (Cooc & Kim, 2017; Martínez et al., 2003). These studies have often employed social network analysis (SNA) as a valuable analytical tool. It visually represents interaction patterns, offering insights into network structure, individuals' positions within the network, and the flow of resources across the network over time (Carolan, 2014).

Using SNA researchers have examined the relationship between dynamic classroom networks and student learning. By focusing on individual actors of social networks in online language learning classrooms (e.g., students and teachers), studies have clarified online discussion interaction patterns at different time points, student participation (Zheng & Warschauer, 2015), social presence (Satar & Akcan, 2018), and cognitive engagement (Zhu, 2006). For instance, Zheng and Warschauer (2015) compared the sociogram of the first and last two months of an eight-month online discussion and found a significant shift in the teacher's role; the teacher shifted to a peripheral position in the network, and student responses to the teacher's posts increased. In traditional classroom environments, researchers have explored students' learning experiences by analyzing the development of collaborative patterns in computer-supported collaborative learning settings (Martínez et al., 2003) and the influence of students' reading skills on their peers in interconnected peer relationships (Cooc & Kim, 2017).

While SNA offers a visual representation of classroom interactions, supplementary qualitative analyses can provide a deeper understanding of the interaction dynamics. Numerous studies on classroom interactions have integrated SNA with various methods, such as qualitative content analysis (Zhu, 2006), discourse analysis (Matsuzawa et al., 2012; Ryu & Lombardi, 2015), and growth model analysis (Zheng & Warschauer, 2015). This combined approach has more compelling implications for the relationships among actors and overall network patterns. For example, Zhu (2006) examined the association between interaction types and cognitive engagement in four online discussions. While SNA revealed no direct relationship between levels of cognitive engagement and types of interaction, content analysis indicated that cognitive engagement in online discussions might be impacted by teachers' questions and the roles they played as observers, managers, and participants. The use of additional qualitative data sources, such as open-ended questionnaires, observations, and focus group interviews, provides a more in-depth interpretation of the interaction patterns emerging from classroom activities, thus increasing analysis robustness and reliability (Martínez et al., 2003).

As discussed thus far, SNA has been widely used to study classroom interactions in various settings, mainly focusing on interactions among human participants within their networks. However, there is a limited understanding of how emerging technologies with conversational abilities can contribute as actors in the network and collaboratively shape classroom interactions with humans.

Conversational Artificial Intelligence (CAI) to Support Language Learning

In the field of computer-assisted language learning, researchers have conducted a diverse range of investigations to explore the potential of technology-enhanced learning environments that offer dynamic opportunities for language acquisition (Golonka et al., 2014). Among the many technologies available, CAI has gained popularity and its use in language learning has increased in recent years (Ji et al., 2023). Furthermore, innovations in AI technologies have opened new opportunities for teachers to better assist students by reducing their own daily workload and providing personalized and interactive learning opportunities (Chaudhry & Kazim, 2021). Researchers have explored the use of intelligent personal assistants (IPAs), such as Google Assistant, Alexa, and Echo, in language classrooms (Dizon, 2017, 2020; Moussalli & Cardoso, 2020; Tai & Chen, 2022). IPAs are integrated with smart speakers that use natural language processing and speech recognition. Their ability to provide information and perform tasks can

significantly impact second language interactions, making them a convenient language learning tool (Tai & Chen, 2022). For example, drawing on their previous research, which explored how Echo provides speaking opportunities to language learners (Moussalli & Cardoso, 2016), Moussalli and Cardoso (2020) conducted a follow-up investigation into Echo's ability to recognize and process non-native accented speech with various degrees of accentedness. The study also analyzed learners' interactions with Echo, focusing on the strategies they employed when faced with communication breakdowns. The findings revealed that learners utilized a range of strategies, including repeating, rephrasing, and abandoning questions, to overcome communication challenges.

When incorporated into language classrooms, CAI with advanced AI technologies is expected to enhance teaching and learning practices. First, it can potentially alleviate the challenges faced by current language classrooms by providing individualized feedback (Hsu et al., 2021) and speaking practice opportunities (Muhammad et al., 2020). For example, Hsu et al. (2021) and Muhammad et al. (2020) developed chatbot systems that incorporate speech recognition technology and provide opportunities for English-speaking practice. These studies have demonstrated the efficacy of such systems in relieving foreign language anxiety and improving conversational skills.

Moreover, the perspective on AI in education has evolved from considering AI systems as substitutes for human teachers to embracing a more collaborative partnership (Baker, 2016). While human teachers actively participate in instructional activities, such as data interpretation, learning activity design, and decision-making (Cukurova et al., 2019), CAIs can serve as supportive tools to enhance their efficiency and efficacy. However, little empirical evidence exists on how such collaborations would unfold in real classroom settings. Therefore, our study examined the dynamics of classroom interaction supported by CAI in a language classroom. By examining these dynamics, we examine how a language teacher facilitates a CAI-integrated language class.

Methods

This exploratory study employed an intrinsic case study approach. While an instrumental case study aims to understand a particular phenomenon by generalizing across cases, an intrinsic case study investigates a unique and specific case (Stake, 1995). Here, a 50-minute language class with one teacher, one CAI, and four students constituted one unit of analysis, and two such units were analyzed in total. This study adopted SNA to understand how learners interacted with CAI during language learning. Further, content analysis was used to interpret the SNA findings and elicit meaningful conclusions on interaction patterns, themes, and human-computer collaboration.

Participants and Research Context

Participants included one male and four female learners in their twenties from a small private English as a Foreign Language (EFL) class in South Korea. One student was absent from each of the first and second classes, and four took both classes. This unique research setting—a small private tutoring unit—was selected primarily for its accessibility.

The participants were representative of typical South Korean college students who often opted for private tutoring for language skills enhancement. Private tutoring is prevalent in South Korea owing to the high demand for English learning. English is included in school curriculum from Grade 3 onward. For Koreans, English is not merely a school subject, but rather a widely embraced national obsession, commonly referred to as the "English fever" (Paik, 2018). They have a strong desire to become proficient in English and invest time and money to practice English. The study participants signed up for an additional spoken English class offered by a private institute for the purpose of travel and making foreign friends.

Further, a small sample study allowed for improved implementation, control, and fidelity. At universities, in regular English classes of 30–40 students, the opportunities to practice verbal communication and speaking are often limited. Moreover, introducing new technologies into such classes may be more complex.

Therefore, the chosen study setting provided us with an initial understanding of how AI technology can be incorporated into language learning classrooms.

Technology and Lesson Implemented

Compared with other digital tools for language learning, CAI can enhance communication and interaction more effectively by allowing students to use natural spoken language and thus we chose Google Assistant as a CAI for the study. Our study lesson focused on vocabulary skills, and CAI provided students with many opportunities to practice pronunciation, learn vocabulary through conversations, and engage in short conversations using the target vocabulary. Additionally, Google Assistant is perceived as more user-friendly among language learners compared with other IPAs such as Alexa (Kim et al., 2019), and it can connect with other information sources enabled by Google search engines (Longo et al., 2019). Moreover, the instructor had previously used it and was familiar with it.

Each class was a 50-minute vocabulary-focused foreign language class conducted by a non-native instructor who had been instructing the students for four months. The instructor was in her early thirties and had six years of teaching experience as an EFL teacher, with an educational background in general education and taught English to non-native speakers in both the United States and South Korea. She had high overall confidence in using technology in class and had prior experience using Google Assistant for Internet searches, games, and educational purposes. Considering the learners' English proficiency level (intermediate), the instructor used both their first language (Korean) and English during the lesson.

The instructor's choice of topics was traveling in the first class and fashion in the second. Researchers and teachers co-designed the lesson plan to generate relevant and authentic activities in the classroom context. The researchers, who were familiar with Google Assistant, suggested possible activities, and the teacher selected the activities and topics for the lesson. Both classes comprised pre-, main-, and post-activity sessions. During pre-activity, the instructor gave a brief introduction to the class objectives and how to use Google Assistant, followed by an information gap activity on the target words, asking learners to write the names of the things they found in the picture in English.

In the main activity, learners engaged in vocabulary activities using Google Assistant. They shared a cell phone on which the Google Assistant app was installed and took turns asking Google Assistant questions about word definitions, meanings, or pictures. To initiate conversations with Google Assistant, learners either used the touch screen on a cell phone or a voice command saying, "Hey, Google." Google Assistant responded with the requested resources. The learners also practiced a target word by using it to make a sentence, while Google Assistant provided a contextually relevant response resembling that of a human. Further, during vocabulary gameplay (Mad Libs), it presented a sentence with blank spaces and the learners filled in the blanks with target words based on the given prompts. It then combined the learners' words with the original prompt to create a completed story and read it aloud. The teacher observed and facilitated the students' interactions with Google Assistant. Throughout the activity, the teacher maintained a balance between allowing independent interactions with the CAI and providing guidance or feedback, where necessary, thus fostering a real-time reflective environment for all interactions. Finally, the teacher summarized their learning in the post-activity session and concluded the lesson.

Data Collection and Analysis

The two 50-minute lessons were video-recorded using a GoPro® action camera installed in front of the classroom. Two semi-structured group interviews were conducted approximately 20 minutes after each class, where students were asked about their overall experience of AI-integrated language learning and their perceptions of interacting with CAI. We triangulated the video recordings of the two classes and the interview content. The video recordings served as the primary data source, whereas the interviews were used to identify the corresponding information and provide explanatory insights. For anonymity, we report the students' names as #1, #2, #3, #4, and #5.

Video Analysis

We first analyzed the video recordings, focusing on the main activity in which CAI was used. Both the verbal and nonverbal classroom interactions for the two 50-minute classes were transcribed through multiple watches and discussions. We focused on coding gestures as a form of nonverbal interaction considering their role in directing or influencing other participants. Specifically, gestures that displayed a clear intention and led to a specific response from learners were included in the analysis. This included a range of gestures, from hand movements to interactions with objects such as cell phones which were used deliberately to guide an activity or influence interaction direction. For instance, we coded an explicit gesture made by the teacher in which she handed a cell phone to Student #3. The total duration of the main activity in which CAI was integrated was 13 minutes and 23 seconds for the first class and 19 minutes and 40 seconds for the second class. We then examined each verbal and nonverbal interaction in the transcription and separated it each time a student, teacher, or CAI initiated an interaction. Within the same interaction, each transcript was separated by a punctuation marker or pause, yielding 229 interactions for the first class and 415 interactions for the second class during the main activity. For these 644 interactions, the interaction patterns were coded by identifying who initiated the interaction and whom it was aimed at. Inter-rater reliability of the interaction pattern coding was evaluated using percent agreement, a common method adopted in computer-assisted language learning studies (e.g., Timpe-Laughlin et al., 2022). The inter-rater reliability was 93.45% and 93.25% for the first and second classes, respectively. Disagreements were resolved through discussion until 100% agreement was reached.

Social Network Analysis

To answer the first research question and identify the overall interaction structure, we conducted SNA for each class using R software. To prepare the SNA data, we transformed teacher–whole class interaction data into teacher–student #1, teacher–student #2, teacher–student #3, teacher–student #4, and teacher–student #5 nodes, resulting in 490 nodes for the first class and 886 nodes for the second class. We then conducted a centrality analysis of the six actors (four students, one teacher, and one CAI) in the network.

In a network, each actor is depicted as a node, and the line connecting the two nodes signifies the interaction between these individuals. Centrality measures in SNA determine the significance of a node within a given network (Camacho et al. 2020). Degree centrality signifies the prominence of a node based on its number of connections. Betweenness centrality denotes a node's role as a connector within a network, based on the number of shortest paths in which it participates. Closeness centrality indicates a node's accessibility to others in the network; nodes with shorter average paths to others have higher centrality. Eigenvector centrality reflects the influence of a node by considering the significance of its neighboring nodes.

Content Analysis

To supplement the SNA findings and further unpack the interaction patterns, qualitative content analysis (Mayring, 2000) was performed by separately employing open coding of the interaction themes. For the teacher → student interaction pattern, our analysis was based on Wei et al.'s (2018) teacher talk move framework, which is a systematically developed teacher talk move taxonomy. Coding for teaching talk moves was gradually elaborated through continuous discussion until a consensus was reached. The inter-rater reliability of interaction theme coding using the final coding framework was 81.22% and 82.17% for the first and second classes, respectively. We had additional discussions to resolve any disagreements. Finally, to answer the second research question on language teachers' classroom facilitation, we further analyzed student–teacher and student–CAI interaction patterns through additional content analysis, focusing on the collaboration between the teacher and CAI. Specifically, we collaboratively examined classroom transcriptions to identify instances where the teacher modified teaching strategies in conjunction with, or in response to the CAI's feedback and responses.

Results

Classroom Interactions Between the Teacher, Students, and CAI

Figure 1 presents a sociogram of the interaction pattern data. In both classes, the teacher and CAI were placed in the center and connected to all four students, with no isolation found within the network. In the first class, the students were more densely connected with the teacher than with the CAI, whereas the teacher and CAI were more equally connected with the students in the second class.

Figure 1

Sociogram of (a) First Class and (b) Second Class

(a)   (b)
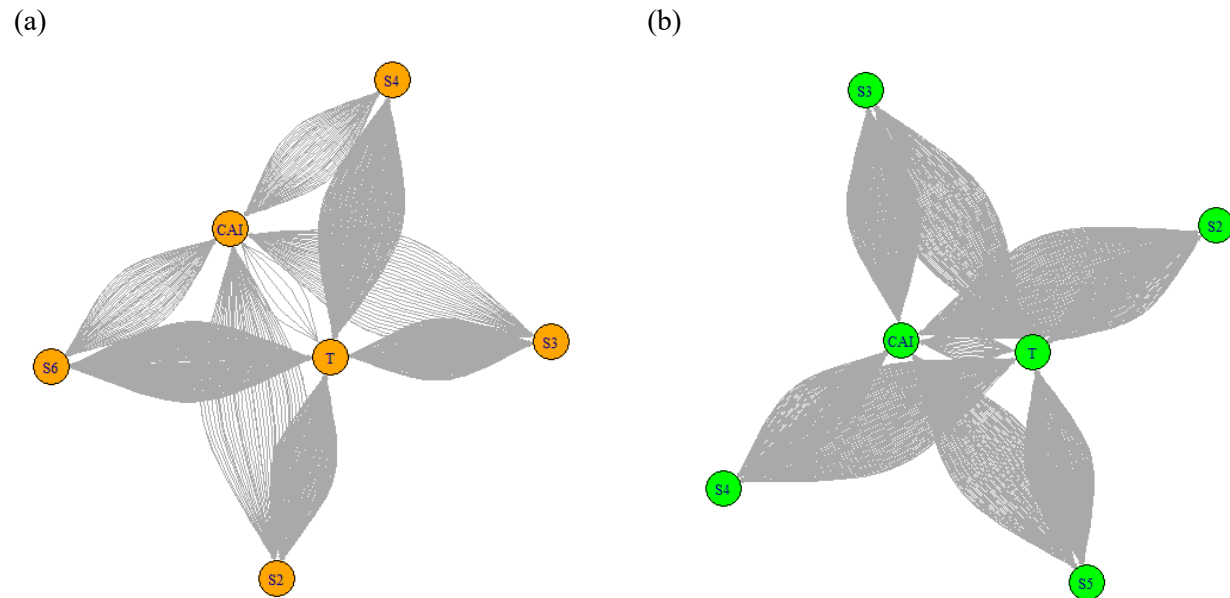
Similarly, in centrality analyses (Table 1), the teacher showed the highest eigenvector centrality among all six actors in both classes, indicating core network positions. The eigenvector centrality of the teacher decreased from 0.659 in the first class to 0.541 in the second, whereas the eigenvector centrality of the CAI increased from 0.267 to 0.474. This indicates a decrease in the teacher's influence on learners and an increase in the CAI's influence on learners. In the interviews, three learners who participated in both classes answered that their familiarity with CAI increased in the second class. Meanwhile, the betweenness and closeness measures did not change in the second class because the analysis involved a small number of actors, and a sub-network group was not established within the network to generate significant differences.

We then analyzed human–computer interactions (between students–CAI and teachers–CAI) and human–human interactions (between students–teachers) across the two classes and found 18 interaction themes, as shown in Table 2. Five interaction patterns were identified: (a) CAI → Student, (b) Student → Teacher, (c) Student → CAI, (d) Teacher → Student, and (e) Teacher → CAI. Human‐computer interactions found in the study (a, c, and e interaction patterns) were mostly one-way, that is, the CAI responded when the teacher or student initiated an interaction and did not initiate interactions. The codebook for interaction themes of each interaction pattern is provided online via Open Science Framework with example excerpts.

Table 1

Descriptive Centrality Measures for First Class and Second Class

Actor	Class 1				Class 2			
	Degree	Betweenness	Closeness	Eigenvector	Degree	Betweenness	Eigenvector	Degree
S1	128	0.200	0.125	0.374	223	0.200	0.125	0.354
S2	114	0.200	0.125	0.334	201	0.200	0.125	0.335
S3	127	0.200	0.125	0.358	206	0.200	0.125	0.333
S4	115	0.200	0.125	0.338	N/A	N/A	N/A	N/A
S5	N/A	N/A	N/A	N/A	236	0.200	0.125	0.366
T	350	4.800	0.200	0.659	477	4.800	0.200	0.541
CAI	144	4.800	0.167	0.267	427	4.800	0.167	0.474

Note. N/A indicates absent students.

Interactions Between Student and CAI

As shown in (a) and (c) in Table 2, students initiated student–CAI interactions to use the CAI as an activity partner during a Mad Libs game, check their pronunciation, and ask for learning resources, while the CAI responded by working as an activity partner, checking students' pronunciation, and providing learning resources. Furthermore, in the first class, the CAI provided learners with an authentic response when they used the target vocabulary in a sentence. For example, Student #4 said, "I'm exhausted." The CAI answered, "Yes, that's because you've been working so hard."

Interactions Between Teacher and CAI

As shown in (e) in Table 2, in teacher-initiated teacher–CAI interactions, the teacher used CAI only to model the students. For example, in the second class, the teacher said, "Show me the picture of a wardrobe." after telling students how to ask a CAI question. This type of modeling was more frequent in the second class, with 19 interactions, compared to five interactions in the first class.

Interactions Between Student and Teacher

As shown in (b) in Table 2, we found that students initiated student–teacher interactions either by asking and answering questions or by expressing feelings. Particularly, students began to express their feelings toward the use of the CAI in the second class. For example, Student #2 said, "I am not sure if I can do well this time." Student #5 said, "I am a bit irritated that it did not understand my pronunciation." In the interview, Student #2 also expressed a change in feeling by answering, "In the first class, I could not speak properly because I was a little nervous, but in the second class, I paid more attention to my pronunciation." Students answered in the interview after the second class that they were frustrated when their pronunciation was not properly recognized by the CAI, and that they were motivated to practice more to avoid frustration.

Meanwhile, as shown in (d) in Table 2, the teacher initiated teacher–student interactions in more diverse ways. Specifically, we found seven teacher talk move types (backchanneling, checking, clarifying, debriefing, instructing, modeling, and procedural) matching Wei et al.'s (2018) framework. In the first class, procedural ($n = 35$), instructing ($n = 23$), backchanneling ($n = 14$), and checking ($n = 13$) accounted for 72.65% of the teacher talk moves. Using procedural talk moves, the teacher assigned the order of the students' interactions with the CAI. Using instructing talk moves, the teacher helped the students

understand the target words, occasionally by incorporating Korean into her explanation. Backchanneling talk moves were used throughout the class to indicate that the teacher was listening to the students. Using checking talk moves, the teacher verified the students' understanding of the target words.

Table 2

Frequency of Interaction Themes in Each Interaction Pattern

Interaction Patterns and Themes	Class 1		Class 2	
	n	%	n	%
(a) CAI → Student				
1. providing learning resources	12	38.71	58	53.21
2. activity partner	15	48.39	40	36.7
3. checking pronunciation	2	6.45	11	10.09
4. simulating authentic response	2	6.45	0	0
Total	31	100	109	100
(b) Student → Teacher				
5. asking questions	23	74.20	25	54.35
6. answering questions	8	25.80	12	26.09
7. expressing feelings	0	0	9	19.57
Total	31	100	46	100
(c) Student → CAI				
8. asking for resources	11	47.83	20	37.74
9. activity partner	10	43.48	22	41.51
10. checking pronunciation	2	8.7	11	20.75
Total	23	100	53	100
(d) Teacher → Student				
11. backchanneling	14	11.97	23	14.38
12. checking	13	11.11	5	3.13
13. clarifying	3	2.56	3	1.88
14. debriefing	1	0.85	1	0.63
15. instructing	23	19.66	21	13.13
16. modeling	9	7.69	5	3.13
17. procedural	35	29.91	48	30
18. emerging talk move*	19	16.24	54	33.75
- emotional support	(7)	(36.8)	(27)	(50)
- technical support	(3)	(15.8)	(4)	(7.4)
- marking CAI's response	(9)	(47.4)	(23)	(42.6)
Total	117	100	160	100
(e) Teacher → CAI				
19. modeling	5	100	19	100

Total	5	100	19	100

Note. * indicates talk moves that were not defined in Wei et al.'s (2018) framework but emerged in our study.

Other talk move types included modeling ($n = 9$), clarifying ($n = 3$), and debriefing ($n = 1$). Using modeling talk moves, the teacher asked target words to the CAI so that students could follow. Through clarifying talk moves, the teacher refined the target words or expressions to ask the CAI. Using debriefing talk moves, the teacher summarized the students' pronunciation of the target words.

We also identified several talk moves that did not match our framework. Specifically, the teacher provided emotional and technical support and attempted to draw the students' attention to specific aspects of the CAI answers that she thought were important. For instance, during the Mad Libs activity in the first class, the teacher encouraged Student #2 by saying, "It's okay, it's okay." when the student stared at the teacher after an unsuccessful attempt at completion. Also, in the second class, the teacher drew students' attention to the CAI's response by pointing at the screen and saying, "It says glazier." When the CAI did not recognize the students' pronunciation of the word blazer, it showed a picture of a glazier.

Teacher's Collaboration with CAI for Classroom Facilitation

To answer the second research question on collaboration between teachers and CAI, we conducted additional content analysis on teacher-initiated interactions, focusing on teachers' classroom facilitation. We identified three instances demonstrating the real-time management of classroom activities: a) activity adaptation to assess individual pronunciation, b) providing clarifications to enhance student comprehension, and c) guiding students' focus and attention.

First, the teacher adopted a learning activity to facilitate whole-class engagement in practicing the pronunciation of challenging words. In the second class, the teacher noticed that students were struggling with the correct pronunciation of the target word "hesitate" and promptly redirected their attention to this specific word, facilitating multiple whole-class practice opportunities. Subsequently, the CAI offered individual students the opportunity to assess their pronunciation by acting as a virtual native speaker. In cases where the CAI failed to recognize the students' input, the teacher encouraged them to continue practicing the word until their pronunciation was accurately detected.

Excerpt 1

Teacher	We had difficulties with the word hesitate, right?
Teacher	Let's practice together.
Class	Hesitate.
...	
Teacher	(Giving cell phone to Student #3) Okay.
Student #3	Hesitate.
CAI	Here's the definition of hesitate.
CAI	Pause before saying especially through uncertainty.
Teacher	Okay, good.
Student #4	Hesitate.
CAI	Here's the definition of hesitate.
CAI	Pause before saying especially through uncertainty.
Teacher	Okay.

Student #2	Hesitate.

Second, the teacher provided clarifications to enhance student comprehension. During class activities, CAI played a crucial role in aiding students' understanding of the target words by presenting them with pertinent resources, including word definitions and visual aids. When the teacher deemed it necessary, she attentively repeated the complete phrase or portion while providing a Korean translation. In the interviews, the students found the matching pictures and the teacher's additional explanations were instrumental in understanding word meanings.

Excerpt 2

CAI	This is the definition of hesitate.
Teacher	Listen to its definition.
CAI	Pause before saying especially through uncertainty.
Teacher	Pause.
Teacher	Pause is 일시정지 [Korean translation of pause].
Teacher	Pause before saying especially through uncertainty.
Teacher	Saying or doing something, you pause.
Teacher	It's like 주저하다 [Korean translation of hesitate].
Teacher	Okay? Did you get it?

Additionally, following the CAI definition, the teacher deconstructed the definition into smaller segments and guided students to focus on the most relevant chunk for enhancing their comprehension of the target words. Additionally, the teacher provided an explanation closely related to the target words to further aid their understanding.

Excerpt 3

CAI	Here is the definition of exhausted.
CAI	Drained of one's physical or mental resources.
CAI	Very tired.
Teacher	It was at the end.
Teacher	Very tired.
Teacher	Very tired.
Teacher	What is it?
Teacher	Exhausted.
Student #3	Very tired.
Teacher	Yes, it means very tired.
Teacher	Exhausted means more tired than the word tired.

Excerpt 4

CAI	Here's the definition of trousers.
CAI	An outer garment covering the body from the waist to the ankles, with a separate part for each leg.

Teacher	Let me read it one more time for you.
Teacher	Waist to the ankles and waist to the ankles with separate parts
	for each leg.
Teacher	Waist to the ankle.
Teacher	Separate parts to the leg.

Discussion

The purpose of this case study was to examine interaction patterns and themes that emerged in a CAI-integrated vocabulary-focused foreign language class, as well as to explore teachers' classroom facilitation while collaborating with CAI. Utilizing Vygotsky's sociocultural theory, we showcased a unique form of interaction where technology became the more knowledgeable individual, as opposed to previous computer-mediated communications research that typically examined technology-facilitated interactions (Kim, 2014; Zeng, 2017).

Patterns and Themes Emerged from Students–Teacher–CAI Interactions

To answer the first research question, we examined the interaction patterns and themes identified in the two CAI-integrated EFL classes. Five interaction patterns (CAI → Student, Student → Teacher, Student → CAI, Teacher → Student, Teacher → CAI) emerged and we conducted SNA on these patterns to visualize the overall interaction structure. The teacher and CAI were both found to play central roles during classroom interactions across both sessions. These results suggest that language teachers still play a pivotal role in CAI-integrated language classrooms. This finding supports many previous studies that emphasize the presence of teachers in AI-integrated education (Baker, 2016; Chaudhry & Kazim, 2021). Meanwhile, the teacher's interaction frequency in the network decreased in the second session compared to the first, while CAI's interaction frequency relatively increased, suggesting that students have become more accustomed to interacting with CAI and their interaction with CAI increased, facilitated by the teacher.

We then focused on the themes for each interaction pattern. During the interactions between students and the CAI, the students used the CAI as an activity partner, a source of additional resources related to target words, and a pronunciation checker. In turn, the CAI responded to these requests. Conversely, when interacting with the teacher, the students posed questions and provided answers while expressing their emotions. While students asked straightforward questions to the CAI about word meanings and pictures, they presented more context-specific questions related to target words and expressions to the teacher, such as "Is this word really used in the United States?" The students started to express their feelings in the second class.

For teacher's interactions with students and CAI, we found seven themes (backchanneling, checking, clarifying, debriefing, instructing, modeling, and procedural) aligned with Wei et al.'s (2018) teacher talk moves framework. While some talk moves were equally frequent in both classes, checking and modeling during teacher → student interactions dropped slightly in the second class. The modeling talk moves increased during teacher → CAI interactions, but this was because the teacher intervened in the Mad Libs activity to shorten the gameplay time and end the class on time. We assume that in the second class, the need for the teacher to check students' understanding decreased because both the teacher and students became more familiar with using CAI in the classroom. In the interview, one student reported feeling that she became closer to the CAI in the second class. Another notable finding was that the teacher used talk moves not defined in the framework more frequently during the second class. Particularly, the teacher increasingly supported the students' emotional needs, directed their attention to the CAI's response, and employed facilitation strategies more actively. For example, the teacher diversified her approach to encourage students (e.g., using high-fives) and created enjoyable learning experiences in the second class.

Evidence of Teachers' Collaboration with CAI

Next, we explored the human–computer collaboration within a CAI-integrated language classroom to address the second research question. From the results, we found evidence of collaboration between the teacher and CAI in facilitating learning activities. In many instances, the CAI provided support to the non-native English-speaking teacher by assuming roles traditionally defined as teachers' responsibilities in language classrooms (Brandl, 2007), such as providing resources and evaluation. As a virtual native speaker, the CAI actively engages in communication and interaction with students, offering them opportunities to practice vocabulary pronunciation and providing word definitions using native pronunciation. During this process, students could not only evaluate their listening skills but also gauge the accuracy of their pronunciation based on whether the CAI could comprehend their speech. This student–CAI interaction was continuously facilitated by the teacher, who engaged in real-time reflective management of all activities. The collaboration between the teacher and CAI established a learning context wherein students could imitate native speakers' pronunciation with the assistance from more advanced English speakers, the teacher and the CAI. This approach aligns with the sociocultural perspective (Vygotsky & Cole, 1978) and is endorsed by various interaction theorists (e.g., Li, 2018).

Language teachers' concerns and discussions about where they stand in AI-integrated language classrooms have increased exponentially since the popularity of ChatGPT. Our findings suggest that the use of CAI can build a collaborative relationship with teachers rather than replace them, as suggested by AI researchers (Baker, 2016; Chaudhry & Kazim, 2021). This pioneering empirical examination highlights the need for additional research on human–computer collaboration and classroom orchestration, as it has the potential to provide valuable teaching strategies for CAI-integrated language classrooms.

Conclusion

Limitations and Suggestions for Future Research

Although the study provided important insights on CAI usage in language teaching, it was limited by its focus on only two lessons. Future studies with longer intervention times would better capture the dynamics of teacher roles and human–computer collaboration in CAI-integrated language classrooms. Additionally, in-depth interviews with teachers will offer a better understanding of the rationale behind the use of different talk moves in classrooms. Additionally, while a few studies (Dizon, 2017; Moussalli & Cardoso, 2020) have explored language learners' perceptions of IPA, the interaction with IPAs in these studies was as short as 20–30 minutes and was not part of a regular class. More studies are needed that incorporate CAI as part of language learning activities and measure language learners' perceptions of the benefits and challenges of CAI-integrated classes using different methods such as technology acceptance surveys and student interviews.

Furthermore, both classes were heavily teacher-centered, limiting the interactions between students. More classroom interaction studies in CAI-integrated classrooms are needed to incorporate collaborative tasks and diverse learners with varying English proficiency levels and familiarity with CAIs. Students from diverse backgrounds may have different levels of language anxiety and consequently show different interaction patterns. Finally, we did not examine the relationship between dynamic interaction patterns and the students' language learning performance. Future studies should measure learners' language skill improvement outcomes and explore their association with teacher facilitation in CAI-integrated foreign language classrooms.

In our study, we conducted an empirical examination of the collaboration between a human teacher and CAI in a small language classroom. While our focus was primarily on this unique collaboration, there is a broader landscape we did not explore: classroom orchestration. This encompasses the intricate task of managing individual learners, smaller groups, and the class as a whole, particularly in CAI-augmented environments. Given the evolving landscape of CAI-incorporated language classrooms, understanding these orchestration strategies can offer invaluable insights into teaching methodologies for language

teachers. Although the dynamics and interactions observed in our private classroom setting offer a foundational understanding, we acknowledge that they do not directly represent the challenges and complexities of orchestrating larger formal classrooms. Teachers' classroom facilitation can be more nuanced in larger classroom settings. We recommend that future research delve into these classroom orchestration strategies in larger and more varied educational contexts and explore the interplay between teachers, students, and CAIs in managing and enhancing the learning experience.

Study Significance

Innovations in AI technologies have opened new opportunities for language teachers to better assist students' learning processes and tackle perennial concerns in foreign language classrooms. However, as an emerging technology, no study has provided an in-depth analysis of classroom interactions when CAI is incorporated into language learning. The findings of this study provide empirical evidence that CAI can be efficiently integrated into language classrooms, demonstrating teachers' classroom facilitation and suggesting ways to build partnerships with CAI.

In the evolving landscape of language learning, this study dives deep into the interactions underpinned by sociocultural theory, shedding light on a fresh dimension in which technology is not just a mediator but also an active participant in learning. Our exploration unveils new avenues for how learners engage in and internalize learning when technology is an equal or more proficient learning partner. This study calls for further CAI-based language-learning studies with diverse learning scenarios and longer intervention times. Beyond these pedagogical contributions, we expand the previous methodological approach to SNA in online language learning environments to investigate different actors in CAI-integrated language learning classrooms.

Acknowledgements

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