

# Exploring Multiliteracy of Pre-Service Language Teachers through Spherical Video-Based Virtual Reality

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**ABSTRACT:** This qualitative study aims to explore how the production of language learning materials using spherical video-based virtual reality (SVVR) affords pre-service teachers multiliteracy development while also attempting to discover their perceptions toward adopting this emerging technology for future language teaching. Data from multiple sources was collected from pre-service English teachers enrolled in a TESOL graduate program in Taiwan, including video-recordings of the participants' presentations on their final SVVR projects and their self-generated VR teaching materials/artifacts, with two one-to-one semi-structured interviews further analyzed based on thematic analysis. The major findings demonstrate that through conducting the SVVR project, participants learned: (1) to compose multimodal lessons; (2) to concretize intangible contexts for learning; and (3) to use space as a mode for teaching and learning. The authors presented insights into affordance of SVVR material production for their multiliteracy development of engaging pre-service English teachers, as well as their perceptions with regard to this SVVR hands-on experience. Moreover, the authors offer recommendations for putting such experience into practice.

**Keywords:** SVVR, Multimodality, Pre-service English teachers

## 1. Introduction

With its characteristics of being interactive and immersive within a realistic learning environment, virtual reality (VR) has been widely applied in the language learning context and has shown great potential for enhancing L2 learning achievement (e.g., Ebadi & Ebadijalal, 2020). VR refers to computer technology that can situate users in real-world simulated environments to stimulate interaction between users and virtual objects in a virtual context (Ghanbarzadeh et al., 2014). The two main types of VR are identified: low-immersive VR (LiVR) and high-immersive VR (HiVR). While LiVR displays three-dimensional (3D) virtual space experiences through conventional computer devices, (e.g., desktop computers), HiVR presents a 360° 3D virtual context that creates a sensation of physical presence provided by head-mounted displays (HMDs) (Kaplan-Rakowski & Gruber, 2019). LiVR is typically more accessible and cost-effective, but appears less realistic to the senses. On the other hand, HiVR creates a great sense of immersion and high interaction but is often more costly and necessitates more skill to use than LiVR. (Chang et al., 2020). Recently, spherical video-based virtual reality (SVVR) has emerged, a new VR form that can rely on either LiVR or HiVR and is designed to be low-cost, easy-to-access and easy-to-produce (Jong et al., 2020). SVVR delivers 360-degree spherical videos for viewers to look in all directions by rotating what they want to see with an HMD or with a conventional computer device (Chen & Hwang, 2020). Given its features of financial affordability and its relative ease-of-use with regards to computer skills, language instructors are able to design and improve their own teaching materials and activities for creating an immersive and interactive environment for students to learn a second language (Chien et al., 2020).

In this era of switching from printed materials to the screen, McVee et al. (2008) posited that technology should not be viewed simply as hardware and software, in effect a tool for enhancing learning. Instead, technology is about literacy, a process that synergizes semiotic resources for people to create meanings. This transactional stance (Bruce, 1997) emphasizing the dynamic and interwoven relationship of technology and literacy resonates with the New London Group's new literacy. According to the New London Group (1996), communication is not limited to written or spoken interaction, but expands itself to multimodal forms of expressing oneself by combining linguistic, visual, audio, gestural, and spatial texts afforded by digital and internet technology. Therefore, modern literacy should shift away from traditional literacy with its primary focus on writing and speaking toward multimodal literacy, defined as "the meaning-making skills constituting reading, viewing, understanding, responding to and producing and interacting with multimedia and digital texts" (Walsh, 2010, p. 213). According to Rowsell and Walsh (2011), multimodal literacy focuses on "multimodality," the ability to use different modes to create meaning. In contrast, "multiliteracy" refers to the pedagogical potential of incorporating the transformational new form of literacy into classrooms to engage students so as avail themselves to the multiple forms of digital technology.

Regarding language education, Veliz and Hossein (2020) have also pointed out that in the multifaceted technology-mediated world, it is almost inevitable to incorporate digital multimodal tools into language classrooms for enhancing language learning experiences. Language teachers' multiliteracies have thus become essential for teaching a second language in the modern digital age (Jiang et al., 2021). Li (2020) argues that while an increasing number of studies have documented exactly how language learners engage in, and benefit from, a wide range of multimodal practices, research on multimodal experiences of language teachers is still in its infancy. This leaves teachers feeling unprepared, and they therefore hesitate to incorporate multimodal practices into their classrooms. Considering that language teachers' multimodal experiences and knowledge play an important role in students' multimodal literacy development, aligning with Rowsell and Walsh's (2011) concept of "multiliteracy," this study is designed to explore how pre-service teachers' multiliteracies develop through utilizing SVVR tools to design teaching materials in an English as a Foreign Language (EFL) context. The following questions guide us through this inquiry:

- RQ1: How does a SVVR project afford pre-service teachers' multiliteracy development in English language teaching?
- RQ2: What are the perspectives of pre-service teachers toward using SVVR to enhance their English language teaching?

Given that teacher preparation is fundamental in implementing new technology with multimodal-informed pedagogy, this study is significant. It offers opportunities for SVVR technology to be introduced to, and practiced by, pre-service teachers while also exploring their multimodal pedagogy development and their perceptions toward adopting SVVR for language teaching.

## **2. Literature review**

### **2.1. From digital literacy to multimodal literacy in language teacher education**

The ability to understand and utilize technology has been coined "digital literacy" (Dudenev & Hockly, 2013), a term often used interchangeably for new media literacies, twenty-first century skills, or digital competencies (Jeong, 2017). As teachers play a pivotal role in transforming technology into meaningful language learning, numerous studies have investigated the integration of digital literacy into language teacher education (Kuru-Gönen, 2019; Jeong, 2017). However, as Dzekoe (2020) rightly pointed out, in an age when people use technology not merely as a tool, but as a process to design semiotic products and events, almost all screen-based texts are multimodal in nature. Our understanding of using technology in language teaching settings should go beyond digital literacy, with its focus mainly on the ability to utilizing different technology tools. As such, it can move toward a "multimodal literacy" that captures learners' understanding of the multimodal affordance of different digital tools: that is, how digital technologies are designed with different modes and what they allow users to produce and achieve so as to express meaning (Dzekoe, 2020). Accordingly, language teachers' multiliteracies—the ability to integrate multimodality into classrooms—have become essential in training their students to become designers able to use a wide-ranging multimodal repertoire to "interpret, manage, share, and create meaning in the growing range of digital communication channels" (Dudenev et al., 2013, p. 2).

In L1 teacher education programs for English Language Art (ELA), Miller (2007) and Hundley and Holbrook (2013) had pre- and in-service teachers conduct a multimodal composition project wherein they combined different modes to design multimodal materials for teaching the English language. Teachers in both studies revealed that they gradually came to see themselves as an active creator who orchestrated visuals, music and printed text in the project to transform their students' learning experiences from reading/writing print to visual/auditory texts. However, some teachers still hold a "print bias" (Miller, 2007, p. 64) and consider multimodal texts to be illegitimate instructional materials, and therefore showed reluctance to teach English language in multimodal formats. In an L2 learning context, both Rance-Roney (2010) and Li (2020) reported that the participating teachers in their graduate courses showed very positive benefits in developing their professionalism in teaching English language through engaging in multimodal practices using technological platforms of their own preference (e.g., Prezi and Storybird). However, Yi and Choi's study (2015) echoed the teachers' experiences in Miller's work (2007) in which, though acknowledging the potential of multimodal pedagogy, the in-service teachers in their study showed concern that too much time spent on various modes other than text might hurt the academic performance of their students, as learning outcomes were still assessed primarily through text mode. Yi and Choi (2015) called for more investigation into teacher education about multimodal pedagogy to develop the ability of pre-/in-service teachers to design proper multimodal lessons which align with mandatory standards in their teaching contexts.

## **2.2. VR and SVVR for language learning and teacher education**

With the characteristics of being interactive and immersive within a realistic learning environment, various VR channels (e.g., Second Life, Google Expeditions) have offered great potential for enhancing L2 learning achievement (Chen et al., 2021; Ebadi & Ebadijalal, 2020; Wu et al., 2021), while providing ample opportunities for students to experience contexts and concepts which might not be viable in the real world (Choi et al., 2016). Scholarly attention has also been increasingly geared toward implementing VR into language teacher education. For instance, Chen (2019) showcased how an ESL teacher, through the guidance of a mentor, learned how to develop English lessons using Second Life to motivate students in a remedial English support program. Moreover, Kozlova and Priven (2015) investigated how a group of pre-service teachers in Canada used 3D virtual worlds to design engaging English language lessons for undergraduate EFL students in Turkey.

Despite the pedagogical benefits offered by VR channels, they are often presented in fixed sets of images which cannot be adjusted by teachers for developing more flexible teaching materials. Moreover, it is usually technically and financially challenging for teachers and schools to develop realistic 3D interactive VR content (McFaul & FitzGerald, 2019). Even when a developed VR platform is available, it is difficult for most teachers to learn to design VR content for pedagogical purposes when no sufficient instruction is provided (Chen, 2019). Recently, spherical video-based virtual reality (SVVR) has been used to address these difficulties. SVVR refers to a VR approach presenting 360-degree spherical videos, creating a realistic environment for users to look in all directions (Chen & Hwang, 2020; Walshe & Driver, 2019) with the use of an HMD or conventional computer device. Compared to the general HiVR, SVVR can be easily and inexpensively implemented in classrooms, as it offers a variety of ready-to-use 3D spherical videos and objects for users to design their own VR tasks. Users can also create their own spherical 360-degree videos with a handy spherical (360-degree) camera or download free available spherical videos online. Secondly, SVVR can be accessed by users' own mobile phones using an inexpensive cardboard goggle setup, costing as low as US\$6 (Jong et al., 2020); alternatively, it can be viewed without goggles from standard computer devices.

SVVR has been recognized for its features of being low-cost, easy-to-access and easy-to-produce, and has thus been widely applied for educational purposes (Han, 2020). Only a recent handful studies have focused on using SVVR in language education. For example, Chen et al. (2021) examined the effect of integrating SVVR technology into problem-based English learning of Taiwanese engineering majors, finding a positive effect on their English vocabulary acquisition and motivation toward future English learning. Moreover, Chen and Hwang (2020) found significant improvement in English oral presentation ability and learning motivation in students having different cognitive styles (i.e., field-dependent and field-independent) who experienced SVVR learning in an English for Tourism course. Lastly, Chien et al. (2020) implemented peer assessment into SVVR-based English courses in Taiwanese high schools. The results showed that the peer-assessment-based SVVR group revealed significant improvement in English speaking, learning motivation, critical thinking skills, and reduction of anxiety toward learning English.

As shown in this section, many researchers have noticed the potential of VR and SVVR in educational applications and language education. Yet research on teacher training in using VR, particularly SVVR, is still relatively scarce. Moreover, little attention has been paid to multimodality or multiliteracy development in a VR context. According to Philippe et al. (2020), there were no peer-reviewed articles found published between 2010 and 2020 on Science Direct (Elsevier) related to multimodality, VR and teaching and learning. Given that the teacher plays a central role in developing students' multimodal literacy when utilizing a new technology, for example VR, teachers' multiliteracies in the context of VR application deserves more examination.

## **3. Methodology**

### **3.1. Context and participants**

Thirteen graduate students majoring in English enrolled in an 18-week elective course entitled Teaching Materials and Pedagogy in TESOL at a four-year academic university in central Taiwan. Seven of the thirteen students volunteered to participate in this study: among the seven participants, while five of them agreed to be interviewed and to share their SVVR artifacts for this research, another two agreed to be interviewed but had no intention to share their artifacts for research purposes due to personal privacy issues. Consent forms were signed by all participants before data collection. Ages ranged between 22 and 31. Most of these pre-service English teachers had little or no formal teaching experience prior to the class, and none of them had experienced VR instruction in their previous courses or used the SVVR technique to create learning materials of their own.

However, all of them had used VR for their own entertainment purposes, such as movies, tourism, museums, or gaming. The students learned about general TESOL teaching principles for the first nine weeks, after which each student needed to design a lesson plan in the English language on a topic of their interest (Wks. 10-12). Students were then introduced to an SVVR tool, Uptale (Wk. 13), and asked to design an individual SVVR project based on the lesson plan as their final project (Wks. 14-17). At the end of the semester, students had to do an individual presentation and demonstrate their SVVR projects to the class (Wk. 18).

### **3.2. Production software and technology used for SVVR learning materials production**

The SVVR learning materials produced by the pre-service teachers were completed through Uptale (<https://www.uptale.io>), a web-based authorized platform accessed by computer for the building of an immersive, contextualized, and interactive learning environment. The researchers chose Uptale due to its affordable cost and its relative ease-of-use regarding necessary computer literacy/skills. Uptale allows users to attach 360-degree panoramic videos/images along with text descriptions, narratives, questions for interaction, ambient sounds and voice recording to each scene. The 360-degree panoramic videos are available from Uptale or can be captured using 360-degree cameras by users. To ensure that the pre-service teachers would understand and make full use of the available features of Uptale, the course instructor (the second author) provided a three-hour training workshop in advance wherein the main features of Uptale were introduced. Familiarized with Uptale features, the participants then arranged the scenes contextually based on their pre-designed lesson plans, which included the main goals of the class, the level of its learners, learning focus, learning time and activities. To conclude, through Uptale SVVR, the hypothetical students of the participants in this study could learn in a more immersive and interactive environment through 360-degree spherical images or videos that are more realistic than 3D animations.

### **3.3. Research design**

The researchers adopted a qualitative research design to address the research questions (Creswell & Poth, 2016). The researchers collected data from three sources: (1) participants' artifacts from the SVVR project ( $n = 5$ ); (2) video-recordings of the participants' presentations about their final SVVR artifacts ( $n = 5$ ), each presentation recording lasting approximately 25 minutes, including a Q&A section; and (3) two semi-structured one-on-one interviews with each volunteer interviewee ( $n = 7$ ), the first interview conducted one day after their final presentations and the other after initial analysis for follow-up questions and member-checking. Each interview lasted one hour and was conducted by the first author after the final grades for the course were released. Due to circumstances surrounding the pandemic at the end of research course, participants' presentations and research interviews were conducted and recorded online through Microsoft Teams software. While the final SVVR presentations were conducted in English, individual interviews were in Mandarin. All data sets were used to answer RQ1, while interview data was used to answer RQ2.

### **3.4. Data analysis**

For the presentation and interview data, we adopted Braun and Clarke's (2006) thematic analysis method and followed the six steps they suggested which allowed the researcher to identify, analyze, and report patterns across data sets to address the research questions appropriately and adequately (Table 1).

As for SVVR artifacts, we followed Bezemer and Kress (2016) as our analytical guide and understood that communication, including teaching and learning, is a process of meaning-making. We analyzed the creation of the SVVR artifacts as a process of how the pre-service teachers, the meaning-makers, used a variety of modes available on Uptale tool as meaning-making resources to "construct social (learning) environment" meaningful for their students (p. 62). Along with the rationales provided by the participants in the presentation and interview data for using different modes to design their SVVR teaching materials, we better understood how the SVVR project afforded their multiliteracy development. During the analysis course, we constantly compared and contrasted the relevant features among the three major data sources—SVVR artifacts, presentation recordings, and interviews—to triangulate and enrich the dataset in order to reach a sound understanding and interpretation of the participants' experiences and multiliteracy development in producing SVVR projects for English language teaching. During the process of producing the report, the Mandarin transcription was translated by the first researcher into English, then checked by second researcher and the pre-service teachers before being presented as quotes in this paper. Pseudonyms were used to conceal the identities of the participants. For RQ2, all responses of the volunteer interviewees ( $n = 7$ ) will be presented in the paper. For RQ1, the researchers presented

an analysis of the five SVVR projects from the interviewees who were willing to share their artifacts and respective comments.

*Table 1. Phases of thematic analysis*

Phase	Description of the process
0. Transcribing data	Transcribing the spoken data in presentations and interviews verbatim in English or Mandarin.
1. Familiarizing yourself with your data	The first author read and re-read the data along with corresponding SVVR artifacts, noting initial ideas.
2. Generating initial codes	The first author coded relevant features in relation to research questions across multiple data sets.
3. Searching for themes	The first author collated codes repeatedly and identified the themes in relation to the participants' experiences of conducting the SVVR project and multiliteracy development.
4. Reviewing themes	Based on the emerging themes categorized by the first author, two researchers reviewed and discussed the themes together.
5. Defining and naming themes	Two researchers re-coded the data and re-organized the themes until they could clearly define and name the themes.
6. Producing the report	Two researchers selected vivid and compelling excerpts for each theme to answer the research questions and finally produced a scholarly report of the analysis.

## 4. Findings and discussion

### 4.1. Pre-service teachers' multiliteracy development in English language teaching

#### 4.1.1. Learning to compose multimodal lessons

Several participants reported that they were worried that they might not be able to complete the SVVR tasks because of their limited technology skills. However, they also mentioned that through doing this SVVR project, they became more confident and motivated to design English lessons that differ from the traditional way of teaching. As Cindy commented, through this SVVR project she realized that:

Traditional learning methods such as memorizing vocabulary and grammar rules from a textbook cannot really motivate students to learn the English language in today's digital world. (Interview)




Therefore, she was motivated to design a task for students to learn vocabulary of different animals in the grasslands of Africa (see Figure 1).

*Figure 1. Cindy's artifact of African grasslands*



Cindy designed a lesson on the SVVR platform integrating modes such as text (questions and answer options), sounds (reading out-loud of questions and answer options) and African folk music along with a 360-degree spherical video of the African grasslands created by herself. By composing a task with these modes, Cindy

wanted her students “to feel learning is actually interesting and fun, just like playing games” (Presentation). Cindy later commented that she particularly liked the spherical view because “students were really immersed in and surrounded by the African grasslands while they played” (Post-interview). Compared to learning from printed teaching materials, Cindy believed that it could be easier to learn the vocabulary of African animals when students were surrounded by a virtual environment where they could explore the 360-degree image with folk music playing. As she excitedly said, “it’s just like they were sitting in a jeep, driving around and exploring!” (Post-interview).

Jean emphasized the importance of the spoken mode made possible in this tool. For example, Jean designed a task where a mom called her daughter (the students) to order a take-out meal (Figure 2). First, students had to listen carefully to what they needed to get for the mom. They then pressed the  button and a Korean staff member took their orders. The students then pressed the  button and ordered the food as the mom required. Their voices were recorded, and students could press the  button to hear their own voice played back. Jean stated:

I think it is good to have students be able to interact and speak up to the staff. It is easy for them to get all kinds of input, but rarely they can practice speaking in a space like this...they can learn all the aspects here. (Interview)

Figure 2. Jean’s artifact of a Korean restaurant



Jean observed that despite being constantly exposed to a digital environment, digital natives seldom had the opportunity to speak up in that space. The interactive environment afforded by the SVVR tool offered hypothetical students a valuable learning space to learn all aspects of the English language, including the skills of interacting and speaking with others. In addition to the spoken mode, Jean also integrated pictures of a Korean idol group throughout the 360-degree spherical video with Korean pop songs playing. Jean believed that the images and music could contextualize the interactional environment and make the space more authentic for interaction.

While several participants had noticed the importance of integrating a variety of modes into their teaching material, Jill noted:

I was afraid that I couldn’t express myself clearly through different ways, so I still relied on text to go with the sounds and pictures to explain what I wanted them to do. (Presentation)

Jill’s experience demonstrated that along with various semiotic means, such as visual and aural, text mode also serves as equally important to other semiotic modes for people to express themselves (McVee et al., 2008). As a novice teacher, Jill found the traditional text modes offered her a sense of security to clearly express her teaching purposes to her future students. According to Early et al. (2015), written and spoken modes are also important means for communication in our new age and therefore should not be ignored. Enabled by its voice recording and voice recognition functions, the SVVR tool used in this study afforded an interactive space for pre-service teachers to include visual and audio (Cindy), speaking (Jean) and written forms (Jill) as modes to enrich their multimodal teaching tasks.

#### 4.1.2. Concretizing the intangible context for learning

Several participants also showed the ability to compose their VR instructional artifacts, using different modes, into a highly immersive learning environment for students to experience contexts that might not be accessible in their real world (Choi et al., 2016). For instance, aware that her students might not be able to physically view the great migration in Africa, Cindy created a 360-degree spherical image coupled with a video showing the Great Migration of African antelopes to introduce the concept and vocabulary “Great Migration” to students (Figure 3). As she explained:

Using only sounds or pictures can’t really show how fast antelopes are moving in such a big crowd when they migrate. I think the video can show the speed and sounds of antelopes, even the flow of water. It can immerse them into the real context, like the Great Migration is really happening around them. (Interview)

Figure 3. Cindy’s artifact of the Great Migration

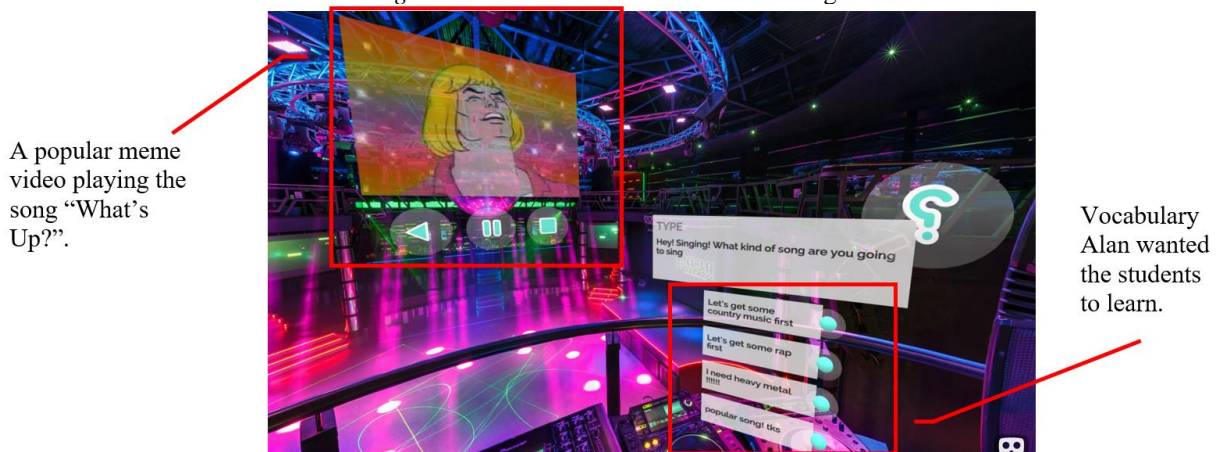


With a 360-degree image and a video of the Great Migration, Cindy used multiple modes, such as images of the animals, motion (e.g., speed), and the sounds of running antelopes and water flow from the video to simulate the great migration. By doing so, she hoped that students could learn the concept and vocabulary while “it is really happening around them.”

Similarly, for high school students to experience singing in a karaoke lounge, a place where the majority of students might not have the chance to go because of the cost, Alan created a SVVR project for students to experience this activity while learning English:

I couldn’t find an image of a karaoke lounge from the tool so I chose this place with dark but colorful lighting...I put on a very popular music video to make it more like a karaoke place and also to catch the students’ attention for learning. (Presentation)

Figure 4. Alan’s artifact of a karaoke lounge




In this scene (Figure 4), Alan chose a background picture with “dark but colorful lighting,” where he put on a popular music video among young people with the song playing “What’s Up” by 4 Non-Blondes. The music video was not used for karaoke singing, but was commonly used among young people as a meme asking for information on social media. With its colorful lighting and popular music video, Alan orchestrated a multimodal environment that was close to the students’ life and culture, in order to trigger their interest in learning English vocabulary such as country music, rap, and heavy metal.

What is also worth noting was that several participants even created an intercultural communication context for their students to experience English as a lingua franca (ELF) by adding different English accents in the SVVR task. For example, Alan purposely added a Japanese accent in one conversation in one karaoke scene as shown in Figure 5.

Figure 5. Alan’s artifact for ELF experiences at a karaoke entrance



At the entrance, a waitress welcomed the customers by saying, “There are still rooms available. Please check in with the counter.” By pushing the  button, the students answered “thank you” in order to move on to the next scene. Among many other accents available from the SVVR tool, including native English speakers, Alan chose a Japanese accent for the waitress because:

It is very likely that people will encounter English speakers from all around the world...it would be good to train the students to understand different kinds of accents.” (Presentation)

In this globalized world, English is used as a means of interaction. Meaning should come foremost and forms second. From this perspective, different accents and varieties of English should be valued for intercultural communication (Jenkins, 2009). By orchestrating an artifact with a 3D picture of a local karaoke place and an image of a Japanese waitress speaking with a Japanese accent, Alan created an ELF space for his students in Taiwan so as to learn to accommodate Japanese accents in English-mediated interaction.

Like Alan, Jean also created a similar space (see Figure 2) by choosing a Korean-English accent to represent the staff’s voice in order to make students feel that they were “really situated in a Korean restaurant” (Post-interview). As English has become a lingua franca, the language has been globalized into many forms and accents for communication in various interactional context (Jenkins, 2009). The SVVR tool allows multiple modes to orchestrate such a globalized space in the virtual world for Alan, Jean and their students to experience a globalized context of English communication.

#### 4.1.3. Learning “space” as a mode for teaching and learning

“Space” is an important piece of the multimodal repertoire for communication (Keating, 2016). In the highly immersive and interactive SVVR project, several participants realized that space was not merely a vessel, but text, that is, meanings people design and compose to communicate for their own purposes (Bezemer & Kress, 2016). For example, Nicky chose an image with a big counter (Figure 6) as her scene background for students to learn how to tell clinic staff their appointment time with the doctor. When asked about her choice of such a big counter, she stated that the counter made the space more interactive for learning:



The counter helps people know more precisely what situation they are in and what they need to do in that situation, such as needing to greet first and then explain the purpose for coming here. (Interview)

Figure 6. Nicky's artifact of a clinic counter

Text instruction:  
Tell the counter  
staff your  
appointment time  
with the dentist.

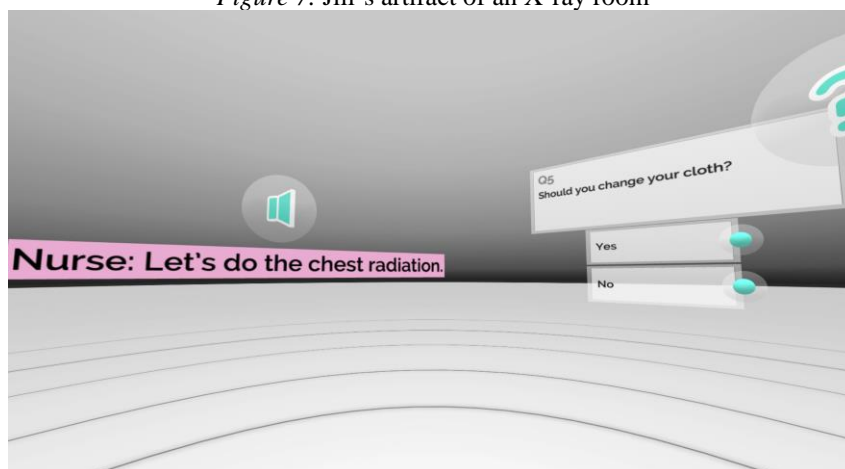


According to Jucker et al. (2018), interaction takes place in a spatial context when interactants become aware of being perceived. The counter space here does not refer to merely a physical object, but also to a semiotic resource Nicky used to help students become aware that they are situated at a clinic counter and within the space of a particular institutional discourse, like “you need to greet first and then explain your purpose for coming here.” With the text instruction “tell the counter staff your appointment time with the dentist,” students are made to notice that they are being perceived as an interactant in the space. Using the big counter along with the text instruction, Nicky constructed the space as a mode for students to visualize the conversation in which they had to interact with the other interactant (i.e., clinic staff), using language appropriate for a dentist clinic counter.

Likewise, Jill chose an image of an X-ray room (Figure 7) as a scene background and constructed a pedagogical space for students to learn how to interact by “feeling” the X-ray room. The following quote relates her description of the scene design:

This is how I felt when I was in an X-ray room. The room is grey and looks spacious. The door is pretty heavy and the whole room is cold and mechanical. I felt people don't talk much but just want me to follow instructions...to finish and leave there as soon as possible. (Interview)

Figure 7. Jill's artifact of an X-ray room



Using the color “grey,” Jill depicted the X-ray room as “cold, heavy, and mechanical” that make people “feel alone.” According to Jucker et al. (2018), senses serve as a central role in constructing our experiences and understanding of the world. By using her senses (e.g., cold, heavy, mechanical and alone) to construct the space, Jill constructed the space as a somewhat unpleasant place to stay, where minimum interpersonal interaction was

required. Using the “grey color” to compose feelings in the space, Jill seemed to guide the students to understand the appropriate communication discourse in an X-ray room—that is, “no talking, just follow instructions.” Jill further elaborated that situated in an unpleasant atmosphere, “the students will not linger around but finish the questions in this scene quickly and move on to the next scene for another task.” (Interview). The space was presented as a text carrying communicative meanings between Jill and her students, instructing the students to ‘finish the task quickly and move on to the next task.’”

Cindy also learned to organize the digital space to communicate with her students. She stated that “although it’s a 360-degree spherical image, I tried to put the relevant clues for students within 180-degrees.” As shown in Figure 8, there are only two clues in the 180-degree dimension; one is a picture of a camel, and the other is a question asking students to count the number of the camels appearing in the safari. In organizing the space in this manner, she hoped that her students could find the clues more efficiently:

It is to have students learn English by answering questions through the clues that are given. If students are spending too much time finding the clues around the image, it will just be wasting time and not so effective. (Interview)

Figure 8. Cindy’s artifact of camels in the 180-degree dimension



By placing relevant clues within the 180-degree dimension, Cindy tried to communicate with her students not to waste time searching all around the image, but rather focus on the dimension she had purposefully designed to include all the information for learning. The spherical image served as a mode for Cindy to communicate with her students about what needed to be learned in the space.

As Keating (2016) rightly pointed out, the digital world has given rise to new discourses about “how to appropriately organize digital spaces and how to interpret behaviors within them” (p. 264). While designing their SVVR artifacts, participants realized that the 3D VR space was not only a vessel that contained different learning tasks for students. Instead, using different modes available in the platform (e.g., big counter; grey color; dimensions), they organized their SVVR space appropriately as a pedagogical environment to communicate with their students about the learning foci in each of the digital scenes and to guide their students to interact appropriately in the context they designed.

## 4.2. Pre-service teachers’ perspectives about integrating SVVR into English learning

### 4.2.1. Technology-novice friendly

Echoing many of the studies on using SVVR in an educational setting (e.g., Chien & Hwang, 2020), the majority of participants agreed that the SVVR tool required simple technology skills for designing VR tasks and was therefore technology-novice friendly. As Jean noted:

I started learning how to incorporate new technologies to help my teaching... (this was) especially helpful for a technology-novice like me who only knows how to make simple PowerPoints” (Interview).

Through doing this project, Ava also stated:

It took a bit of time to get used to each function, but after the workshop and discussion with Vivian, it was easier than I thought. I was pretty worried that I couldn't complete the task because my technology skills were really bad, but I did it! (Interview)

Ava's comment pointed out that not only can this SVVR tool be user-friendly, but also that sufficient instruction (e.g., workshop) can facilitate the pre-service teachers' learning experiences of integrating new technology into their teaching practices (Chen, 2019). The features of being easy-to-access and easy-to-produce have not only made SVVR a friendly context for pre-service teachers to learn how to integrate VR tools into their own teaching, such features also trigger the motivation of teachers to use VR-related technologies in the future. As Nicky said:

I used to think that these were not my things...but after doing this project, I think I became more comfortable and confident in trying and using 3D-related technology for my own purposes or for teaching purposes. (Interview)

Cindy also mentioned that with the step-by-step instruction provided by the course instructor, designing her own VR tasks was easier than expected. This smooth experience motivated her to design another teaching task using the Uptale SVVR tool, even after the course has finished. As she stated, "I am already planning to conduct another teaching task using the same platform." (Post-interview)

#### **4.2.2. From passive to active learners**

Given the feature of being interactive, several participants mentioned that the use of SVVR can turn not only their students but also themselves from passive learners to active learners. For example, Jill noted that in contrast to another technology medium—video which is often used as a pedagogical tool—SVVR transformed students from being passive to active learners as "they have to find the questions and interact with the computer, and it will respond back to them as well" (Interview). Similarly, Andy also remarked about the difference between watching a two-dimensional video and SVVR:

SVVR is different from watching videos because students have to interact immediately with the speaker in the computer in order to get rewards and proceed to the next task. (Interview)

Andy further elaborated that by interacting to get rewards, the game-like activity was particularly efficient for motivating students to actively engage in English-language learning. In addition to encouraging students to actively react in the virtual space, Jean also noted that the virtual interactive environment in SVVR could make students less nervous when speaking English because they were not interacting with "a real person." As Jean commented:

This makes it less stressful... You are talking to a virtual person and she is not really standing in front of you and waiting for you to speak up. I think this could motivate especially shy students to speak up. (Interview)

Although being interactive and immersive in the virtual space, the person with whom the students had to interact was not "really standing in front of you and waiting for you to speak up." This feature made the learning environment less intimidating and therefore had the potential to motivate shy students to speak out more actively.

Not only did the SVVR project provide a potential context to turn language students into active learners, both Cindy and Alan noted that in order to make their projects more immersive and authentic, they spent extra time after the class trying to learn how to make 3D-spherical videos by themselves or how to edit readily available videos they found online. As Cindy commented:

Uptale does not have the safari picture I needed for my SVVR background, so I googled the topic and also asked my friends their advice as to how to make 3D-spherical videos for this project. The one I used was downloaded online. I learned to transfer it into a compatible form to put it in my SVVR project. (Interview)

Through completing this SVVR project, Cindy became an active learner who was willing to develop her own VR skills for her own interests or purposes of teaching the language.

### **4.2.3. More support needed from instructors and peers**

Despite the many benefits expressed by the participants, a few drawbacks were also mentioned. First of all, Alan noticed that although 3D pictures were available, there were very limited options from within the SVVR platform itself. This limitation sometimes made the scene “inauthentic” or “not real” for the designed scenario. As Alan explained:

I was trying to find a 3D picture of a waitress in a karaoke lounge, but there was no 3D portrait to choose from. So, I ended up putting a 2D picture there ...as you can see, she does not really fit into the scene and looks very inauthentic. (Post-interview).

Nicky noticed the same issue. In order to render the scene a more authentic environment for the learning, she tried to make her own 3D pictures or 360-degree spherical video but found it very time-consuming and even costly. She doubted whether she would spend so much time on designing a teaching task for her future students. To address this issue, Nicky suggested that more workshops can be offered to demonstrate how teachers can make their own 3D images and spherical videos. With these skills, they could make the virtual learning space more immersive and effective for learning.

Andy also articulated that the time required was a significant challenge in designing the SVVR task. To address this issue, Andy suggested that it would be helpful to have other viewers to check the scenes for the designer. Having the perspectives of other viewers, Andy believed:

They can tell me what needs to be removed and what needs to be added to improve the tasks so the students can learn more efficiently. (Interview)

Several participants also stressed the importance of having other viewers to provide feedback to improve their SVVR tasks. Ava said:

Because I am the creator, the processes and structure of each scene all makes sense to me...This could be tricky because I wouldn't know if I had made myself clear enough for my students to follow the instructions. (Interview)

To prevent such a blind spot, she had one classmate go through her task. The peer then suggested that some of Ava's scenes were packed with too many questions and text, making the instructions not so clear to follow. Ava then revised some parts of her tasks accordingly. She concluded that peer feedback was very helpful as “it saved a lot of time for me and also made me feel more confident to present the task to others.” (Interview).

To conclude, although challenges were reported, participants also emphasized the importance of peer collaboration and the guidance of their instructor to help smooth the process of learning how to integrate technology such as SVVR into their multimodal teaching artifacts (Chen, 2019; Li, 2020).

## **5. Conclusion and recommendations**

The findings show that pre-service teachers' multiliteracies developed through conducting SVVR teaching projects. Learning by doing a SVVR project along with a training workshop and instructor's guidance, the participants learned how to orchestrate their own SVVR teaching artifacts and created multimodality-informed materials to engage their students to learn the English language in an immersive, immediate, interactive, and multimodal learning environment (Chen, 2019). The ability of teachers to create such environments for language learning is crucial so as to expose their students to a wide range of multimodal repertoire, preparing them to be able to interpret, manage, and create meaning in the digital world (Dudeney et al., 2013). Teacher education thus plays an important role in transforming more teachers into creators of multimodal artifacts using new technologies such as SVVR (Li, 2020; Yi & Choi, 2015).

The multiliteracy concept, findings and discussion above lead to the following three recommendations for practice when integrating an SVVR tool to enhance the multiliteracy of pre-service teachers: (1) explicit and detailed instructions about the functions of SVVR tools is necessary to enhance pre-service teachers' confidence about using new technology, as only when they feel comfortable and confident does the willingness to integrate technology to their own teaching increase; (2) technology skill levels differ regarding knowing how to use such tools to design language lessons, as guidance from instructors or peers is needed for pre-service teachers to learn

how to integrate the new technology into the pedagogy of the language classroom; and (3) workshops for developing 3D images, 360-degree spherical videos or other modes (e.g., music editing) can be provided to train pre-service teachers to make their own virtual objects for SVVR teaching tasks, as when they are not limited to the object options available from the SVVR tool, they can create more powerful and effective SVVR multimodal teaching materials for their future students.

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