

## Chapter 14

# When iVR Meets AI: Practices and Challenges for Language Educators

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Increasing developments in educational technology have redefined language pedagogies through the use of digital tools enabling multi-user interactivity and content creation. Given the increasing use of AI in task-oriented language practices, there is a need to train language teachers to use AI in contextualized linguistic practices. These competencies can be supported by preparing language teachers to use AI with immersive Virtual Reality (iVR) for classroom-based language activities. However, the literature lacks inquiries on language activities grounded on AI and iVR-based collaborative group work. Attempting to bridge this gap, this study presents the results of interventions using the iVR platform Workrooms and ChatGPT conducted at the University of Arizona with language educators attending a professional development course on educational technologies. Data collected from observations of teachers' activities and a post-activity questionnaire provides methodological suggestions for integrating VR and AI in language learning contexts. This contribution gives indications of the technological skill sets necessary to teach and learn languages with AI and iVR needed to socially and professionally interact in an increasingly digital world.

## Introduction

The use of immersive Virtual Reality (iVR) and Artificial Intelligence (AI) has gained momentum in language education research, calling for redefinitions of the teaching practices targeting students' development of collaborative digital communication. To promote the linguistic practices necessary to attain such skills, students can be involved in collaborative tasks

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where they co-create digital materials. Such design activities can heighten language retention and engage students in co-constructing linguistic structures (Johnson & Johnson, 2005). To help the development of these skills, it is necessary to incorporate digital tools that afford the development of higher-order thinking skills and interactivity while using interoperable virtual systems to break physical classroom barriers. Due to the evolving nature of iVR and AI, teachers need to keep their technical knowledge up to date to be able to adopt pedagogical methods supporting students' digital collaboration.

The present pilot study aims to answer the following question: how can observations of language teachers' interactions with generative AI in an iVR environment guide future professional development methods? It is hypothesized that participants' possession of technical knowledge facilitates their collaborative interactions in class planning, as it is necessary to conduct iVR activities with interactional fluidity and navigate ChatGPT with some degree of autonomy. The study attempts to identify the impact of the combined use of iVR and AI in devising language activities to boost participants' collaborative interactions. It displays the results associated with teachers' exposure to iVR and AI through involvement in a task-based language activity conducted with the platforms Horizon Workrooms and ChatGPT. Data was collected through a mixed-methods analysis hoping to cast light on teachers' acquisition of pedagogical and methodological information necessary to boost students' collaborative skills in language learning scenarios combining the use of iVR and AI tools. Promising results show overall high scores attributed to the acceptance and usability of iVR and AI for language learning purposes and provide useful information on the skill sets and instructional guidelines necessary to teach and learn languages with AI-supporting iVR tools.

The study was underpinned by a literature review of pedagogical and methodological considerations related to VR use in language education. The widespread implementation of highly interactive technologies has revolutionized interpersonal communication as individuals rely on computer-mediated communication (CMC) to successfully achieve professional and educational outcomes. From a CMC perspective, the deployment of iVR and AI tools has enabled individuals to attain high levels of realism in conducting collaborative virtual interactions and solving task challenges. Part of the reason behind such effective collaborative affordances can be found in iVR and AI tools. While the former is defined as an "advanced form of human-computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion" (Eichenberg, 2012, p.3), AI is intended to broadly incorporate "computational systems involving algorithms, machine learning methods, natural language processing and other techniques operating on behalf of an individual to improve a communication outcome" (Hancock et al., 2023, p. 90).

Amongst AI tools, ChatGPT has gained worldwide interest since its release in November 2022 as a large language model (LLM) trained to assist users in optimizing communication goals, processing and solving assigned tasks, and sourcing information (Adiguzel et al., 2023; Baidoo-Anu & Owusu Ansah, 2023; Bitzenbauer, 2023). In late 2021, Meta released Horizon Workrooms, a highly engaging iVR platform allowing people to interact through avatars in a virtual meeting room equipped with a whiteboard, projectors, and three options of desk

configuration (Hendrick et al., 2022). The environmental affordances of this iVR space make it usable as a virtual language learning classroom.

Implementing these tools in language education has redefined the pedagogical underpinnings behind collaborative language learning. With the increasing permeation of VR and AI in language education, researchers have enquired about the skills students may develop in educational contexts that blend in-person and remote learning practices. This implies considerations of the competencies that students should develop to interact in a foreign language with human and virtual agents.

Deploying critical skills in the language classroom can assist users in making the best decisions to achieve group goals (Lipman, 1988). Improving such skills is relevant from a language education perspective since to collaboratively conduct group activities with the use of technology, individuals need to establish criteria of validity and consistency to assess digital materials as well as be cognitively accountable and intellectually responsible for communicative and interactional decisions. When teachers plan and deliver collaborative language learning activities with iVR and AI technologies, they need to scaffold activity contents favoring the development of the technical and linguistic skills required to interact with avatar-embodying peers and AI interfaces to search, optimize, question, and select information to achieve task goals (van Gelder, 2005; Sharma et al., 2022). Therefore, teachers must possess the technological know-how to support students in the collaborative use of iVR and AI interfaces to facilitate their interactions and optimize communication strategies and information retrieval to complete task activities.

According to the Common European Framework of Reference for Languages (CEFR) by the Council of Europe (2020), it is necessary for students to develop their language skills in conjunction with mediation strategies, critical thinking, creativity, collaboration, information, media and technology literacy (González-Salamanca et al., 2020; González-Pérez & Ramírez-Montoya, 2022). Facilitating students' acquisition of these competencies has often challenged teachers since it involves careful lesson planning and knowledge of the technologies needed to achieve language-based task goals (Sulaiman & Ismail, 2020, Haug & Mork, 2021). The situation is further complicated by rising concerns about using iVR and AI as language-learning tools and the fact that an iVR environment increases distractions and the cognitive load of task completion. Moreover, students need to be aware that the information sourced via AI interfaces may not be trustworthy. This demands that teachers consider pedagogical as well as technical aspects when introducing AI in classroom activities (Calabrò & Naro, 2019; Makransky et al., 2019, Hou, 2020; Bozkurt et al., 2021; Kasneci et al., 2023). Investigations on evolving language teaching practices through iVR and AI interfaces are needed to help to better understand system interoperability and social collaboration in this context.

The introduction of AI in digital education has called for thorough investigations on the collaborative affordances of using artificial agents to assist students in conducting assigned language tasks (Hockly, 2023). However, the use of AI in language learning tasks has also raised issues concerning the creation of prompts eliciting pertinent responses and the critical evaluation

of AI feedback (Markauskaite et al., 2023). Training and assessing students' AI competencies by language teachers might help to shed light on designing learning experiences fostering students' evaluation of AI feedback and critical thinking. Further analysis is needed in investigating such AI practices within collaborative language learning scenarios to mitigate the potential drawbacks of engagement loss resulting from exposure to technologies unsuited for group activities. A technology that might facilitate interventions of this kind is iVR. In fact, iVR language learning applications were shown to benefit students' collaboration and facilitations of teachers' class planning through classroom management tools and avatar interactions (Pirkkalainen et al., 2021). However, to integrate iVR technologies in language education, teachers must possess self-awareness and accountability, developed through prolonged exposure to the target technologies (Holly et al., 2021).

Studies on iVR-based language education have highlighted its benefits for students' goal orientation, including cognitive load reduction through avatar real-likeness, facilitations of group behaviors, and increases in entitativity and enjoyment (Han et al., 2023; Makransky & Petersen, 2023). Therefore, for the successful implementation of these technologies, it is believed that teachers need to experience students' learning situations through collaborative class planning. Teachers often lack awareness of how collaborative learning activities unfold through iVR/AI use, hence the need to increase their exposure and hands-on experiences. However, whilst recognizing the need for pedagogical inquiries on distributed collaboration with immersive technologies, the majority of research has been student-centric. Less attention has been placed on teachers' exposure to collaborative training settings before the implementation of iVR and AI technologies in language classrooms. What emerges from these considerations is a need for tailored cooperative teacher education activities blending the use of AI and iVR in language learning education. Therefore, the present study aims to address this gap by analyzing the results of language learning interventions conducted on a small number of teachers to raise their awareness of the collaborative affordances of the joint use of AI and iVR.

## **Methods**

An experiential intervention using the iVR activities on Horizon Workrooms was structured according to a task-based methodology comprising a pre-iVR exposure of tech debrief and role assignment, a task phase on Horizon Workrooms, and post-activity reflections on the use of iVR and AI for cooperative purposes. The study targeted aspects of performance and perception by collecting textual data documenting participants' collaboration, the responses to two Likert scale questions, and a one-paragraph, open-ended question. Throughout this paper, the terms "participants" and "teachers" are used interchangeably.

## **Participants**

The participants consisted of three language teachers aged between 33- and 45- years old, working and studying at the University of Arizona. While two of them taught English as a foreign language outside the United States, the other was a Japanese instructor at the University of Arizona. The participants were non-native English speakers who attended a semester-long

study group on integrating virtual technologies in language teaching. They were familiar with wearing VR headsets and using hand controllers, as well as navigating the application manager of Meta Quest 2.

## Research Tools

Each participant was given a Meta Quest 2 headset and joined a virtual office space on Horizon Workrooms after being sent an invitation from the researcher's Meta account. The space consisted of a shared virtual desk, chairs, a blackboard, and windows overlooking a city landscape (Figure 1). The participants accessed iVR virtual pens, sticky notes, and a keyboard by pressing designated buttons on the hand controllers. ChatGPT was imported into the space through Horizon Workrooms' passthrough function and used by one of the participants.

**Figure 1**

*Participants Interact in a Virtual Office Space through the Digital Affordances of Horizon Workrooms*

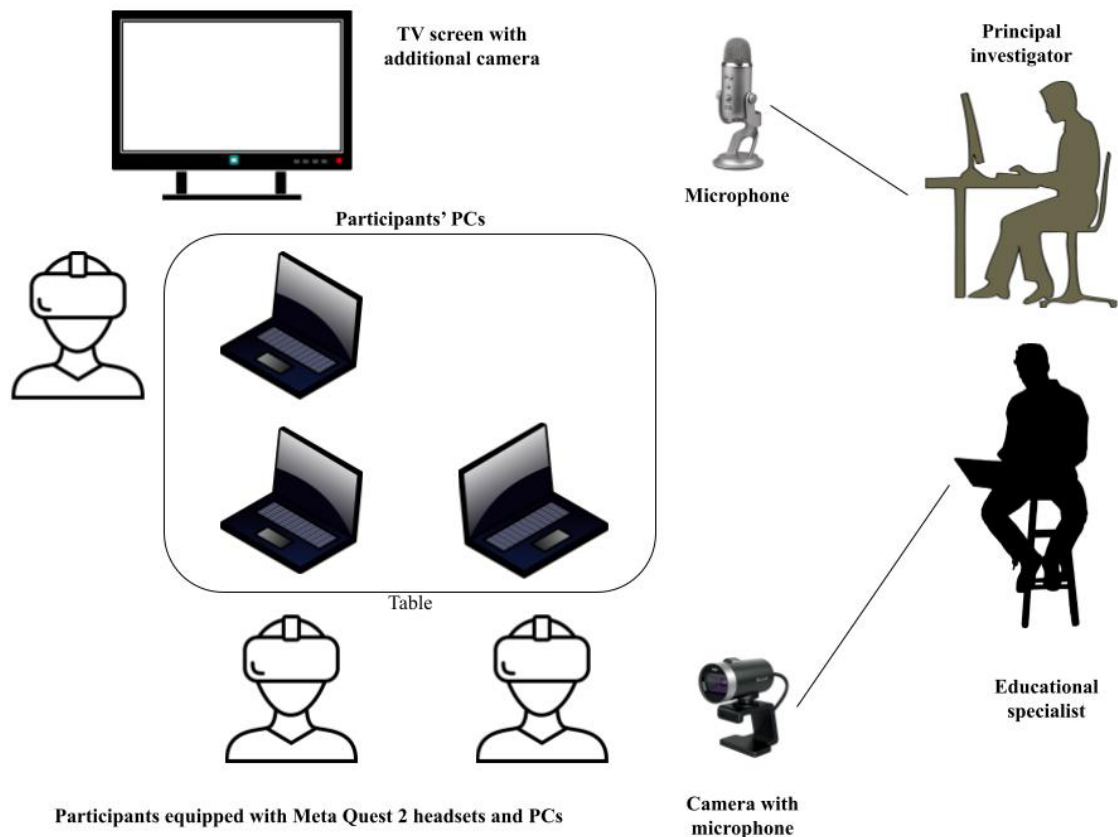


## Lab Setup

The intervention was conducted at the DIALL lab of the University of Arizona on March 29, 2023. The researcher was assisted by an IT specialist in monitoring the recording process. To maximize audio capture, two standalone microphones were connected to a Zoom meeting recorded on the researcher's computer. Two additional cameras were directed toward the center of the room where the in-person meeting was filmed. One camera was microphone-fitted, and the other was embedded in a TV monitor. The Horizon Workrooms meeting was recorded through screen-casting on the researcher's Meta account. The participants sat at a table where 4 Meta Quest 2 headsets were located, as a spare one was used by the researcher to join the Horizon Workrooms space to troubleshoot potential issues and observe iVR interactions.

**Figure 2**

### *Spatial Overview of the Intervention Space*



## Intervention Structure

Before beginning the pilot study, data approval to conduct the activities was received from the institutional review board. The intervention lasted for 2 hours, of which 45 minutes were spent in iVR. Before participating in the session, participants signed a consent form outlining the research aims, potential side-effects of iVR exposure, data collection, storage methods and privacy

protection procedures. Upon returning the signed consent forms, participants were sent email invitations outlining the date and time of the meeting. A questionnaire embedded in this email prompted participants to indicate their knowledge of the platform ChatGPT and willingness to use it in the activity. The intervention was conducted in a blended modality, alternating iVR exposure with in-person interactions. During the in-person phase, the participants were debriefed on the activity instructions. Then, they conducted a role assignment task consisting of assigning group roles based on personal inclinations and preferences. Upon completing this activity, the researcher asked the teachers to decide who would be willing to use ChatGPT on Horizon Workrooms. Upon identifying the volunteer, the teachers were debriefed on safely wearing iVR headsets and using hand controllers.

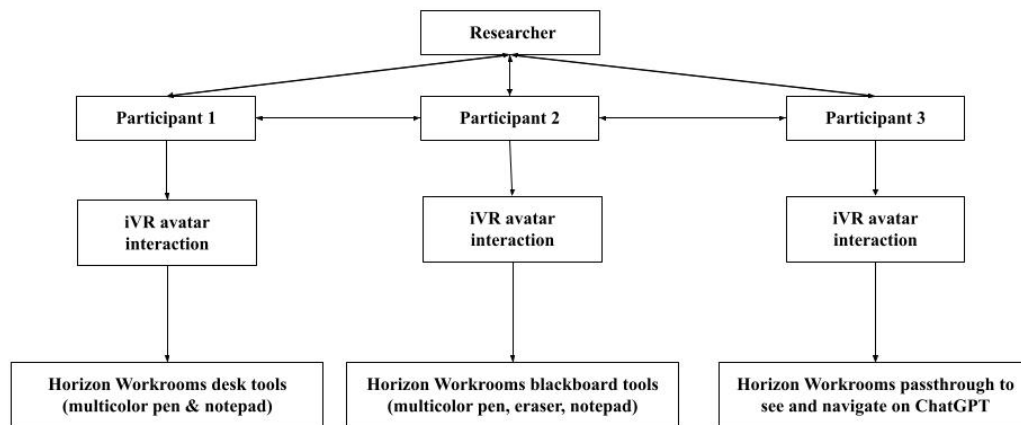
Upon completing this in-person phase, the participants joined a virtual office space on Horizon Workrooms available from their headsets. The whole iVR experience was performed as the teachers sat at a round table while wearing their headsets. To understand platform affordances and familiarize themselves with iVR interactions, the teachers personalized their avatars upon joining Horizon Workrooms. They were also given time to adjust to virtual movements and spatial affordances. Participants spoke in English and muted themselves in Horizon Workrooms to avoid sound overlap as they sat facing one another wearing the headsets.

The task consisted of using the AI tool ChatGPT to plan a fictitious conference trip in English, pretending to have won a budget of 10,000\$ to travel to a conference of their choice. One of the teachers accessed his laptop on the desk in front of him through the passthrough function of the headset Meta Quest 2. As the others discussed the potential destinations of their trip, this teacher used ChatGPT to access information on possible expenses, facilitating the group in drawing a travel plan and identifying suitable lodging. Then, the teachers wrote their decisions on the virtual blackboard of the office space upon negotiating a decision based on their ideas and information retrieved from ChatGPT. Lastly, at the end of the planning process, teachers pitched their work in Horizon Workrooms to the researcher, who was co-present in the office space embodying an avatar.

The last task phase was conducted in person. Upon real-world emersion, the teachers were involved in a focus group interview and responded to an online questionnaire on their perceptual experiences. Table 1 summarises the activity, while Figure 3 consolidates its interactional outline.

**Table 1***Activity Contents, Platforms, and Time Partitioning*

Task phase	Intervention structure		
	iVR space	Contents	Duration
Pre-task	None	Role assignment, brainstorming, and tech debrief	30 minutes
Task cycle: task	<i>Horizon Workrooms</i>	Avatar setup, familiarisation with Workrooms affordances	5 minutes
Task cycle: planning	<i>Horizon Workrooms</i>	Itinerary planning using <i>ChatGPT</i>	30 mins
Task cycle: report	<i>Horizon Workrooms</i>	Itinerary recap and pitching of budget plan	10 minutes
Post-task	None	Focus group interview and online questionnaire completion	45 minutes

**Figure 3***Outline of the Interactional Dynamics between the Researchers and the Participating Teachers during the iVR Activities***Data Analysis**

Teachers' interactions recorded on Zoom during the iVR meeting were later transcribed with the software Descript. Qualitative data included teachers' interactions and responses to a focus group interview. Contents were analyzed by identifying patterns of negotiation and mediation, which included asking for other participants' opinions and clarifications and making hypotheses. These aspects are cited in CEFR guidelines of the Council of Europe (2020) as key communication strategies to assess collaboration levels amongst interactants. Therefore, their presence in



teachers' transcribed speech was a key indicator of collaboration deployment. The degree of collaboration was also noted by observing the participants' use of the first-person plural pronoun "we" instead of the first-person singular pronoun "I," the latter typically indicating more cooperative interactions. Responses to the post-task survey delivered via Google Modules concerning teachers' perceptions of experiencing the integrated use of iVR and AI for collaborative purposes were recorded to assess task perception. Particular attention was placed on evaluating teachers' experiences through the usability and acceptability parameters of Davis (1993), while additional data was collected on collaboration enhancement, avatar interactions, and group planning.

## Results and Discussion

Qualitative results from the pilot study are presented first to illustrate the characteristics of successful collaboration identified in the content analysis of data from participants' task completion. These examples are followed by instances where collaboration was less successful. The underlined segments highlight significant episodes identified in the content analysis of excerpts from the focus group discussion. This data and results from the post-task survey provide perceptual evidence of the participants' collaboration during avatar interactions.

The planning process for the digital tour evidenced successful task collaboration. An example is provided in the excerpt below, which outlines the interactions between the teacher using ChatGPT and a fellow teammate as she summarizes group decisions on the virtual whiteboard of Horizon Workrooms.

T: So, we need five days before the conference to get settled. Why don't we decide on a conference date so we know, like, when we are leaving? I think chat GPT needs to know our exact dates.

O: April. That's the conference dates. Let's say to April 4th. First to third. All right. So, we have to travel at least one day before, so we are settled.

T: So, when are we leaving? When would we like to leave?

V: I guess whichever, maybe the beginning of April, or do you want the first one?

O: It's like spending the whole month of budget in the whole of April. Okay. That's, so the first day, April, it's summertime, right?

Facilitation of collaboration also emerged as teachers asked each other opinions and questions on decision processes as shown in this exchange in which participants work to decide upon travel details

O: Okay, Hawaii?

V: Yeah, why not?

T: So, we have to decide travel dates. Then where to stay. When would we would like to go? [...] So, when we are leaving? When would we like to leave?

V: I guess whichever the beginning of April, or do you want the first one?

O: It's like spending the whole month of budget in the whole April. Okay. That's, so the first day, April, it's summertime, right?

As seen from the extracts below, collaboration was enhanced as participants used the first-person plural pronoun “we” instead of its singular counterpart “I”, hinting at acknowledging the importance of members’ roles in decisional processes. Moreover, pronoun choice fostered virtual realism of interaction flow as participants co-constructed their ideas and contributed to selecting tour destinations and drawing up budget plans.

O: [...] Cause we don't have ideas on what the budget actually looks like, they could have the budget rate of \$ 10,000 for the three of us, or each guess. But if we use \$ 10,000 for each of us then things change.

T: Oh. So, if we reached two weeks it would not be a problem for budget. (uses ChatGPT to confirm his statement)

V: Wait, depending on the price of the hotel.

Focus group comments showed teachers’ explanations of the impact of using iVR and ChatGPT to foster collaboration. Participants explained their perspectives in response to the focus group question “How did you feel while interacting with one another in Horizon Workrooms?”

V: I think the idea of collaborating, like virtual collaborating or feeling that you are in one space, although you are not, is the next step of how to virtually work and teach.

O: This is just the beginning. The perspective, the future, and our future collaboration.

T: And also, I try to research information [on ChatGPT] but it's really hard to type on that keyboard with the headset on because I cannot really see anything on my computer. I can clearly see my screen, but I cannot see my keyboard well. Then when I look at my screen in the real world, the whiteboard is gone. Then I have to re-connect the screen.

This response shows a positive perception of collaboration in this space, but it also raises the issue that the technology was not seen as particularly friendly for performing the intended task. Another issue that appeared was the effect of individual dispositions on the inclination to collaborate. For instance, one participant was prone to lead the team by stating opinions without asking for contributions from their teammates. Leadership was emphasized by their use of the first-person singular pronoun “I” to make decisive statements affecting group decisions.

O: Some of the things I need to consider budgeting for a trip are transportation. Local transportation. Then there is budget.

Conversely, the participant who volunteered to manage ChatGPT interactions seemed more inclined to ask his partners for opinions and clarify his AI findings so that group decisions could be effectively mediated amongst all members. This participant also used ChatGPT to emphasize key elements affecting successful task attainment.

T: Oh. So, if we reached two weeks it would not be a problem for the budget. (uses ChatGPT to confirm his statement) [...] And maybe we need to consider how to get some food. So, we need to add around 5,000 to eight. There is also the consideration of the conference fees. If they give you a hotel conference rate, it could be 14,000 to 21,500, and maybe we can play it safe and say, yeah, why we decide that location, where we would you like to stay, and why. That's kind changing and applies to each one of us. If we then decide to take a break or whatever we need to add more.

Close observations of avatar interactions also revealed that participants self-explored the environment and learned to use virtual pens and notepads. This iVR familiarization favored the appearance of subsequent task-oriented interactions combining the use of ChatGPT with iVR capabilities. For instance, a teacher commented on the price range of lodging in hotels sourced by ChatGPT, which prompted another member to write the amounts on the whiteboard so that the whole group could see it.

O: What's that? It's a lot! (starts writing on the whiteboard the prices mentioned in the conversations to draw a budget plan)

The questionnaire responses provided another source of data indicating participants' general agreement on having perceived a collaboration boost while using the iVR platform Horizon Workrooms. Moreover, the participants expressed positive intentions to use the platform for future collaborative learning activities. When prompted to rate on a scale from 1 to 4 how much the iVR activity on Horizon Workrooms boosted partner collaboration, all three participants positively responded with a maximum value of 4. Rating the likelihood of using Horizon Workrooms and ChatGPT for collaborative learning purposes also produced positive results. While the participants assigned a rating of 4 to ChatGPT, Horizon Workrooms received one rating of 3 (somewhat likely) and two of 4 (very likely), which also led to positive considerations on the likelihood of its class implementation for collaborative purposes. In assessing the impact of avatar interactions on collaboration enhancement, perceptual data indicated participants' enjoyment in interacting with their peers, which they deemed interesting and fun.

However, participants' opinions on collaboration enhancement through avatar interactions were not entirely consistent, as one participant stated it boosted collaboration, while the other disagreed. The open-ended survey question and focus group responses revealed teachers' justifications for thinking that avatar interactions hampered or prevented iVR collaboration.

It might enhance collaboration, providing there is a correspondent task. Some students hesitate to turn on video for Zoom, but avatars could remove the barrier, which will enhance their involvement. But it might be difficult to agree on some aspects, as some people insist on his/her suggestions only.

Being immersed in group interactions implied higher concentration on task demands and potential enjoyment of the virtual experience that distracted participants from tech troubleshooting. This is confirmed by the fact that participants did not ask for clarifications on how to interact in Horizon Workrooms but attempted to solve technical issues on their own and continued to collaborate. The results obtained from interaction observations were further confirmed by analyzing teachers' responses to online questionnaires. Participants concurred that being involved in an iVR activity facilitated collaborative participation. Additional results showed participants' willingness to use Horizon Workrooms and ChatGPT for future collaborative learning processes. Through these answers, participants recognized the benefits of iVR and AI technologies for supporting task-based group experiences. These positive attitudes might increase teachers' willingness to adopt these technologies in future language curricula. During the focus group interview, participants highlighted the necessity of pre-experiential training with Horizon Workrooms and the AI platform ChatGPT.

O: I enjoyed setting up the avatar, choosing the way you look, seeing each other in the immersive reality space. Seeing gestures and the movements and the calibration when moving. We were constantly wondering how to use the tools we were given. The interaction was really cool, but just a bit slow for me because I was trying to figure out how to write on the whiteboard, like how to do this, how to do that. So, it takes some time to get used to that. And then I guess interaction and collaboration would be more effective and not that time consuming. So yeah, the experience is a new one. That's amazing. Before cooperating, it is important to think about the logistic portion of it, how to set up the space and how we are being physically in the same location. So, you and A who have more expertise knowledge about virtual things or all kind of technology can help us. If we are on a different location each time, that's gonna be really hard to do, but otherwise it is really interesting.

Teachers also recognized the importance of understanding and experiencing the dynamics of virtual teamwork for professional development. However, they stated that more time would be required to implement these practices in educational scenarios.

V: Yeah, I can relate to that. It's the same, I guess people are discussing how VR can look really well. I think the idea of collaborating, like virtual collaborating or feeling that you are in one space, although you are not, is the next step of how to virtually work and teach.

O: This is just the beginning. The perspective, the future, our future collaboration.

V: Yeah. Yes. That's the way it would look like but I don't know how many years it will take though.

When prompted to answer questions on the best pedagogical practices combining iVR and AI, the participants highlighted the key role of institutions in providing the equipment and technical support to involve students in collaborative cross-national activities. This prompts considerations of the cost that such operations would entail and suggests the necessity of pre-activity budget and curriculum planning.

T: I think we can do like two students coming here. So, they can help maybe on the other side, such as one Japanese student, the in Japan university student, they can come to university and if they have a technical expert, to help on the tech side. But if it's up to each individual to figure these things out, it's really hard at this moment. I would say a technician could be somebody that troubleshoots or maybe does the activity ahead of time and test it. And stays there for the initial setup. I would say in perspective just having somebody test your gear ahead of time, maybe with a dedicated person would be perfect.

Overall, this pilot study revealed useful insights that can be applied to future research on using iVR and AI in language teacher education. Most importantly, the data showed that participants succeeded in collaborating on the given task, and they perceived the positive value of the task for promoting collaboration. Positive interpretations of these findings should consider the academic and professional background of the participants, who possessed strong teamwork skills from the start of the intervention. This likely facilitated their iVR interactions. It would therefore be necessary to consider teachers' teamwork readiness in future research, and perhaps test iVR and AI on educators with less experience in group activities. It is also believed that collaboration was influenced by uneven tool distribution amongst study participants, whose agency largely depended on iVR tools. Only 1 teacher had access to ChatGPT while immersed in Horizon Workrooms, and the other 2 only interacted with specific iVR features. Such agency gap stimulated teachers to ask for the help of their peers. This suggests that further interventions on the combined use of iVR and AI in teachers' educational practices should focus on parameters of equity and accessibility, ensuring that all study participants can use AI while involved in immersive spaces.

The experience raised considerations for planning future studies with larger numbers of participants. From a usability standpoint, it is important to note that the participant in charge of using ChatGPT lifted his headset multiple times to see his desktop, highlighting a major limitation of Horizon Workrooms in visual rendering. Further limitations were detected from technological affordances, as participants claimed to have been severely distracted by the blurred vision caused by the iVR interfaces. Additionally, data collection logistics prevented screen casting on all the participants' headsets, hence losing evidence of ChatGPT prompts related to budget planning. Since structuring AI prompts is likely to influence information reliability and successful goal attainment, it is believed that further research should consider training teachers on prompt engineering. This would enable further explorations of the interdependent relationships between human beings and machines. Finally, attention should be placed on the interpersonal relationships of trust between AI agents and avatar-embodying teachers in virtual task collaboration and study its overall effects on group efficiency.

## **Conclusion**

This paper has outlined the results of a pilot study conducted during a study group session for teachers. The activity focused on training teachers on combining iVR and AI to involve students in collaborative learning activities. The data was collected during one iVR session with three teachers, one of whom used ChatGPT to source information necessary to conduct a group

activity on budgeting for a fictitious conference trip. Results suggested positive effects on collaboration enhancement between participating teachers who efficiently attained task goals. Despite some technical issues hampering participants' capability to see the ChatGPT interface in iVR, teachers deployed collaborative skills. They also appeared to be willing to integrate iVR and AI in their language curricula. While examining the results from only one intervention, this study showed positive results in the possibility of integrating iVR and AI to enhance students' collaboration. Further investigations would need to be conducted on a wider population sample, triggering further investigations into using iVR and AI to foster task-based collaboration in deploying highly immersive and unimodal tools for group goal attainment. Investigations should also be conducted across different subjects taught by participating teachers to understand whether the combined exposure to iVR and AI affects students' collaboration. Investigations of this kind are deemed important in the upcoming years when iVR and AI are expected to evolve towards enhanced interactivity and design affordances favoring participants' collaboration.

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## Appendix A

Excerpt 1: transcript from participants' interactions in *Horizon Workrooms*

**O:** Some of the things I need to consider when budgeting for a trip are transportation. Local transportation. Then there is the budget.

**V:** Yeah. Budget. To go to Hawaii.

**O:** Okay, Hawaii?

**V:** Yeah, why not?

**T:** So, we have to decide on travel dates. Then where to stay. When would we would like to go?

**O:** The end of April and let's look for three days. Cause we don't have ideas on what the budget actually looks like, they could have the budget rate of \$ 10,000 for the three of us, or each guess. But if we use \$ 10,000 for each of us then things change.

**Researcher:** It is 10,000 for each of you.

**T:** Oh. So, if we reached two weeks it would not be a problem for the budget. (uses ChatGPT to confirm his statement)

**V:** Wait, depending on the price of the hotel.

**Educational specialist:** Make this fun and say there are no restrictions on grant money being given!

**Researcher:** OK, You can spend as much time as you like.

**T:** So, we need five days before the conference to get settled. Why don't we decide on a conference date so we know, like, when we are leaving? I think chat GPT needs to know our exact dates.

**O:** April. That's the conference dates. Let's say to April 4th. First to third. All right. So, we have to travel at least one day before, so we are settled.

**T:** So, when we are leaving? When would we like to leave?

**V:** I guess whichever, maybe the beginning of April, or do you want the first one?

**O:** It's like spending the whole month of budget in the whole of April. Okay. That's, so the first day, April, it's summertime, right?

**Researcher:** So, can you tell me one more time when you went to the conference and were you leaving?

**V:** We leave on the first and come back from the 30th. April 4th, we, are we leaving April 4th and when are we coming back?

**O:** On the 30<sup>th</sup>.

**T:** OK.

**O:** We've got April.

**T:** [using ChatGPT to find budget information] So, it would be three thousand per person I think just for staying depending on the hotel range. That's 4500 to 7,500.

**O:** What's that? It's a lot! (starts writing on the whiteboard the prices mentioned in the conversations to draw a budget plan)

**T:** And maybe we need to consider how to get some food. So, we need to add around 5,000 to eight. There is also the consideration of the conference fees. If they give you a hotel conference rate, it could be 14,000 to 21,500, and maybe we can play it safe and

say, yeah, why did we decide on that location, where we would like to stay, and why.  
That's kind of changing and applies to each one of us. If we then decide to take a break or  
whatever we need to add more.

**O:** I know that. How do you spell the location you are seeing?

**T:** K A U A I. Like we can just write an idea of our knowledge.

**O:** All right. So, a few hundred bucks more from home to Hawaii.

**V:** 3000 is ok. Hawaii means sunny days.

**T:** Where would you like to stay? Hotel or residence?

**O:** Hotel.

**T:** It would then be 300 per person.

**V:** We are talking about \$10,000 per person and it would be cheating.

**O:** The budget is \$10,000 overall. And what about the other parts? Do you reckon that  
would me ask for 30,000 per person?

**T:** Okay. yes. Overall, that's how much we will spend.

## Appendix B

Excerpt 2: transcript from participants' focus group interview.

**O:** I enjoyed setting up the avatar, choosing the way you look, and seeing each other in the immersive reality space. Seeing gestures and the movements and the calibration when moving. We were constantly wondering how to use the tools we were given. The interaction was really cool, but just a bit slow for me because I was trying to figure out how to write on the whiteboard, like how to do this, how to do that. So, it takes some time to get used to that. And then I guess interaction and collaboration would be more effective and not that time-consuming. So yeah, the experience is a new one. That's amazing. Before collaborating, it is important to think about the logistics portion of it, how to set up the space, and how we are being physically in the same location. So, you and A who have more expertise and knowledge about virtual things or all kinds of technology can help us. If we are in a different location each time, that's gonna be hard to do, but otherwise, it is really interesting.

**T:** And also, I try to research information [on ChatGPT] but it's really hard to type on that keyboard with the headset on because I cannot really see anything on my computer. I can clearly see my screen, but I cannot see my keyboard well. Then when I look at my screen in the real world, the whiteboard is gone. Then I have to re-connect the screen. So that's a more technical side.

**V:** Yeah, I can relate to that. It's the same, I guess people are discussing how VR can look really well. I think the idea of collaborating, like virtual collaborating or feeling that you are in one space, although you are not, is the next step of how to virtually work and teach.

**O:** This is just the beginning. The perspective, the future, and our future collaboration.

**V:** Yeah. Yes. That's the way it would look but I don't know how many years it will take though.

**T:** I think we can do like two students coming here. So, they can help maybe on the other side, such as one Japanese student, the in Japan university student, they can come to university and if they have a technical expert, to help on the tech side. But if it's up to each individual to figure these things out, it's really hard at this moment. I would say a technician could be somebody who troubleshoots or maybe does the activity ahead of time and tests it. And stays there for the initial setup. I would say in perspective just having somebody test your gear ahead of time, maybe with a dedicated person would be perfect.

## About the Author

**Ilaria Compagnoni** is a PhD candidate at Ca' Foscari University of Venice (Italy) and a Fulbright Alumna of the University of Arizona (US). Her research focuses on analyzing student interactions using both immersive and non-immersive Virtual Reality, as well as exploring the integration of Artificial Intelligence in L2 writing and teaching practices.