


Teaching With Immersive Virtual Reality: Perceptions of Korean Trainee Teachers

Sangmin-Michelle Lee, School of Global Communication, Kyung Hee University, South Korea

Junjie Gavin Wu, Faculty of Applied Sciences, Macao Polytechnic University, Macao*

 <https://orcid.org/0000-0003-4937-4401>

ABSTRACT

Immersive virtual reality (iVR), an emerging technology, is starting to lead and shape the future of education. Yet, due to technical, financial, or pedagogical reasons, this novel technology has been seldom applied directly in classroom teaching by language learners and teachers. The present study attempts to contribute a qualitative understanding of language learning in the iVR environment from trainee teachers' perspectives. These trainee teachers, armed with basic pedagogical knowledge, designed and practiced teaching with a commercial VR platform. Through analysis of interviews and reflective journals, insights were gathered from the participants who organized teaching in a completely new setting. Findings suggested a great line of contributing and hindering factors of using iVR in language education from teachers' perspectives. Implications are discussed at the end of the article to guide future learning and teaching with immersive technology.

KEYWORDS

contributing factors, hindering factors, Immersive virtual reality, language learning, trainee teachers

INTRODUCTION

Alongside the evolution of the internet, language education has exhibited a similar progressive development pattern from normalized computer technologies (Web 1.0, e.g., PowerPoint), to widely applied mobile technologies (Web 2.0, e.g., WhatsApp), through to cutting-edge immersive technologies (Web 3.0, e.g., extended reality). Virtual reality (VR), one of the latest technologies, has begun to penetrate student learning in various disciplines across the globe. Differing from traditional classroom role-play, which has been criticized for its lack of authenticity, VR offers brand-new immersive learning experiences (Lee, 2022). In particular, the unique context-aware feature of VR empowers language learners by extending the classroom learning environment and mimicking the real world (Dhimolea et al., 2022). For example, in the past, learners needed to engage in conversations or actions based purely on their imagination (e.g., visiting Buckingham Palace), whereas they can now immerse themselves in a VR Buckingham Palace with 3D technology. Through the creation of virtual

DOI: 10.4018/IJCALLT.334362

*Corresponding Author

This article published as an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and production in any medium, provided the author of the original work and original publication source are properly credited.

worlds, learning can also take place in contexts which in the past could be expensive (e.g., going on a trip to Paris), impossible (e.g., conversing with Princess Diana), or dangerous (e.g., learning English expressions about lions by observing and touching lions).

Commercial companies have endeavored to tap into this novel field of education by creating user-friendly tools. For example, *Immerse* is a VR program that provides accessible, contextual, and immersive experiences for language teachers and learners. However, until now, these new VR platforms have not been fully investigated, partly due to the substantial financial resources that are necessary for them to be deployed in schools. Therefore, questions about how teachers can actually make use of this emerging technology in transforming student learning remain largely unanswered. To this end, this paper aims to advance our limited understanding of immersive virtual reality (iVR) in language learning and teaching.

IVR AND LANGUAGE EDUCATION

Based on the degree of immersion, VR can be broadly categorized into non-immersive, semi-immersive, and immersive VR (Villena-Taranilla et al., 2022). To display a vivid virtual world, iVR generally requires specialized and expensive headsets and controllers. In contrast, non-immersive and semi-immersive VR offer users less realistic but more affordable experiences (e.g., Wu et al., 2022). A recent review by Parmaxi (2020) revealed that most literature on VR language learning has focused on the use of non- or semi-immersive VR due to cost, internet requirements, and usability. Yet, researchers such as Chun et al. (2022) and Lan (2020) have suggested that the educational use of iVR increases student motivation and interest in learning, enhances engagement, reduces cognitive load, and reinforces long-term memory. It also lowers language learning anxiety (Wu et al., 2021) and improves communicative competence (DeWitt et al., 2022).

Wang et al. (2020) synthesized the theoretical underpinnings of iVR language learning. In their proposed model, iVR provides learners with opportunities for immersive (physically and psychologically), situated, and scaffolded learning. With these unique affordances, language learners are more likely to progress their learning both linguistically and affectively through meaningful interactions with people, objects, and technology. Nonetheless, Traxler and Kukulska-Hulme (2016) cautioned that advanced technology *per se* is ineffective on its own.

Dhimolea et al. (2022) reviewed the latest research about iVR in language education. According to their review, although related research has increased in recent years, the number of iVR language learning studies remains insufficient. Moreover, they found that most attention has focused on a small number of topics such as vocabulary acquisition, oral communication, and writing skills and most of the existing studies are conducted from the perspective of students. Therefore, to combat the Wow effect of new technology and to provide and sustain student learning, more attention is needed to explore teachers' effective use of iVR in their teaching practices.

McGarr (2021) discussed the benefits of using iVR in teacher education, including translating pedagogical knowledge into teaching practices, reducing trainee teachers' "performativity pressures" (p. 161) in teaching practicum, and reflecting on and modifying their teaching behavior through repeated practice. Chen (2022) recently conducted a study on improving trainee teachers' understanding of and teaching practices with iVR. The results suggested that with proper guidance, trainee teachers became more confident in handling students' iVR learning challenges and were able to transfer skills gained in training sessions to actual teaching. More importantly, the study argued that real-time feedback from teacher educators positively shapes trainee teachers' behavior and affect.

However, it is important to bear in mind the point highlighted by Lan (2020) that to ensure meaningful and effective use of iVR in language education, teachers must be fully prepared, technically, pedagogically, and psychologically to "address the 5W-H questions (who, what, when, where, why, and how)" (p. 9). Teacher agency is essential in addressing various challenges relating to the use of

iVR in teaching, including choosing appropriate assessment tools, protecting the health and wellbeing of students, and overcoming a range of technical issues.

Bower et al.'s (2020) study, which investigated 106 trainee teachers in Australia, argued that the extensive use of iVR among trainee teachers has the potential to normalize this new technology as part of teaching practice. However, a wide range of obstacles were reported with regard to the adoption of iVR in the trainees' future teaching. Some of these were external, such as the attitudes of school management, limited access to iVR equipment, and a lack of proper technical and pedagogical training. Yet more significantly, certain internal barriers, such as an insufficient understanding of and negative attitudes towards iVR, were identified as being "hard to change" (p. 2227) among the teachers. Therefore, it is important to understand the attitudes that trainee teachers hold towards the integration of iVR in teaching. Against this backdrop, the present paper aims to explore how South Korean trainee teachers consider the use of iVR in language education. In particular, we focus on their perceived benefits and challenges of applying iVR in teaching by answering two research questions:

- 1) What are the affordances of using iVR in language education?
- 2) What are the challenges of using iVR in language education?

METHOD

Research Context

Based on convenience sampling, the study was conducted with 12 trainee teachers (female: 8, male: 4; aged between 21 and 30) who were attending a language pedagogy course at a private university in South Korea. A primary goal of the course was to support the teachers to innovatively transform and update their language teaching beliefs and practices by integrating the latest technologies into their teaching. As the importance of the teachers' technological competency has increased, we provided theories relating to use of emerging technologies and microteaching in the iVR environment. In particular, during the course, the basic theories, principles, and practices of integrating technology into education were discussed with practical examples and case studies. The participants were thus able to offer an expert point of view as they were equipped with relevant pedagogical knowledge. Specifically, they offered emic and scientific reflections on their user experience by evaluating the iVR learning experience. On average, the participants rated their technological competence as 4 out of 5.

The VR language learning software *Immerse* was used during the project. *Immerse* is the first iVR language learning software that aims to benefit language learners by engaging them in an iVR community where culture meets language. *Immerse* was first launched in 2021 as a beta version. The commercial version was subsequently released in 2022 to teach different languages, including English, French, and Spanish. The platform creates real-life learning environments such as a zoo, playroom or restaurant where learners can discover, act, interact, and communicate while learning the language (Figure 1). One unique feature of *Immerse* is that learners' movements are realized through moving their avatar in the iVR environment (e.g., walking, climbing, or sitting). There are other useful functions for teachers to design their lessons, including forming teams, rallying, prompting, and focusing on the teacher's instructions. The teacher can add objects (e.g., a timer, scoreboard, or TV monitor) and embed teaching materials (e.g., slides, PDFs, images, and videos) into the environment as shown in Figure 2.

To explore the virtual space, the trainee teachers wore VR headsets and used hand-held controllers (Oculus) to move their avatars. As *Immerse* is still in its infancy, it has limited capacity (max no.= 10 students/room). Hence, the study participants were divided into two groups. They participated in the *Immerse* learning environment under the guidance of an instructor. In terms of the research procedure, the 12 students made use of their pedagogical and technological knowledge to design English lessons and then to perform microteaching in *Immerse* over 15 weeks. In the introductory weeks, the students

Figure 1. Place selections

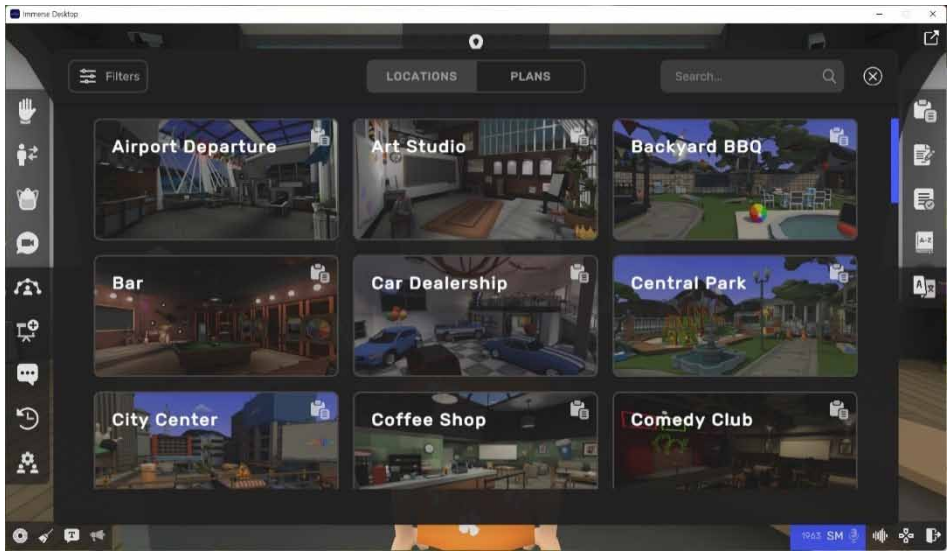


Figure 2. Functions in *Immerse*



explored the immersive VR environment to familiarize themselves with its features. In the following weeks, they worked in teams to develop lesson plans for middle school English classes. They chose different settings for their lessons, such as the magician's room, the coffee shop or the zoo, according to their lesson plans. The instructor monitored the learning process, gave feedback on their lesson plans and evaluated their teaching. Students revised their lesson plans by repeatedly switching between the lesson plan and the performance in *Immerse* to make the lesson more effective. In the final week, each team demonstrated microteaching in *Immerse*.

Data Collection and Analysis

To explore the participants' engagement, qualitative measures were adopted in this study. Reflective journals constituted the main data collection instrument as they are effective in helping to uncover

participants' inner thoughts and feelings about their experiences. The participants were also tasked with completing a Strengths Weaknesses Opportunities Threats (SWOT) analysis to further comprehensively evaluate the iVR technology and its pedagogical effectiveness. In total, the participants produced over 15,000 English words in their reflective journals. A constant comparative analysis method was applied to inductively analyze their reflections. Referring to Strauss and Corbin (1990), three steps were included to analyze the data: 1) Open coding: We read the reflections several times to get familiar with the data. Based on these close readings, initial codes were given to expressions that initially seemed to be related to our research questions. 2) Axial coding: After combing through the data, codes were further grouped into categories and categories were compared and contrasted. 3) Selective coding: Core categories were selected and the relationships among them were determined, which helped the research to address the two research questions. The researchers coded the journals independently and then compared the coding results. Disagreements were resolved based on further discussion.

Next, semi-structured interviews with each student (N=12) were employed. The interview questions included: What did you like about using iVR technology in language education? What difficulties did you experience? What should be improved? Each interview lasted approximately 15 minutes. A similar coding procedure (open, axial, and selective) was carried out to uncover the diverse factors of using iVR in teaching.

RESULTS

RQ 1: What are the Affordances of Using iVR in Language Education?

All of the 12 trainee teachers appreciated the immersive nature of *Immerse* in their teaching practice. Sub-features including multisensory, interactive, authentic, and motivating learning were stressed and intertwined in their reflections (Table 1).

Learning Experiences

When designing and teaching language lessons in *Immerse*, the participants mostly sought to utilize multisensory and experiential learning. Based on their reflections, actions such as exploring one's surroundings to learn about new words, touching and using objects, and producing food were common throughout their teaching practice. Moreover, in their practice, the trainee teachers not only included texts, but pictures and videos were also used to create a more stimulating environment. Learners were

Table 1. Affordances of using *Immerse* in language education

Themes	Subthemes	Indicators	Freq.
Learning experiences	Experiential learning	Moving avatars, manipulating/interacting with objects, active learning, learning by doing	27
	Multisensory and multimodal learning	Using multiple senses and different communication modes	14
Learning environment	Interactive learning	Participating in communicative, interactive, and collaborative learning	35
	Authentic/Contextualized learning	Providing real-life situation, real-life communicative tasks, and situated learning	18
	Sense of presence	Creating a sense of presence, feeling real/realistic	8
Affective engagement	Increased motivation	Perceiving the activities as motivating, enjoyable, fun, interesting, engaging, immersive	32
	Non-threatening environment	Being less stressful, saving face, increased confidence, using avatars	9

also encouraged to present their learning output in a multimodal manner. Park, for example, emphasized the visualization function in iVR, highlighting the multisensory nature of iVR environments. He stated that different to paper and pen-based learning, *Immerse* extended his classroom teaching by creating a more conducive learning environment. Similar to Park, the other participants commented that the multisensory and multimodal environment could enable learners to “mimic the act of grabbing and/or touching objects” (Kim), “[use] various visual materials (movie clips, songs, and ppt slides) to help students feel more interested” (Gil), and that it “influences all types of kinesthetic movement, with the reaction for each movement fully embodied” (Gwan).

In addition, the trainee teachers also believed that iVR provides an experiential way of learning. For example, when making a burger, the trainee teacher, Kang, asked her students to converse with the customer about the order, learn about the ingredients, and master the detailed cooking steps. Although this process seemed easy, Kang explained that “it requires communicative skills, subject knowledge, and linguistic knowledge.” Therefore, in such an activity, to achieve the learning objectives, the trainee teachers maintained that learners had to learn by undertaking tasks in a different manner from their accustomed passive approach to learning.

Learning Environment

Interactive and authentic learning activities were perceived as a major benefit of *Immerse* based on the trainee teachers’ teaching practice and interviews. According to the reflections and interviews, the participants frequently organized learners into groups and completed various activities such as making a magic potion, a hamburger, and smoothies. Contrary to imagination-based classroom learning, through this immersive technology, these activities were carried out in an authentic and interactive manner where the learners collaborated with their classmates. The trainee teachers also reported their use of the rally, grouping, and prompt functions to improve learning behavior. In their interviews, they commented that these functions were utilized in order to “scaffold learners to behaviorally and cognitively focus on the learning activities” (Gwan). This is important as sometimes learners may be distracted when studying in a less teacher-controlled environment.

In the interviews, the teachers also maintained that in such an English medium instruction virtual environment learners are not only exposed to authentic linguistic input (Kang), especially listening (Gil), but also are active in using English to accomplish communicative tasks, due to its visually represented contextualized situations. For example, Park remarked:

...it provides situational context much more easily and effectively than the real school classroom does. Teachers don’t have to force their students to ‘use their imagination’ or ‘pretend to be someone’ anymore. What virtual reality does is to serve visualization, showing the situation itself.

The above excerpt highlights that iVR was able to offer contextualized role play for language learners. Instead of demanding that learners imagine a context, VR allows them to situate themselves in a resourceful environment where they can participate in learning as a member of the virtual community.

In addition, the trainee teachers maintained that authentic interactions afforded by *Immerse* contributed to learning:

Immerse offers a simulated real-world environment where users are able to interact with other participants, giving the impression that they are a part of the virtual world...bringing classrooms closer to real life and developing students’ language performance rather than just their language competence (Jeong).

This interview excerpt highlights the feature of augmenting the sense of being or presence. This was also echoed in Cho’s interview:

...the sense of being in an environment created a realistic sense of being in the environment. The feeling of actually being in the environment where the target language is spoken can be beneficial for students and teachers. Learners can be drawn deeper into the environment while using VR, possibly encouraging them to participate more in class (emphasis added).

Cho outlined the importance of authentic English contexts for language learning and their contribution to learners' active participation. However, Cho also remarked that placing learners in a context is no panacea and that meaningful learner interactions through hands-on activities seem more vital in sustaining their engagement in learning.

Affective Engagement

One major topic discussed across the teachers was the constructive role of iVR in improving learners' motivation. In particular, the embodied actions in iVR, based on the interviews, were believed to be constructive in enhancing learners' engagement, including sustaining their focus on tasks, improving their understanding of abstract or complex ideas, increasing their curiosity and learning interest, and reinforcing their memories through kinesthetic learning. For example, Yoon remarked, "iVR technology has the potential to improve language acquisition by increasing motivation for learners as well as reducing their anxiety when it comes to learning a foreign language." To be more specific, another trainee teacher explained:

Through such real-world tasks, students can get more chances to interact with others in English and improve their communicative competence. Students can also focus on their fluency to produce intelligible English. Most of all, immersive VR situations are far more interesting than undertaking the real-world tasks in a real class, because students may have more fun using new VR tools which are similar to playing a game (Jeong).

Jeong in the above excerpt made a comparison between iVR and traditional classroom learning and highlighted that through the use of iVR learners are able to enjoy more contextual practice and participate in innovative forms of learning, which contribute to the improved levels of learning motivation.

Our participants acknowledged that learning in an iVR environment could help teachers reduce learners' anxiety and further promote learning. For example, Kim said:

Locating EFL learners in a non-threatening setting based on what we have learnt about pedagogy will eventually increase their motivation to acquire and practice the target language.

Since learning from mistakes is a vital step for learners to enhance their language learning, the use of iVR created a less stressful environment. Gwan explained from a pedagogical perspective:

An avatar has several characteristics, one of which is related to anxiety. Students' fear of making mistakes can be lowered because their substitute avatar acts and speaks. In particular, since the avatar's clothing and appearance can be changed over time, other people may be less likely to match and remember what that person did or said than in a traditional classroom. Therefore, students can practice without losing face by using an avatar. They can start conversations with people they do not know without any hesitation, as the avatar itself is anonymous.

Losing and saving face was a common topic repeatedly discussed in the participants' reflections. According to Gwan's professional knowledge about language learning among learners in Korea, by choosing an avatar, learners' anxiety about making mistakes can be mitigated as the appearance of

avatars can be easily changed. The participants believed that the anonymity arising from using avatars is key to reducing learning anxiety, especially for those who are afraid of making mistakes in front of their classmates. This was confirmed by Kim:

Now that students feel less worried about being confronted by real opponents and watched by real audiences, their focus on practicing their L2 will not be disrupted (in the debate task in iVR).

With the immersive learning environment, the use of iVR also showed great promise in promoting affective engagement in language learning. Generally, the trainee teachers believed that iVR was constructive in improving language learners' motivation and reducing learning anxiety and stress.

RQ 2: What Are the Challenges of Using iVR in Language Education?

Although numerous benefits have been discussed above, a great many challenges also emerged from the analysis of the reflections and interviews. These can be categorized into three groups (Table 2). The first is learner-related issues. Specifically, the trainee teachers, based on their own experiences, discovered that *Immerse* can be criticized for the Wow effect, just like many other new technologies. In particular, learners' interest in and motivation for iVR may fade after using it for some time. They worried that this situation may be exacerbated if learners fail to receive sufficient learning support or lack sufficient digital literacy to be able to leverage the technology. Complicating the situation, learners, especially young learners, can be easily distracted since it is difficult for instructors to micro-manage learning in an iVR environment.

The second group of hindering factors is teacher-related issues. The trainee teachers highlighted a few challenges that they faced when teaching in iVR, including their limited digital literacy and issues concerning teaching management. For instance, teachers who have grown up with different technologies, tend not to be well-prepared for the latest technological developments. As the participants mentioned, because of VR's novelty, it was hard for them to produce effective lesson plans and to organize their teaching efficiently. However, this also applied to the participants who are digital natives, i.e., those who were raised and educated in the digital era.

The third group of hindering factors is technology-related issues. In terms of the technology itself, health issues such as motion sickness and fatigue were reported. Other common problems, such as the high cost of iVR equipment, technical hiccups, and poor internet connection were discussed in the participants' reflections. One unique challenge concerning *Immerse* that the participants complained about was the fact that the system only allows a small number of users to participate in learning. This is a serious concern that deserves the urgent attention of *Immerse*'s designers if teachers aim to use *Immerse* to simultaneously engage multiple classes of students.

DISCUSSION

The study has investigated both positive and negative factors of using iVR in language learning based on the emic perspective of trainee teachers who used iVR for microteaching. Several important facilitating features emerged from the trainee teachers' reported data. First, differing from imaginative role play, the contextualized and multi-sensory learning features of iVR are believed to play an essential role in facilitating learners to live, learn, and play with the language. Since *Immerse* enables users to manipulate objects and use gestures in their surroundings, language learning can be more engaging and hands-on for learners. Compared to text-based, uni-sensory learning, iVR seemingly has the unique feature of catering to learners with different learning styles and needs (Vázquez et al., 2018). Growing up in a highly digitalized world, most, if not all, digital native students can be accustomed to studying in a non-paper-based, multimodal manner (Miller & Wu, 2021). Yet, school education in many countries has not widely applied the use of new

Table 2. Challenges of using *Immerse* in language education

Actors	Drawbacks	Excerpts
Learners	Boredom	Visiting the same place would give students boredom, leading them to be distracted in class (Gwan).
	Limited digital competencies	...technology illiterate students may have difficulty using programs such as <i>Immerse</i> or even Oculus (Lee).
	Distractions to learning	Students are easy to be distracted by new devices and situations (Park).
	Insufficient learning feedback	When errors are found in the student's speaking, it is difficult to make corrective feedback (Gil).
Teachers	Limited teacher digital competencies	...every teacher needs expertise enough to devise the most efficient and appropriate teaching plans in iVR setting (Nam).
	Time-consuming organization	During class design, there are also some functions that cannot be set in advance, so if they are completed on-site during class time, it will also delay some efficiency (Jeong).
	Difficult learning management	If teachers cannot make full use of tools in iVR programs, all activities can have confusion and rather worsen the class climate (Kang).
Designers	Health issues	...the use of iVR with Oculus could cause terrible motion sickness in some people (Lee).
	Unaffordable prices	The biggest threat to virtual reality being applied at schools is their limited budget. This budget problem would lead to low accessibility to technology-based education (Park).
	Poor internet connections	It is necessary to continuously manage internet connection and electronic devices (Kim).
	Small class size	In the traditional middle school classroom, the number of students varies from 15 to 25, but each class in iVR could have only 10 students (Gwan).
	Technical support	Technical errors can happen anytime and it will disturb the learning flow (Kang).

technologies due to fiscal, pedagogical, or technological reasons (Lan, 2020). Thus, a discrepancy between learners' daily lives and their classroom learning may emerge, because of which learners, especially those with non-mainstream learning styles, risk being marginalized. However, research has shown that when learning a language, the inclusion of visual, auditory, tactile, and kinesthetic stimuli can enhance learners' ability to process information, regulate the learning process, and mediate learning behavior (Shams & Seitz, 2008). Through the association of information, such as what a word looks like, how it sounds, and how it feels, various dimensions of learner engagement can be enhanced due to a reduced cognitive workload, which leads to improved comprehension and memory (Nijakowska, 2013).

Second, interactive learning activities were also used by the participants with the hope of achieving better learner engagement. The trainee teachers, based on their prior pedagogical knowledge and language learning theories, believed that language learning relies on interactions within the situated community. Thus, they purposefully designed activities that facilitated learner interaction. Although the communicative language teaching approach encourages interactive learning among students, interactions between learners and their surroundings are still rarely seen in English classrooms in Korea. Interactive activities to a large extent can motivate students to pay more attention to their environments and to apply their linguistic knowledge and communicative skills in practice (Parmaxi, 2020). The iVR environment can more naturally engage students in communicative situations and facilitate interaction among students, and in this environment, the students are no longer passive recipients of knowledge (Hu-Au & Lee, 2017). Furthermore, previous findings have suggested that interactions with and support from teachers are equally important in increasing learner engagement

(Nguyen et al., 2018). This is particularly the case for Asian learners who are accustomed to teacher-centered learning and for whom autonomous learning in an unfamiliar technological environment can be affectively threatening (Wu et al., 2021). Therefore, timely guidance and feedback from teachers will be useful to enhance students' learning behavior in self-regulated language learning (Godwin-Jones, 2019).

Third, iVR in this study was believed by the participants to be helpful in augmenting learners' affective states of learning. By practicing English in a non-threatening and forgiving context, learners are encouraged to explore the virtual world in a safe way (e.g., having a drink without worrying about getting drunk) and to learn from mistakes (e.g., re-doing a task several times), through which their motivations and engagement can be enhanced. Language learning has long been plagued by learners' negative emotions and feelings such as fear of making mistakes, especially due to the washback effect of the exam-oriented culture in many countries (Xu & Carless, 2017). Additionally, within a Confucian cultural setting, when learners make mistakes in public they "may experience a high chance of losing face, which jeopardizes their confidence and interest in learning" (Wu et al., 2021, p. 13). However, the anonymity afforded by user-designed avatars was deemed useful in reducing the students' emotional burden about losing face or undermining their peers. By improving learners' emotional responses, overall learner engagement can be greatly improved with "sustained attention and mental effort" (Aubrey, 2022, p. 63).

Several barriers were also found to hinder the effective use of iVR in teaching. First, the lack of digital competency among teachers and learners was found to be a severe obstacle for realizing deeper learning. Due to the lack of prior exposure and sufficient training in relation to iVR, the trainee teachers in this study felt insufficiently supported theoretically, pedagogically, and technologically to teach effectively using the technology. As such, they sometimes were unsure and lacked confidence about the optimal way of conducting teaching in iVR. Therefore, teacher training will be a relevant challenge when using emerging technologies (Jeong, 2017) since technologies such as iVR "open[s] up new possibilities for education, and simultaneously make new demands of education" (Pegrum in Wu, 2022, p. 163). However, it is important to note that we are not arguing for the extensive use of technology in language education. Instead, we suggest that urgent attention should be given to support learners and teachers to develop metacognitive strategies to be technology-wise by regulating learning and increasing their attentional literacy (see a detailed discussion in Pegrum and Palalas, 2021).

Meanwhile, the lack of teacher digital literacy can also lead to issues related to student learning. For instance, teachers' unpreparedness in using iVR may lead to problems such as insufficient teacher feedback and poor classroom management, just as the trainee teachers mentioned in this study. With limited support from teachers, learners may find it cognitively challenging to invest serious effort into self-regulated learning. To complicate matters, the class sizes (usually over 10 students per class) in South Korea, the often unstable internet connections on campus, and the potential health issues caused by using headsets were brought up by the teacher participants during their interviews. When facing these learning, technical, and health barriers without teacher support, learners may demonstrate negative emotions such as boredom, dislike, or frustration, toward the use of iVR, which in turn will undermine their learning performance (Nguyen et al., 2018).

Finally, in line with Moro et al. (2017), based on teachers' experiences, when the Wow effect of the immersive technology wears off, the potential for a sense of boredom among learners was repeatedly mentioned. According to Dewaele and Li (2021), boredom plays a key role in determining learner engagement and effectiveness because "boredom was found to be closely related to disengagement, inattention, and reduced motivation" (p. 929). Furthermore, boredom is a complex construct that can be caused by a variety of internal and external factors, such as a learner's personality traits, task difficulty, and peer and teacher performance. Since iVR technology remains in an early stage of development, highly customized artificial intelligence features should be incorporated into iVR learning. With the provision of customized learning (e.g., task design,

learning scaffolding), learners' psychological and emotional states can be expected to improve, which will lead to better learning performance.

IMPLICATIONS

Several implications can be summarized based on the findings:

- 1) *For teachers:* First, due to its novelty, studying with iVR can be foreign and daunting for learners. Thus, teachers should formally discuss a repertoire of self-regulated and metacognitive learning strategies with learners (Philp & Duchesne, 2016). For example, teachers can highlight to learners how they can be more cognitively engaged through the coordination of their senses. Furthermore, different techniques for staying behaviorally focused while learning in a distracting iVR environment are also worth discussing with learners. Second, teachers who have grown up in different generations tend to have different attitudes and practices regarding the use of technology in education. A teacher's willingness and agency to make changes are vital for organizing successful learning with emerging technologies. Based on Puentedura (2006), teachers, informed by their affective states, can leverage technology to transform their teaching. This can range from the most basic methods to replace pens and paper to the most advanced innovative learning tools. Under these different circumstances, learners will likely demonstrate different degrees of learning behavior. Educators have argued that in order to maximize student achievement in technological environments, teachers need to develop their transformative agency and become more open to change (Brevik et al., 2019).
- 2) *For teacher educators:* Teacher education programs are essential in influencing teachers' pedagogical cognition and behavior. Since iVR is a new technology that remains inaccessible to many teachers, teacher educators need to consider providing training to psychologically and pedagogically prepare teachers to better engage their students in iVR learning (Wu et al., 2021). Specifically, due to the multi-sensory nature of iVR, teachers may benefit from hands-on training experience by analyzing case studies, conducting teaching observations, and researching their own teaching behavior.
- 3) *For designers:* Constant updates to the immersive technology should be based on active dialogue with users, including learners and teachers. Zhang et al. (2020), drawing upon design thinking, proposed a model for new technology-supported language learning by highlighting the necessity of designing student-centered learning based on learners' needs. Designers must play a key role alongside teachers in augmenting learners' experiences by uncovering problems concerning learner engagement and making technological modifications.

CONCLUSION

Immersive technology is still in its infancy and is subject to ongoing development and refinement. Naturally, language learning with this emerging technology remains a predicted vision rather than a present-day reality. The current study, based on introspective data of teaching practices of applying iVR, has attempted to advance our limited understanding from trainee teachers' perspectives. Factors relating to the use of iVR in language education have been discussed.

While it has produced a range of valuable insights, it is also important to acknowledge several limitations concerning the current research. First, to produce more generalizable insights into teachers' use of iVR, a mixed-methods approach with a larger number of participants may be of use in future research. Second, teachers from different disciplinary backgrounds and with diverse teaching experiences may perceive the use of iVR differently. It will therefore be valuable for future studies to explore the divergences across groups of teachers with various backgrounds.

Third, since the trainee teachers in the present study came from a leading university in South Korea, it would be worthwhile to investigate the perceptions and behavior of learners and teachers from less privileged institutions or areas. Yet, despite these shortcomings, this study has provided useful findings for learners, teachers, teacher educators, and designers. It is expected that with more in-depth and comprehensive knowledge of the pedagogical use of iVR, it will soon become a mainstream technology in language education.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST

The authors of this publication declare there is no conflict of interest.

REFERENCES

- Aubrey, S. (2022). Dynamic engagement in second language computer-mediated collaborative writing tasks: Does communication mode matter? *Studies in Second Language Learning and Teaching*, 12(1), 59–86. doi:10.14746/ssllt.2022.12.1.4
- Bower, M., DeWitt, D., & Lai, J. W. (2020). Reasons associated with preservice teachers' intention to use immersive virtual reality in education. *British Journal of Educational Technology*, 51(6), 2215–2233. doi:10.1111/bjet.13009
- Brevik, L., Gudmundsdottir, G., Lund, A., & Strømme, T. (2019). Transformative agency in teacher education: Fostering professional digital competence. *Teaching and Teacher Education*, 86, 102875. doi:10.1016/j.tate.2019.07.005
- Chen, C. Y. (2022). Immersive virtual reality to train preservice teachers in managing students' challenging behaviours: A pilot study. *British Journal of Educational Technology*, 53(4), 998–1024. doi:10.1111/bjet.13181
- Chun, D. M., Karimi, H., & Sañosa, D. J. (2022). Traveling by Headset: Immersive VR for Language Learning. *CALICO Journal*, 39(2). doi:10.1558/cj.21306
- Dewaele, J. M., & Li, C. (2021). Teacher enthusiasm and students' social-behavioral learning engagement: The mediating role of student enjoyment and boredom in Chinese EFL classes. *Language Teaching Research*, 25(6), 922–945. doi:10.1177/13621688211014538
- DeWitt, D., Chan, S. F., & Loban, R. (2022). Virtual reality for developing intercultural communication competence in Mandarin as a Foreign language. *Educational Technology Research and Development*, 70(2), 615–638. doi:10.1007/s11423-021-10074-9
- Dhimolea, T. K., Kaplan-Rakowski, R., & Lin, L. (2022). A systematic review of research on high-immersion virtual reality for language learning. *TechTrends*, 66(5), 1–15. doi:10.1007/s11528-022-00717-w
- Godwin-Jones, R. (2019). Riding the digital wilds: Learner autonomy and informal language learning. *Language Learning & Technology*, 23(1), 8–25.
- Hu-Au, E., & Lee, J. J. (2017). Virtual reality in education: A tool for learning in the experience age. *International Journal of Innovation in Education*, 4(4), 215–226. doi:10.1504/IJIE.2017.091481
- Jeong, K. O. (2017). Preparing EFL student teachers with new technologies in the Korean context. *Computer Assisted Language Learning*, 30(6), 488–509. doi:10.1080/09588221.2017.1321554
- Lan, Y. J. (2020). Immersion, interaction and experience-oriented learning: Bringing virtual reality into FL learning. *Language Learning & Technology*, 24(1), 1–15.
- Lee, S. M. (2022). A systematic review of context-aware technology use in foreign language learning. *Computer Assisted Language Learning*, 35(3), 294–318. doi:10.1080/09588221.2019.1688836
- McGarr, O. (2021). The use of virtual simulations in teacher education to develop pre-service teachers' behaviour and classroom management skills: Implications for reflective practice. *Journal of Education for Teaching*, 47(2), 274–286. doi:10.1080/02607476.2020.1733398
- Miller, L., & Wu, J. G. (Eds.). (2021). *Language learning with technology: Perspectives from Asia*. Springer. doi:10.1007/978-981-16-2697-5
- Moro, C., Štromberga, Z., & Stirling, A. (2017). Virtualisation devices for student learning: Comparison between desktop-based (Oculus Rift) and mobile-based (Gear VR) virtual reality in medical and health science education. *Australasian Journal of Educational Technology*, 33(6). doi:10.14742/ajet.3840
- Nguyen, T. D., Cannata, M., & Miller, J. (2018). Understanding student behavioral engagement: Importance of student interaction with peers and teachers. *The Journal of Educational Research*, 111(2), 163–174. doi:10.1080/00220671.2016.1220359
- Nijakowska, J. (2013). Multisensory Structured Learning Approach in Teaching Foreign Languages to Dyslexic Learners. In D. Gabrys-Barker, E. Piechurska-Kuciel, & J. Zybert (Eds.), *Investigations in teaching and learning languages: Second language learning and teaching*. Springer. doi:10.1007/978-3-319-00044-2_14

Parmaxi, A. (2020). Virtual reality in language learning: A systematic review and implications for research and practice. *Interactive Learning Environments*, 1–13.

Pegrum, M., & Palalas, A. (2021). Attentional literacy as a new literacy: Helping students deal with digital disarray. *Canadian Journal of Learning and Technology*, 47(2). <https://cjlt.ca/index.php/cjlt/article/view/28037/20563>. doi:10.21432/cjlt28037

Philp, J., & Duchesne, S. (2016). Exploring engagement in tasks in the language classroom. *Annual Review of Applied Linguistics*, 36, 50–72. doi:10.1017/S0267190515000094

Puentedura, R. R. (2006). Transformation, technology, and education in the state of Maine. Hippa US. https://www.hippasus.com/trpweblog/archives/2006_11.html

Shams, L., & Seitz, A. R. (2008). Benefits of multisensory learning. *Trends in Cognitive Sciences*, 12(11), 411–417. doi:10.1016/j.tics.2008.07.006 PMID:18805039

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research*. Sage publications.

Traxler, J., & Kukulska-Hulme, A. (Eds.). (2016). *Mobile learning: The next generation*. Routledge.

Vázquez, C., Xia, L., Aikawa, T., & Maes, P. (2018). Words in motion: Kinesthetic language learning in virtual reality. In *2018 IEEE 18th International Conference on advanced learning technologies (ICALT)* (pp. 272–276). IEEE.

Villena-Taranilla, R., Tirado-Olivares, S., Cozar-Gutierrez, R., & González-Calero, J. A. (2022). Effects of virtual reality on learning outcomes in K-6 education: A meta-analysis. *Educational Research Review*, 35, 100434. doi:10.1016/j.edurev.2022.100434

Wang, C. P., Lan, Y. J., Tseng, W. T., Lin, Y. T. R., & Gupta, K. C. L. (2020). On the effects of 3D virtual worlds in language learning—a meta-analysis. *Computer Assisted Language Learning*, 33(8), 891–915. doi:10.1080/09588221.2019.1598444

Wu, J. G. (2022). Emerging technologies and research designs in technology-enhanced language learning: An interview with Mark Pegrum. *International Journal of TESOL Studies*, 4(3), 162–170.

Wu, J. G., Miller, L., Huang, Q., & Wang, M. (2021). Learning with immersive virtual reality: An exploratory study of Chinese college nursing students. *RELC Journal*, 00336882211044860. doi:10.1177/00336882211044860

Wu, J. G., Zhang, D., & Wang, M. (2022). *Game-based virtual reality for languaculture learning: An example of the Forbidden City*. In 8th International Conference of the Immersive Learning Research Network, Vienna, Austria. https://www.researchgate.net/publication/360232026_Game-Based_Virtual_Reality_for_Languaculture_Learning_An_Example_of_the_Forbidden_City

Xu, Y., & Carless, D. (2017). ‘Only true friends could be cruelly honest’: Cognitive scaffolding and social-affective support in teacher feedback literacy. *Assessment & Evaluation in Higher Education*, 42(7), 1082–1094. doi:10.1080/02602938.2016.1226759

Zhang, D., Wang, M., & Wu, J. G. (2020). Design and implementation of augmented reality for English language education. In V. Geroimenko (Ed.), *Augmented reality in education: A new technology for teaching and learning* 217–234. Springer. doi:10.1007/978-3-030-42156-4_12

Sangmin-Michelle Lee is a professor of Global Communication at Kyung Hee University in the Republic of Korea. She earned her PhD from Pennsylvania State University in language education. She has published papers and conducted projects on language learning in a technology-enhanced learning environment, machine translation, L2 writing, game-based learning, and digital creativity.

Junjie Gavin Wu is a Tenured Lecturer in the Faculty of Applied Sciences, Macao Polytechnic University. He is an Associate Editor of IEEE Transactions on Learning Technologies (SSCI, SCI, & EI), a Book Review Editor of TESL-EJ (Scopus), and an Assistant Editor of Computers & Education: X Reality (DOAJ). Gavin serves on the organizing committee of PacCALL and ChinaCALL. He has over 40 English publications and two edited books with Routledge and Springer.