〈Research Article〉

Students' Creation of VR English Lessons:

Adopting a Constructivist Approach

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Abstract

Virtual reality (VR) has many benefits for English education, such as using visual contextual clues for communication, lowering foreign language anxiety, improving speaking performance, promoting collaboration work, and applying higher thinking skills. Adopting a constructivist approach, a project where the third-year university students planned English lessons and taught English to second-year students using a VR platform, Immerse, was implemented During the project, the VR English lessons were video recorded. After the project, a questionnaire and a group interview was conducted with the third-year students who participated as teachers. The analysis of the videos, the questionnaire, and the group interview showed that the VR scenes and the objects in the scenes helped mediate communication with the students. They also thought they improved their English-speaking skills, worked collaboratively, and adopted higher thinking skills. Based on the results, pedagogical implications for students to create VR English lessons and teach English to other students for teacher training will be suggested.

KeyWords

Virtual Reality, Constructivist Approach, Computer Mediated Communication, Bloom's Taxonomy, Collaborative Learning

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1 Introduction

Since Meta announced it would change its business focus from SNS to the metaverse, more industries have entered the metaverse market. Metaverse is based on the convergence of technologies such as virtual reality (VR) and augmented reality (AR) that enable multimodal interactions with virtual surroundings, digital objects, and people (Mystakidis, 2022). Meta (2022) explains that the metaverse will "let you socialize, learn, collaborate and play in ways that go beyond what we can imagine." As a result, the metaverse may offer learning opportunities beyond our imagination. One metaverse example is VR, recognized as one emerging technology that will significantly influence future teaching and learning in higher education institutions (Educause, 2020). VR is defined as computer-generated simulations of three-dimensional objects and environments (Dionisio et al., 2013), and VR enables users to enter a virtual world via interactive simulations, giving them the feeling of being completely immersed (Scrivner et al., 2019).

In English-as-a-foreign-language (EFL) environments, it is difficult for students to be in genuine contexts using English; however, participants may feel as if they were in real contexts by being fully immersed in a virtual space. Therefore, contexts and contextual clues in VR may help mediate communication among participants. Computer-mediated communication (CMC) focuses on language and language use in networked computer environments (Herring, 2001). CMC using VR is called VR-mediated communication and can be as intricate as face-to-face communication (Dzardanova et al., 2022). Therefore, investigating how VR can mediate communication among participants is valuable. Computer-mediated discourse analysis can be applied to CMC research. Herring (2001, p. 1) defines computer-mediated discourse as "the communication produced when human beings interact with one another by transmitting messages via networked computers." Analyzing computer-mediated discourse is called Computer-Mediated Discourse Analysis (CMDA). CMDA views online behavior through language and language use and analyzes online interactions, such as words, utterances, and messages (Herring, 2004). In a role-play task to examine pragmatic competence in Taguchi's (2021) study, participants in a virtual reality environment paid attention to many audio-visual signals in the VR scene and used them to direct their actions, compared to participants in a computer-based version. The study by Taguchi (2021) implies that visual contextual clues in VR can mediate communication. Though the possibility of VR mediating communication has been discussed, little research has investigated whether contexts and contextual clues in VR scenes helped mediate communication among participants by analyzing communication in VR scenes' videos.

Another possibility of using VR in language education stems from the impact on participants' anxiety about learning a foreign language (Lin & Lan, 2015; Thrasher, 2022; York et al., 2021). Thrasher (2022)

reported positive effects of VR on the participants' lowering foreign language anxiety and speaking performance in learning French. In Saito's (2021) study, the participants reduced their foreign language anxiety, and some improved their scores on the TOEIC speaking test after the VR English lessons. Although the potential benefits of VR on lowering foreign language anxiety and improving speaking proficiency have been reported, little research has investigated the benefits of VR on teachers' speaking proficiency. In Japan, high school teachers are to teach English classes in English under the policy of teaching English in English (The Ministry of Education, Culture, Sports, Science, and Technology, 2019). However, some teachers resist teaching in English because they are concerned about their low English proficiency (Glasgow, 2018) and inaccuracies in their spoken English (Suzuki & Roger, 2014). VR may help teachers lower foreign language anxiety and decrease negative concerns about their English because teachers can also use avatars. Generation Z students are often prepared to use technology to enhance their learning (Thrasher, 2022). Also, student trainees who will be teachers soon are part of Generation Z; thus, they may flexibly incorporate new technology like VR. Little research has investigated the possibility of using VR for student trainees to lower their foreign language anxiety. If student trainees teach English in VR using avatars, they may lower their foreign language anxiety and increase confidence in speaking English.

VR may create opportunities for collaborative learning among students. In the study by Yeh et al. (2018), in which children created VR scenes collaboratively, the results show that collaborative work became a great opportunity for some students to recognize the importance of collaboration. VR may also help learners apply lower and higher thinking skills of Bloom's Taxonomy. In the revised model of Bloom's Taxonomy (Anderson et al., 2013), thinking skills are categorized into remembering, understanding, applying, analyzing, evaluating, and creating. In the revised Bloom's Taxonomy, two levels of lower thinking skills (remembering and understanding) are essential bases for four higher thinking skills (applying, analyzing, evaluating, and creating). Bell and Fogler (1997) propose that VR offers a setting in which students may apply Bloom's taxonomy's higher thinking skills completely distinctly from traditional instructional techniques. Hsu (2020) investigated the effectiveness of high school students learning mathematics by incorporating VR digital materials. The results of the post-test questionnaire showed improvements in the first four levels of Bloom's educational goals. Chen (2016) investigated the effects of a VR learning environment on linguistic and student cognitive development using Bloom's taxonomy as a framework. The pre-and post-tests results showed that the participants improved their linguistic ability, and VR learning helped develop higher levels of thinking. However, no research investigated into whether a VR project in which students plan and implement English lessons using VR helped them work collaboratively and apply higher thinking skills. Based on the previous research and the existing research gaps, this study is set to investigate the following three research questions.

RQ1: Whether the use of VR helps students working as teachers mediate communication with students
RQ2: Whether the students working as teachers think the VR project helped them improve their speaking skills
RQ3: Whether the VR project helps the students working as teachers work collaboratively and apply higher thinking skills of the revised Bloom's Taxonomy

2 Theoretical Framework Underlying the Research Questions

The main theoretical framework of this study is constructivism. According to the constructivism theory, "learning is an active process of constructing rather than acquiring knowledge" (Duffy et al., 1996, p. 2). In a constructivist approach, learners' active roles are crucial in constructing new knowledge; they connect information with previously assimilated knowledge (Huang et al., 2010). The constructivist approach has been applied to VR research. For example, in the systematic review of VR by Kavanagh et al. (2017), constructivism was listed as the second pedagogical motivational factor following collaboration in their thematic analysis of 90 papers describing VR use in education. Thorsteinsson and Page (2008) argue that constructivism is considered an appropriate theoretical framework for the virtual learning environment. Constructivism is relevant for the current study because the students who experienced the VR English lessons as students construct new knowledge and VR English lessons based on their prior experience.

Thorsteinsson and Page (2008) suggest that in-service teachers should experience and learn about VR because VR can provide learners with constructivism learning by working with peers collaboratively. Also, they emphasize the importance of in-service teachers' learning VR as one of the new technologies to upgrade their knowledge, skills, and teaching methods. VR has been suggested as an appropriate medical training method because it enables learners to experience scenarios that they might encounter at the emergency department and to interact with the VR environment and patients (Pottle, 2019). By adopting a constructivist approach, VR may be able to support teacher training in English education so that student trainees can experience the latest technology and consider the possibility of integrating it into English education. Informed by constructivism, the current study investigates whether a group project in which students prepare and implement VR English lessons helped them to improve their English-speaking skills, work collaboratively, and apply higher thinking skills of the revised Bloom's Taxonomy.

3 Methods

In the previous project, university students experienced VR English lessons offered by native English teachers using a VR platform, Immerse. The characteristic of Immerse VR platform used in the research is that participants can enter a variety of scenes, such as an airport, a park, and a fast-food restaurant, as avatars. Based on the previous study, a new project where the third-year students who had experienced the VR English lessons planned English lessons using the same Immerse VR platform and offered VR English lessons to second-year students. In this section, participants of the VR English lessons and the project overview are explained first. Then, the data collection and analysis of the VR English lessons' videos, the questionnaire, the group interview, and the report are presented.

3.1 Participants of the VR English Lessons

The study participants were four third-year university students taking part in the project as teachers (hereafter, trainees) and eight second-year students taking part in the project as students. The trainees' English proficiency is higher than that of the second-year students. For example, the trainees' average

Table 1: Participants in Each Group

Group A		Group B	
3rd-year students	2nd-year students	3rd-year students	2nd-year students
Trainee A (Leader)	Student A	Trainee C	Student E
Trainee B	Student B	Trainee D	Student F
	Student C		Student G
	Student D		Student H

TOEIC L&R score was 708, while the average of the second-year students' TOEIC L&R score was 591. All of them were students at a private university in Japan.

The trainees and the second-year students were divided into groups, Group A and Group B. In each group, there were two trainees and four second-year students taking part as students. Trainee A was assigned as the leader of the project. Table 1 shows participants in each group.

3.2 The VR Project Overview

First, they learned how to prepare for English lessons using Immerse VR platform by an instructor from Immerse in June 2021. Then, one student was assigned as a leader of the project, and during the summer break in 2021, they met online and prepared VR English lessons. Then, the trainees offered VR English lessons to second-year students in October and November. Finally, at the end of the project in January 2022, they collaborately wrote a VR project report.

In each group, four VR English lessons were offered. The four trainees offered the lessons using their PCs, and the students took the lessons using Oculus Quest 2, Head Mount Displays (HMDs). Each lesson was about 30 minutes. At the beginning of the first class, they had the students get accustomed to using HMDs and remote controllers. The VR lessons they had prepared included self-introduction, a vocabulary game, and role plays in immigration control, a car dealership, and a fast-food shop. After the project, they wrote a project report collaboratively with Google Docs, which is an appropriate tool for making a document collaboratively because students can work and write in the same document.

The VR project applied skills from lower thinking skills to higher thinking skills with reference to the revised Bloom's Taxonomy (Anderson et al., 2014). Table 2 shows an application of the revised Bloom's

Table 2: Application of the Revised Bloom's Taxonomy for the Project

Revised Bloom's Taxonomy	Revised Bloom's Taxonomy for this project	Contents
Creating	Evaluating	Evaluate their own VR lessons by writing a report
Evaluating	Analyzing	Analyze their own and other students' VR English lessons
Analyzing	**Creating**	Plan and offer their VR lessons considering the pros and cons of the VR lessons
Applying	Applying	Apply what they learned about the VR lessons
Understanding	Understanding	Understand the pros and cons of the VR lessons
Remembering	Remembering	Remember the VR lessons they took as the students

Taxonomy for this project. As shown, the last stage of the revised Bloom's Taxonomy, creating, is at the middle stage of this VR project.

3.3 Data Collection and Analysis

This section presents how the data from VR English lessons' videos, a questionnaire, and a group interview were collected and analyzed. In addition, how a report that the trainees wrote at the end of the project was used as additional data is explained.

3.3.1 Data Collection and Analysis of the VR English Lessons' Videos

During each VR lesson offered by the trainees, a video of the lesson was recorded. Discourse analysis was employed to investigate whether VR helped the trainees mediate communication with the students. Utterances and functions of utterances in the video-recorded data were analyzed. If the trainees used backchannels, they were also analyzed. Backchannels are linguistic means of not taking the turn but of saying short words or sentences such as mm, ah-ha, to show that a listener of a conversation is attending to messages by a speaker (McCarthy, 1991). For the investigation, words related to images in a VR scene were bolded. For example, if a cake was shown in the VR scene, the word "cake" in the utterances was bolded. Also, a word related to a VR scene, such as "destination" in an airport scene, was bolded. If there was an utterance often used in a specific scene, such as "I would like to have a coffee" in a scene of a cafe, it was underlined.

3.3.2 Data Collection and Analysis of the Questionnaire

A questionnaire survey with the trainees was conducted after the VR project. The questions were divided into two parts. The first part of the questions was related to their perception of improvement in their English-speaking skills. As teachers, being able to begin and maintain a conversation and encourage quiet students to speak in English is important; thus, questions about whether teaching English in VR enabled them to initiate and maintain a conversation and encourage the students to speak more when the students were quiet were included. Also, questions about whether the project helped them increase confidence in speaking English and lower their foreign language anxiety and whether using avatars helped them lower their foreign language anxiety were included. The second part of the questions was related to whether the VR project helped them work collaboratively. A five-point Lickert scale, strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree, were adopted for answer choices.

3.3.3 Data Collection and Analysis of the Group Interview

A group interview with the trainees was conducted after the VR project. A group interview is useful when a group of people works together for some time or for a common purpose (Watts & Ebbutt, 1987). Since the trainees were working together for the same purpose to offer the VR English lessons, a group interview was considered to be an appropriate interview method. The interview was conducted online as a follow-up after the questionnaire survey. The interview was about an hour long.

The interview questions were categorized into three parts, whether VR helped them to mediate

communication with the second-year students, whether they think the VR project helped them improve their English-speaking skills and whether the VR project helped them work collaboratively and apply higher thinking skills. The interview data were transcribed, and the transcribed data were analyzed using content analysis. "Content analysis is a technique for a systematic quantitative description of the manifest content of communication" (Kvale and Brinkmann, 2009, p. 203). To analyze whether VR helped the trainees to mediate communication with the students, VR and avatars were used as words for the content analysis. VR and avatars in the transcript were extracted and examined if the utterances with the words of VR and avatars were related to mediating communication. The questions related to whether they think the VR project helped them improve their English-speaking skills were asked as follow-up questions to ask the same questions in the questionnaire survey. For the analysis, utterances considered to be reasons and explanations for their answers were extracted and analyzed. In order to analyze whether the VR project helped them apply higher thinking skills, the data of the students' utterances were coded and analyzed using content analysis. Coding is a technique for identifying statements by attaching one or more keywords to a text (Kvale & Brinkmann, 2009). If utterances were related to remembering, understanding, applying, analyzing, creating, and evaluating of the adapted Bloom's taxonomy, coding of R, U, AP, AN, C, and E, were added respectively on excerpts of their utterances.

3.3.4 The Trainees' Report as Additional Data

At the end of the project, the trainees wrote a project report collaboratively using Google Docs. In the report, they wrote the outline of the project, the experience of the VR English lessons that they took as students, the contents of training by Immerse, contents of the VR English lessons that they offered, reflection about the lessons, and their opinions about the possibility of using VR for English education. What they wrote in the report was used as additional information to answer the research questions. For example, they wrote reasons for choosing certain VR scenes for their English lessons, and the information was added to the video analysis to answer the research question one.

4 Results

4.1 VR for Mediating Communication

This section presents the video analysis results and the group interviews to answer the first research question. Then, screenshots of VR scenes will be presented to explain how scenes and objects in the scenes helped the trainees communicate with the students. The names of the participants on the screenshot are hidden to protect participants' privacy.

4.1.1 Results of the Video Analysis

The first excerpt is a scene of immigration control. About a reason for choosing the scenes, Trainee A wrote in the journal that the environment can be freely arranged in virtual spaces, so he wanted to offer environment-dependent lessons that would be difficult to realize in offline English conversation classes. As shown in Figure 1, there is an immigration officer and one visitor at the counter on the screenshot.

Table 3 shows a discourse in the scene with information about speakers, line numbers, utterances, and their functions. Trainee A played a role as an immigration officer, and the students played a role as a

Figure 1: Scene of the Immigration Control

Table 3: An Excerpt in the Immigration Control VR Scene

Speakers	Line	Utterances	Functions
Trainee A	1	OK. The first question is, "What are you here for?"	Asking a question
Student B	2	For vacation.	Answering a question
Trainee A	3	For vacation. OK. And next, what do you do?	Confirmation Asking a question
Student B	4	(Silence)	
Trainee A	5	Student?	Prompting the answer
Student B	6	Student	Answering a question
Trainee A	7	What makes you study English? Why have you been studying English?	Asking a question
Student B	8	To speak with foreign people	Answering a question
Trainee A	9	Uh-huh	Confirmation
Student B	10	To speak English	Adding an answer
Trainee A	11	Okay. How long have you been studying English?	Asking a question
Student B	12	I have been studying English for ten years.	Answering a question
Trainee A	13	What do you want to do in the future after graduation?	Asking a question
Student B	14	Umm...I don't have what I want to be in the future. I want to work at education. For education.	Answering a question
Trainee	15	Uh-huh. Okay. Could you tell me why?	Confirmation Asking a question
Student B	16	Why? Because I like teaching for children. I want to make some... make some... umm	Answering a question
Trainee A	17	Make students happy?	Giving a hint of a possible answer
Student B	18	Yes, to make some students happy to study.	Answering a question
Trainee A	19	Okay. Great. You're cleared to go.	Finishing the immigration process

visitor. Utterances associated with immigration control from Line 1 to Line 6 in this scene are underlined. Trainee A asked for the visit reasons and the occupation, and Student B answered the questions, which is a typical interaction seen at the immigration control. From Line 7 to Line 18, Trainee A asked questions about a reason for studying English, the length of studying English, and the student's future dream, which may not be typical questions asked at immigration control.

In the scene, Trainee A tried to communicate with Student B by asking questions, adding follow-up questions, using back channels, and saying the possible answers. In Line 5, he tried to elicit an answer from Student B by saying "Student?" after the silence. In Line 9, after listening to the answer from Student B, he said "Uh-huh" not taking a turn, which led to the additional answer from Student B. About the future dream, Student B said the answer in Line 14, and after that, Trainee A confirmed by saying, "Uh-huh. Okay". Following that, he added another question. In Line 16, Student B gave a partial answer but could not say what she wanted. Finally, in Line 17, he guessed what Student B wanted to say and hinted at a plausible answer by saying, "Make student happy?". Following that, Student B could complete her answer.

In this excerpt, the immigration control scene seemed to be a function to mediate communication from Line 1 to Line 6, but the latter part of the discourse was not directly linked to immigration control. However, Trainee A wrote in the report that he purposefully included additional questions to frequently asked questions at the immigration control because it was an English lesson, so he hoped to develop a conversation. As he wrote, the conversation was developed based on the conversation from Line 1 to Line 6.

The second excerpt is a scene from a fast-food restaurant. Trainee D was a teacher in this scene, and she wrote in the report that she wanted the participants to feel as if they were in a fast-food restaurant by having them play a situation game. In this scene, Trainee D had the students practice phrases used in a restaurant first, and then they practiced a role play of being a staff or a customer. Figure 2 shows the screenshot of the fast-food restaurant. A cash register in Figure 2 can be used, and if they tap orders such as a hamburger and a soda on the menu using a remote controller, they can see the total price on a receipt and get itipt.

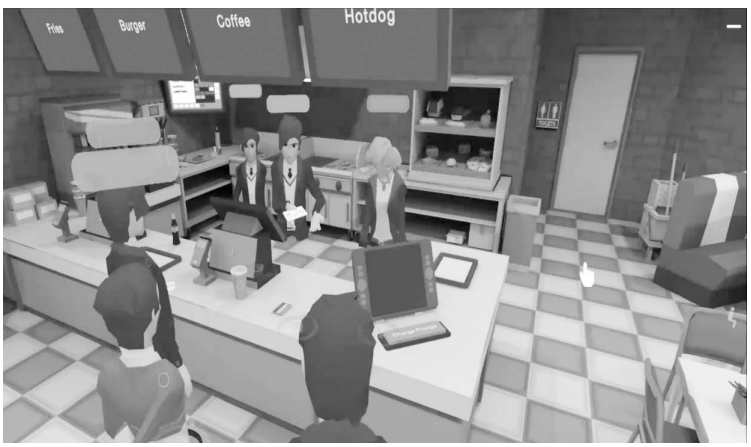

Figure 2: Scene of the Fast-Food Restaurant

Table 4: *An Excerpt in the Fast-Food Restaurant VR Scene*

Speakers	Line	Utterances	Functions
Trainee D	1	Let's start.	Telling the student to initiate a conversation
Student E	2	What would you like to have?	Taking an order
Student F	3	I would like to choose a hot dog and a coffee.	Making an order
Student E	4	A hot dog and a coffee?	Confirmation
Student F	5	Yes.	Reply to the confirmation
Student E	6	Anything else?	Asking a question
Student F	7	That's all.	Answering the question
Trainee D	8	That would be...	Prompting the student to tell the price.
Student E	9	The total comes to $6.48.	Telling the price
Student F	10	OK.	Confirmation
Student E	11	The receipt.	Giving a receipt
Student F	12	Thank you.	Thanking
Trainee D	13	(Student's Name), you don't have to say something more? You said the price and the customer gets it. And you'll say.. What would you say? Thank you?	Prompting the student to say thank you.
Student E	14	Thank you	Thanking the customer
Trainee D	15	So much?	Encouraging the student to add "so much".
Student E	16	Thank you so much.	Thanking the customer.

Table 4 shows an excerpt of the discourse after the students learned how to use the cash register with remote controllers. In this scene, Trainee D tried to facilitate communication between Student E and Student F by letting them do the role-play. In Line 1, Trainee D encourages Student E to initiate a conversation, and in Line 2, Student E is taking an order using the phrase they studied. Student F chose a hamburger and a coffee, which appeared on the menu in Figure 2. In Line 8, Trainee D is prompting Student E to say the total price that appeared on the cash register and a receipt, which are shown in an avatar's hand of Student E in Figure 2. In Line 9, Student E is saying the price of $6.48. After that, Student E said "Receipt" without saying "thank you so much", so in Line 13, Trainee D is prompting Student E to say "Thank you so much" to the customer, Student F.

The scene of the fast-food restaurant and the menu, the cash register, and the receipt in the scene were used as prompts to choose an order from the menu (Line 3), make confirmation of the order (Line 4), tell the total price (Line 9) and give the receipt (Line 12). Trainee D also wrote in the journal that she believed the participants could feel more immersed in VR by using as many tools in the VR world as possible.

4.1.2 Results of the Group Interview

For the trainees to be in the VR scenes seemed helpful in initiating a conversation. Trainee D said: "Being in VR was easier for me to speak English, so I was able to start speaking English in the

environment of VR." One possible reason for them to find it easy to speak English in the VR environment may lie in using avatars. Student C said: "Not being able to see other's faces was a little help, and it was easy for me to start a conversation." He also added the reasons: "In the situations where facial expressions of others cannot be seen, I was not influenced by visual information, so I was able to start a topic smoothly." However, not seeing others' faces can negatively affect communicating with the students. Student A said: "I could not communicate flexibly because I could not see others' faces." Student D also said, "What I found most difficult was I was not able to see others' facial expressions. It was difficult for me to understand whether the students were having trouble answering now or just they were thinking."

While Students A and D noted the negative effect of using the VR scenes, the objects in the VR scenes seemed helpful in communicating with the students. Regarding the VR scenes, Trainee C chose a magic room in his lessons and commented: "the place was an unusual place, so in that sense, it was relatively easy to start a conversation." Also, Trainee D mentioned the objects in the VR scenes, "There were various items in various places in the VR world, and it was easy to create opportunities for conversations that would never have been possible in an ordinary classroom." Trainee D let the students use the objects such as the cash register and the receipt effectively for the role play in the fast-food restaurant scene.

4.2 Students' Perceptions of the VR Lessons on Their English-Speaking Skills

The data from the questionnaire and the group interview were analyzed to investigate whether they think the VR project helped them improve their English-speaking skills. In this section, first, the results of the questionnaire are presented. Following that, the results of the group interview are presented.

4.2.1 Results of the Questionnaire

Table 5 shows the questionnaire results about their perception of the VR project on their

Table 5: Results of the Questionnaire about Students' Perception of the VR Lessons

Questions	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly agree
1. Teaching English in VR helped to improve my English-speaking skills	2 50%	2 50%	0 0%	0 0%	0 0%
2. Teaching English in VR enabled me to initiate a conversation	1 25%	3 75%	0 0%	0 0%	0 0%
3. Teaching English in VR enabled me to maintain a conversation	1 25%	2 50%	1 25%	0 0%	0 0%
4. Teaching English in VR enabled me to encourage participants to speak when they were not speaking much.	2 50%	2 50%	0 0%	0 0%	0 0%
5. Teaching English in VR enabled me to speak English with more confidence	1 25%	2 50%	1 25%	0 0%	0 0%
6. Teaching English in VR lowered my anxiety in speaking English	1 25%	2 50%	1 25%	0 0%	0 0%
7. The use of avatars lowered my anxiety in speaking English.	3 75%	0 0%	1 25%	0 0%	0 0%

English-speaking skills. All of them think teaching English in VR helped them improve their English-speaking skills and enabled them to start a conversation and encourage the participants to speak when they were not speaking much. Except for one student who neither agreed nor disagreed, three think that teaching English in VR enabled them to speak English more confidently and lowered their anxiety in speaking English, and using avatars lowered their anxiety in speaking English.

4.2.2 Results of the Group Interview

All participants said in the interview that teaching English in VR helped improve their speaking skills. For example, Trainee C commented: "I was able to learn how to use English in a more communicative way, considering not only my own English skills but also those of others." Trainee B said about being able to initiate a conversation, "I tried to initiate a conversation, and the hurdle to start a talk was lowered through the VR lessons." Both Trainee A and Trainee D mentioned they were able to encourage the students to speak by giving a hint and giving an example. In fact, as explained, Trainee A gave a possible answer in the immigration control scene, and Trainee D gave a hint to the students in the fast-food scene.

Trainee C said his confidence level has not changed; however, three said they could have more confidence in speaking English. Trainee D mentioned that she became confident and that the comment that the lesson was fun from the students made her more confident. Regarding anxiety in speaking English, Trainee D mentioned she was not anxious about speaking English because she had been taking English lessons for a couple of years. However, for the other three, using avatars seemed helpful for them to lower anxiety in speaking English. Trainee C said that using VR helped him lower anxiety because other person's facial expressions did not influence him. Using avatars helped Trainee B not be afraid of making a mistake in speaking English:

> Degrees of nervousness using an avatar or not were significantly different, and I was not upset even if I made a slight mistake, thanks to which I was able to give the lessons, so I thought avatars were good.

4.3 Collaboration and Application of Higher Thinking Skills in the VR Project

The data from the questionnaire and the group interview were analyzed to investigate whether the VR project helped them work collaboratively and apply higher thinking skills. In this section, first, the results of the questionnaire are presented. Following that, the results of the group interview are presented.

4.3.1 Results of the Questionnaire

Table 6 shows the questionnaire results about their perception of the VR project on collaborative work. As shown in Table 6, they all thought they could prepare for the project by confirming the project's objective and supporting each other at the preparation stage and during the VR lessons. At the evaluation stage, they could write the report collaboratively with other members and evaluate the project objectively. Also, using Google Docs at the evaluation stage helped them compile the final report. One student chose neither agree nor disagree about Question 12; however, the student conducted the VR

Table 6: *Results of the Questionnaire about Their Perception of Collaborative Work*

Questions	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly agree
8. In preparing for the VR project, I confirmed the project's objectives with other members and prepared for the VR project collaboratively.	3	1	0	0	0
	75%	25%	0%	0%	0%
9. In preparing for the VR project, we supported each other and proceeded with the preparation.	3	1	0	0	0
	75%	25%	0%	0%	0%
10. While offering the VR English class, I got support from other members.	3	1	0	0	0
	75%	25%	0%	0%	0%
11. While other members offered the VR English lessons, I supported other members.	2	2	0	0	0
	50%	50%	0%	0%	0%
12. I learned from other members' VR English lessons.	3	0	1	0	0
	75%	0%	25%	0%	0%
13. In writing a final report, I was able to write it collaboratively with other members.	4	0	0	0	0
	100	0%	0%	0%	0%
14. Using Google Docs helped us to compile the final report.	3	1	0	0	0
	75%	25%	0%	0%	0%
15. By collaboratively writing the report with other members, I evaluated the project objectively.	3	1	0	0	0
	75%	25%	0%	0%	0%

lessons first; therefore, it is assumed that she thought she could not make the most of what she learned from others for her lessons.

4.3.2 Results of the Group Interview

The group interview results are presented in terms of the adapted Bloom's Taxonomy. First, the utterances related to remembering and understanding are presented. Following that, utterances related to higher thinking skills are presented in the order of applying, analyzing, creating, and evaluating. Since Trainee A was a project leader, he answered several questions as a representative.

First, they remembered the lessons they had taken as students and understood the pros and cons of the VR lessons. Trainee A said: "We always kept our previous experience in mind as a source of comparison" and "Based on what we experienced, we decided to plan lessons, so having the experience was useful." The comments imply that remembering their VR English lessons became the foundation for higher thinking skills.

Remembering the VR lessons as the students led to the process of applying. Trainee A said: "I think it was essential for us to have this experience ourselves to think about what kind of classes would be interesting from the user's point of view." Understanding the pros and cons of the VR lessons they had taken also led to applying the good points of the VR lessons to their English lessons. Trainee A mentioned: "We made a list of good points and points that we thought could have been better, and we made use of the good points."

Regarding the creating process, Student A said: "we were able to create the program while considering the good and bad points." They also discussed the lesson time while creating the lessons reflecting

their experience and made the time for their VR lessons shorter than the lessons that they had taken as students. Trainee A said the reason for their decision of the time:

> One of the concerns was that wearing the VR, VR equipment, or a headset would make the participants feel sick, so we took it into consideration this time to some extent.

About analyzing, they thought they could analyze the other trainees' classes and learn from them. Trainee C said: "I watched other people's classes and learned a lot." Trainee A also said: "By objectively observing other people's classes, I learned a lot about how to speak and conduct classes in a way that is different from my own, and each person has unique strengths."

Related to evaluating, writing a report became a good opportunity for Trainee D, and she said: "By compiling the entire report, I was able to understand the overall picture of what we worked on." Reflecting on the report, Trainee A said: "Writing the report gave them a chance to look back and objectively review what they have done from the beginning to the end." As they mentioned, writing the report became an opportunity to evaluate the group project objectively.

The group interview results show that they could apply not only lower thinking skills but also higher thinking skills through the group project. Also, they worked collaboratively, as shown in the questionnaire results. Trainee A also mentioned that the project became an opportunity to learn the importance of exchanging ideas. Trainee C mentioned that the project became an experience for collaborative work:

> I think we succeeded by collaborating with each other, which is something I probably couldn't have done alone. It was a great learning experience for me, both in terms of VR and working together on something.

5 Discussion

The result of the discourse analysis shows that the VR scenes of the immigration control and the fast-food restaurant and the menu, the cash register, and the receipt at the fast-food restaurant helped Trainee A and Trainee D mediated communication in the role-play tasks with the students, respectively. The benefits of role-playing to examine pragmatic competence in VR were mentioned in Taguchi's (2021) study because participants in a VR environment paid attention to many audio-visual signals in the VR scene and used them to direct their actions. The trainees' opinions support that the VR scenes and the objects in the VR scenes helped them mediate communication with the students. As Dzardanova et al. (2022) argue, CMC using VR can be as intricate as face-to-face. However, the trainees in this study found it difficult to communicate sometimes because they could not see the students' facial expressions, although it was also mentioned as a benefit to communicate with the students. Butler-Goto (2021) mentions that gestures, back channels such as nodding, and eye contact are crucial in communication. Trainee A used back channels, and participants can use gestures such as clapping in the VR software used for this study. However, there are limitations to using gestures, back channels, and eye contact in communication in VR.

The results showed that the students perceived they could lower their foreign language anxiety, increase confidence in speaking English, and improve their speaking skills. The findings supported research on the effects of VR use for language education on foreign language anxiety (Lin & Lan, 2015,

Thrasher, 2022, York et al., 2021) and foreign language anxiety and speaking performance (Thrasher, 2022; Saito, 2021). One benefit of teaching VR is that the trainees could use avatars, which helped the three trainees lower their foreign language anxiety. In Japan, senior high school teachers are to teach English in English; however, some teachers are not willing to teach English in English because of concerns about their low English proficiency (Glasgow, 2018) and low accuracy in their spoken English (Suzuki & Roger, 2014). As the results show, the use of VR might be helpful for student trainees who will be English teachers in the future to lower foreign language anxiety and increase confidence in speaking English.

The trainees worked collaboratively through the VR project, adopting the constructivist approach. As a result, they understood the importance of collaborative work, as in the study by Yeh et al. (2018), in which the participants worked collaboratively by making the VR scenes and recognized the importance of collaborative work. Furthermore, the trainee mentioned that the experience of working collaboratively in the VR project could be applied to other areas. Thus, their successful experience in collaborative work may help them be ready for future jobs; Butler-Goto (2021) mentions that companies are looking for people who can be productive in communicating and collaborating with others. Also, as the possibility of VR for learners to apply higher thinking skills is mentioned (Chen, 2016; Bell & Fogler, 1997), this study shows that the VR group project provided them with the opportunities of applying higher thinking skills.

6 Conclusion

Adopting a constructivist approach, the current study investigated whether the use of VR helped the trainees mediate communication with the students, and they think the VR project helped them to improve their speaking proficiency and to work collaboratively and apply higher thinking skills. The results of analyzing the video, the questionnaire, and the group interviews showed that the VR scenes and the objects in the scenes helped them mediate communication with the students; they thought they improved their speaking skills, and the project helped them work collaboratively and apply higher thinking skills. Interestingly, using avatars helped them to mediate communication with the students and the trainees who were not confident in speaking English to lower their anxiety in speaking English; however, using avatars also limited communication because of the difficulty in having eye contact.

This is a small case study with a limited number of participants and the VR lessons that the trainees offered for a limited time. Thus, the number of the participants and the VR lessons could have been increased for a more extended time. Also, in this study, only the small parts of the videos were analyzed. However, all the collected video data could have been analyzed to investigate whether VR helped them mediate communication with the students. Although the questionnaire and interview results showed that they had improved speaking skills, they were self-reported. Thus, pre-and post-speaking tests could have been implemented to investigate the effects of planning and offering VR English lessons on their speaking skills. In this study, the data obtained from the questionnaire and the group interview only with the trainees were analyzed; however, the questionnaire and the interview data obtained from the second-year students were not included. In order to investigate the possibility of mutual effects on the speaking skills of the students as well as the trainees, the data is expected to be analyzed.

Although there are some limitations to communicating in VR, contexts and contextual clues created in VR may mediate communication among participants. Thus, by integrating VR into English education in

EFL contexts like Japan, teachers can give students experience using English in meaningful contexts. Through this VR group project, they learned and considered how the new technology of VR can be integrated into English education, reflecting the possibilities and limitations of teaching English in VR. Furthermore, the student trainees are a part of Generation Z, who can incorporate the use of technology into their learning, as Thrasher (2022) mentions. Therefore, integrating VR into pre-service teacher training can be suggested for student trainees who will be English teachers to be familiar with the latest technology and to lower their foreign language anxiety, increase confidence in speaking English, and improve speaking skills. However, to introduce VR in English education and teacher training, issues related to HDMs, such as cost, cyber-sickness, and ethical issues, need to be considered.

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