CHAPTER ONE

Immersion into virtual reality for language learning

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Contents

Abstract

This chapter is aimed at elaborating the effects of virtual immersion on language learning, especially on the affective dimension, including learner motivation and autonomy. Following the literature review on language learning in virtual worlds, three empirical studies are introduced focusing on (1) Chinese as a foreign language (CFL) writing with a sixth grader with autism spectrum disorder (ASD), (2) English as a foreign language (EFL) with 132 elementary school students, and (3) learning by creation with 65 fourth and fifth graders as the participants. The three studies introduced were rooted in sociocultural theory and adopted student-centered learning activities. The participants were all elementary school students, with an ASD student in the first study and ordinary students in the latter two. The learning contents are foreign languages, CFL in the first study, EFL in the second study, and 3D construction for language learning in the third one. By observing the learning process and analyzing students' answers to the interview questions, the students' learning motivation and autonomy were found to have been inspired. Their attitudes toward the learning contents or activities were positive, and they expressed their pleasure in virtual environments. Finally, suggestions for future research are provided based on the findings obtained from the previously mentioned studies.

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1. Introduction

To learn a language in addition to one's first language takes time, persistent involvement, attention, and motivation. The affective dimension is always one of the most important issues in foreign language (FL) education and research (Krashen, 1981). Given that decontextualized language learning fails to inspire language learners' motivation and autonomy, learning languages in an authentic context is therefore acknowledged as key by most FL researchers and educators (Godwin-Jones, 2018; Lan, 2015; Mitchell & Myles, 2004).

The argument for contextualized language learning is rooted in Vygotsky's sociocultural theory (Vygotsky 1978), which emphasizes the role of the interactions between the contexts and individuals in the acquisition process of a foreign language. It is in situated learning that pragmatic skills are as important as linguistic knowledge if learners want to use the foreign language appropriately to interact with others. Learning an FL in context helps learners transfer what they learned to a real-life situation, especially in the realm of distinguishing the usage of words or prepositions in semantically polysemic ways (Wong, Zhao, & MacWhinney, 2018).

Therefore, for FL teachers, providing their students with the opportunity to actively interact with each other under meaningful contexts is a must. However, it is always a challenge for FL teachers to create an authentic context to enhance their students' FL acquisition by involving them in an immersive and meaningful learning environment (Lan, 2015). High pressure in following the syllabus, a heavy teaching load, and limited resources or budget seem to make implementing contextualized FL teaching a mission impossible. As technology advances rapidly in the digital age, the creation of authentic contexts for FL teaching and learning has become more accessible and more achievable than before, when FL teachers mainly used paper-based teaching aids or physical instruments without the support of advanced technologies. Among the numerous advanced technological tools commonly adopted in technology-enhanced language learning (TELL) settings, such as mobile phones, apps, and social networking software, virtual reality (VR) is one that has attracted the special attention and interest of FL educators and researchers in recent years. The capability of enhancing students' skills through gradual immersive and social experiences has made VR one of the foremost research topics in TELL (Chun, 2019).

According to Lan (2020), the focuses of VR applications for FL education include visual experiences, entertainment, social networking, operation, and creation. When focusing on providing FL learners with visual experiences, FL learners immerse themselves in virtual worlds with a feeling of "being there." They can observe a volcano, explore outer space, dive deeply in the ocean, or wander in an ancient Roman city (Heathman, 2016; Meyer, 2016). A device like a thick pair of goggles or Google Cardboard accompanied with 360-degree real-world videos are often used by FL learners for obtaining visual experiences. If entertainment is the focus of using VR for FL education, then a gamified scenario with embedded learning materials will be the design focus of the VR software (Lan, 2016). During the gaming process, players' motivation remains high, regardless of whether a headset or motion-capture technology is used or not (Lan, Hsiao, & Shih, 2018).

Supporting social interaction is one of the specific features of VR, so having FL learners involved in virtual environments to build social networking is one of the most common VR applications for language learning. Such a connection allows FL learners to make friends from around the globe as they explore the virtual worlds without the limitation of time, space, or even physical conditions (Cheng, Huang, & Yang, 2015). Building such a social connection not only benefits learners' FL performance but also improves their intercultural awareness and appreciation (Liaw, 2019). The features of authenticity and immersion make VR an ideal tool to provide FL learners with experience in manipulating and interacting with the objects in the VR environment when embodied cognition is simultaneously considered (Lan, Fang, Legault, & Li, 2015; Mohsen, 2016). Learning an FL can even be possible through simulating a process of event development, such as growing crops as a farmer in Africa (Franciosi, Yagi, Tomoshige, & Ye, 2016). Although most of the VR applications for FL education offer predesigned materials or scenarios, like those mentioned already, some VR authoring tools transfer the construction or creation responsibility to learners. For example, the Omni-Immersion Version (OIV) developed by the NTNU Technology Enhanced Language Learning laboratory (NTNU TELL Lab) allows learners above 9 years old to create their virtual worlds, individually or collaboratively. Once the VR worlds are ready, FL learners continue to create their stories, which occur in the contexts they created (Yeh & Lan, 2018).

It is worthy of notice that by synthesizing the previously mentioned applications of VR for FL education, almost all the studies reported that

the VR immersion experience enhances learners' FL performance with positive attitudes and high motivation. Regarding the FL performance, it has been found that VR is beneficial to vocabulary learning (e.g., Lan, Fang, et al., 2015; Vázquez, Xia, Aikawa, & Maes, 2018), writing (e.g., Lan, Lyu, & Chin, 2019), listening (e.g., Lan & Liao, 2018), oral communication (e.g., Lan, Kan, Sung, & Chang, 2016; Liaw, 2019), intercultural perception (e.g., Liaw, 2019), and autonomy (e.g., Yeh & Lan, 2018). The existing literature with positive effects of VR immersion on FL learning shares a similar factor, i.e., the learning activities that the FL learners were engaged in were student-centered rather than teacher-dominated.

For example, Lan, Fang, et al. (2015) developed three contexts in VR, including a kitchen, a supermarket, and a zoo, for enhancing Chinese vocabulary learning by college students from a university in the United States. They compared the difference in the results of learning 90 Chinese two-syllable words within 15 min by the participating students between two different learning contexts: 2D line-drawing and 3D virtual immersion. They found that the learning trajectory of the participants in the 3D virtual immersion showed a larger acceleration than that of those in the 2D line-drawing context. Liaw (2019) conducted a yearlong, two-phase study to cultivate college students' intercultural communication skills by involving the participating students in different VR contexts to carry out interpersonal oral communication. In the VR worlds, the participating students met their interlocutors, who were from different countries. Liaw found that the participating students greatly enjoyed the interactions with their international interlocutors via VR technologies. Such a way of learning also expanded their learning from classroom settings to the outside world. Yeh and Lan (2018) tried to integrate VR into regular EFL classes. Fifth-graders from an elementary school in a rural area in northern Taiwan used a 3D authoring tool, Build & Show. A total of 29 students of two fifth-grade classes participated in the study. They learned how to use the authoring tool to build their own virtual worlds. However, one class (Class A, 14 students) built the VR worlds as an assignment of a regular computer class, while the other class (Class B, 15 students) built the VR worlds for their English learning according to the English teacher's request. After the 3D building activities, Class A learned English in a traditional approach. In contrast to Class A, Class B was taught using the learning contents they had created in the VR worlds. It was found that students concentrated more and were more motivated in learning when they created their own learning environments. Their learning outcome was also positively influenced.

In line with what has been described here, Lan, Wei, and Chiu (2014) pointed out that successful language learning emphasizes the language learners' active involvement in interaction in authentic contexts according to the perspective of sociocultural second-language acquisition. It echoes Long's (1996) argument that social and meaningful interaction in authentic contexts is essential for acquiring a second language (L2). The crucial factors for successful FL learning mentioned already, i.e., immersion, active learner participation, and social interaction, can be supported by the three Is of 3D virtual worlds, i.e., immersion, imagination, and interaction, if innovative language tasks are available. Fig. 1 shows the framework of language learning in virtual worlds. It states that although the three Is of VR of imagination, interaction, and immersion, as shown in the yellow part of Fig. 1, support the three essential components of foreign language acquisition (the green part of Fig. 1), they do not work without assigning students the appropriate learning tasks or contexts, i.e., the blue part of Fig. 1.

Additionally, when students learn in a state of flow, their motivation is high; their learning is autonomous; their attention is concentrated and, consequently, the learning outcome is satisfactory. According to Csíkszentmihályi

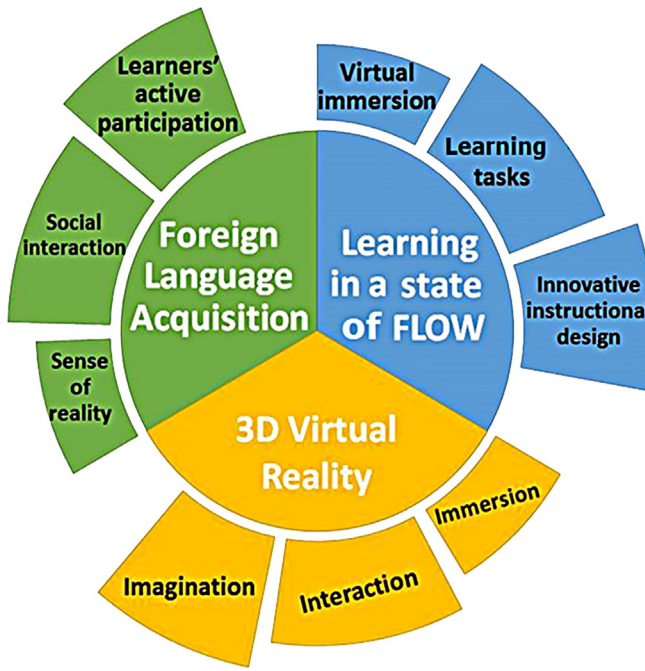

Fig. 1 The framework of language learning in VR.

(2000), flow is an optimal experience. In a state of flow, learners have a sense of control over their environment and are focused on specific goals (Sun, Kuo, Hou, & Lin, 2017). Following the framework shown in Fig. 1, three studies of VR applications in FL education are introduced in Sections 2.1–2.3. Finally, the concluding remarks and suggestions for future research are given.

2. Empirical examples of VR application in language education

2.1 Virtual worlds for CFL writing by a student with ASD

Children need to acquire social and cognitive skills, including language skills. For ordinary children, learning languages refines critical thinking and executive functions, such as paying attention to details, self-control, and mental flexibility (Griswold, 2016). They start to develop language skills from the day when they are born. In contrast with ordinary children, the development tends to be delayed for about 12 months in children with ASD. Furthermore, ASD is a developmental disorder that mainly affects social life and behavior. According to the report of the Centers for Disease Control and Prevention (CDC) (2018), about 1 in 59 children has been identified with ASD. This figure has shown incredible growth, from 1 in 150 in 2000.

In 2013, the American Psychiatric Association (APA) merged four distinct autism diagnoses into one umbrella diagnosis of ASD (American Psychiatric Association, 2013). It included autistic disorder, childhood disintegrative disorder, pervasive developmental disorder–not otherwise specified, and Asperger syndrome. The characteristics of a case of ASD include the signs of (1) social and communication impairment and (2) repetitive and stereotyped behaviors. Usually students with ASD tend to show far less interest in interacting with people or things around them and their surroundings. Such a lack of interest in interaction decreases the opportunities for students with ASD to develop their language skills as their ordinary peers do. Furthermore, they also suffer from language disorders in four main aspects: phonological awareness, vocabulary, syntax, and oral narration (Eden & Ingber, 2014; Reed, 2014). The impairment in structural language, such as lexicon and grammar, are manifest (Naigles & Tek, 2017). Moreover, children with ASD often use more gestures when communicating with others. That is because they tend to show far less interest in people and things around them, and also, they do not have a strong desire to interact with their surroundings. Hence, they have many fewer chances to develop

their language skills. Additionally, according to Asaro-Saddler, Arcidiacono, and Deyoe (2017), numerous studies have pointed out that many students with ASD struggle with writing. Writing is important for students, not only because it is a useful tool for the development of academic proficiency, but it also is a vital skill for academic or occupational success (Lan, Sung, Cheng, & Chang, 2015). It is also a skill used by students to show their understanding and knowledge (Asaro-Saddler, 2016). By building writing skills, students with ASD can express themselves and communicate better with others.

To deal with the problems in language development encountered by students with ASD, various approaches and teaching aids are used in traditional interventional environments. In addition to the common instruments, such as paper-based cards (with words or pictures) and building blocks used during the intervention process, multimedia, videos, interactive eBooks, and advanced technology are also recommended (Barton, Pustejovsky, Maggin, & Reichow, 2017; Birmingham & Davies, 2001; Virnes, Kärnä, & Vellonen, 2015). Among the previously mentioned advanced technological tools, the capability of enhancing students' skills to gradually obtain actively immersive and social experiences has made 3D virtual worlds one of the important research topics in special education in recent years (e.g., Ayres & Langone, 2008; Cheng et al., 2015; Eden, 2014; McKinney, Horspool, Willers, Safie, & Richlin, 2009).

The first study introduced in this section focused on improving the Chinese essay writing ability by a sixth-grader with ASD (Lo & Lan, in press). The student learned CFL at a Mandarin Chinese immersion school located in the US Midwest. At the Mandarin Chinese immersion school, the student had been receiving instruction in the core subject areas, including English language arts, Mandarin Chinese language arts, math, and science in the resource rooms. He also received speech-language services to enhance his social language skills and occupational therapy for self-regulation. However, at the Chinese immersion school, he showed low interest in learning languages, especially Mandarin Chinese. He often complained that there was no need for him to learn Mandarin Chinese at school, and he did not want to do so since he thought his Mandarin Chinese was good enough and he did not need to learn more.

Furthermore, based on his performance in the placement test, the participant needed help in learning Mandarin Chinese. He was evaluated for his Mandarin Chinese skills in the following areas, using Yinghua Academy's own Mandarin Chinese materials when moving to the school: reading, writing, listening, and speaking. The results showed that he was at the second-grade level in speaking and listening skills, and at the

first-grade level in writing and reading. Indeed, all the linguistic skills of the participating student needed much improvement. Furthermore, as described earlier, the speech-language services had been offered for improving his social language skills, so the educational application of this study focused on improving his writing skills.

Two kinds of writing instruction were given to the student to understand how virtual worlds can benefit his CFL writing: Stage I, traditional writing instruction (TWI), followed by Stage II, virtual immersion writing instruction (VIWI). In each type of instruction, the participant worked on the following three writing topics: (1) describing the scene, "kitchen"; (2) going to the convenience store; and (3) comparing between different types of transportation. Each writing topic was presented over two sessions of 50 min each on 2 days weekly. During the first session, the student worked on learning vocabulary words and sentence structures related to the writing topic and created a mind map as a prewriting and planning activity. In the second session, the teacher first helped the student review the materials learned in the first session, and then the participant completed the essay writing.

Additionally, during the prewriting activity in the first session, the participant was given a set of colored pictures. The picture prompts for writing were a set of screenshots of each scene in an island in Second Life (SL) called NTNU TELL Island created by the NTNU TELL Lab. Fig. 2 shows the

Fig. 2 Screenshots taken from SL of the transportation stations that were used during the TWI for the writing topic of comparing between different types of transportation.

picture prompts used for the third unit: "comparing between different types of transportation." Based on the pictures, the student drew a mind map to collect his ideas for the activity in the second session, essay writing.

After the completion of TWI, there was a 5-week interval before VIWI was given. During the 5-week interval, neither essay writing activities nor learning materials related to the three topics were provided for the student. All the learning activities followed the school syllabus, and the student received regular instruction. Additionally, in the last week of the interval, the student received training on SL operation, focusing on avatar control. The virtual contexts in SL used for the operation training were different from those used for the essay writing activities to avoid possible practice effects.

The instruction for writing on the topic was identical to that in TWI, except for the prewriting activity. In TWI, the student looked at a set of pictures, while in VIWI, the student logged into the virtual contexts in SL to explore the environments and collect his ideas. All the virtual scenes were allowed for free exploration via the user avatar and facilitated the collection of his ideas for writing soon after the exploration. After the same period as that in TWI, the student drew a mind map to organize his ideas for essay writing. Finally, after the completion of the writing on three topics, the student was orally interviewed to understand his attitudes toward the two stages of the writing activities.

The results of the study confirmed the effects of VR immersion on the participating ASD student's learning outcome and his learning motivation. Take the third unit as an example. During TWI, in the first session, the student observed three pictures (Fig. 2) with the oral prompts given by the teacher. He then drew what he saw as a mind map for later essay writing. On the contrary, to work on the same topic in VIWI, the student logged into SL and controlled his avatar to observe different types of transportation. The teacher also provided oral prompts to guide the student's exploration. Table 1 illustrates the transcriptions of teacher-student dialogues and the student's or the teacher's actions during the prewriting processes, i.e., observing the pictures or exploring in SL.

Based on what is illustrated in Table 1, it was found that both the student's actions and oral expressions were passive and very much dependent on the prompts given by the teacher under TWI. The student needed more prompts given by the teacher to continue the observation in TWI than in VIWI. In contrast to what was found in TWI, the student behaved more actively under VIWI. He actively explored in SL and then shared what he saw with the teacher and also expanded the mind map accordingly.

Table 1 The teacher-student dialogues and actions in Stages I and II on the topic of comparing between different types of transportation.

TWI		VIWI	
Teacher-student dialogues (T: teacher, S: student)	**Actions done by the student or the teacher**	**Teacher-student dialogues (T: teacher, S: student)**	**Actions done by the student or the teacher**
T: 你在图片上看到了什么?想一想他们有什么一样跟不一样的地方? (What do you see in the pictures? What are some similarities and differences?) S: 我看到有校车跟公交车 (I see a school bus and a public bus) T: 還有呢?看看他們都有什麼?有什麼不一樣? (Anything else? What do they have in common and how do they differ?) S: 公交車跟校車有門，校車黃色，公交車白色 (Both the public bus and the school bus have doors. The school bus is yellow, and the public bus is white) S: 有高鐵 (There is a high-speed train) S: 後面有紅綠燈 (There are traffic lights in the back)	T: Pointed to the pictures shown in Fig. 2 S: (Very excited) S: Drew out two single branches for the school bus and the public bus on the mind map S: Looked at the pictures for a while S: Created two branches for the door and "white" from the public bus bubble on the mind map S: Created two other branches for the door and "yellow" from the school bus bubble S: Noticed the high-speed rail station S: Drew one branch for the high-speed train and a single branch for the traffic light	T: 你看到了什么?想一想他们有什么一样跟不一样的地方? (What do you see? What are some similarities and differences?) S: 有校车，它很大，有很多座位跟一个门，黄色的，咦，这里还有写STOP (There is a school bus. It is big with many seats and a door, and it is yellow. Hmm, it also reads STOP) S: 公交車大大的，也有門，頂上是白色的，還有窗戶 (The public bus is big with a door as well. The top is white, and there are windows) S: 這裡有個公交車站，小小的，有座位，很多人 (There is a public bus stop, quite small, with seats and many people) S: 哇!好大啊，是紫色的 (Wow! It is enormous and purple)	S: (Very excited) Immediately moved the avatar toward the bus and circled it about three times S: Noted the school bus on the mind map, branched out for the other observations on the size, seats, color, and the words to indicate their relations S: Circled the school bus two times more S: Moved toward the public bus S: Looked at the public bus S: Wrote down "public bus" and created individual branches for its traits including size, color, window, and door S: Circled the public bus about two times and moved back to the school bus again before moving toward the public bus station S: Moved the avatar to the other side of the bus S: Drew a single branch for the public bus stop and then two other branches from it for the seats and noted "many people" S: Kept moving his avatar around between the school bus and the public bus S: Went back and forth between the two buses S: (About 3 min later) Moved toward the high-speed rail station and saw it S: Wrote down speed rail train and branched out for its color and size

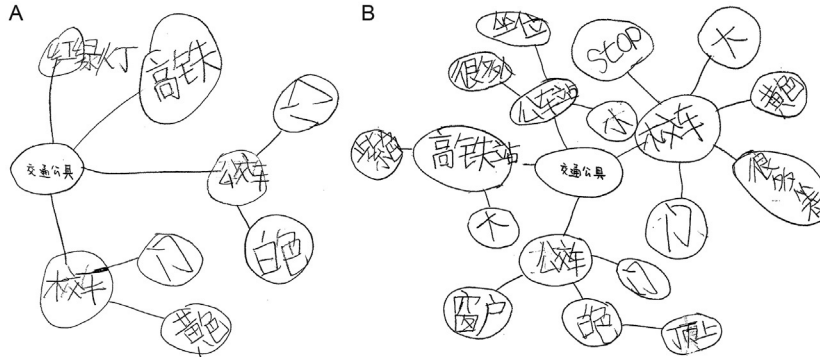

Fig. 3 The mind maps from the writing topic of comparing between different types of transportation: (A) TWI, and (B) VIWI.

The different teacher-student dialogues and actions between the sessions conducted by two learning approaches influenced how the student drew the mind maps (Fig. 3). It is interesting to note that there are two two-layer nodes in the mind map created in TWI, illustrating the attributes of the public bus and the school bus, but he created a more structured mind map with more layers when he explored in SL in VIWI.

Similarly, the differences in the mind maps influenced what the student wrote in his essay on the same topic, as shown in Fig. 4.

In the essay produced in TWI, as shown in Fig. 4A, the student wrote: "There are three different types of transportation. There is a high-speed train. It is all blue. There is a school bus, and it is yellow. They all have doors. There is a public bus, and it is blue. I see words on it. There are people. I see traffic lights over there. There are many traffic lights." Overall, the essay is adequate. However, it remains simple with descriptions in simple sentences and a loose organization, although the student did notice and showed the similarities and differences between the public bus and the school bus in the mind map. He failed to present what he created in the mind map in his essay. For example, he did notice the color of the public bus is different from that of the school bus. In his essay, he only mentioned the color of the school bus but not that of the public bus. An interesting finding with this essay is that the student mentioned the color of the high-speed train in his essay but not in his mind map.

On the contrary, the essay created in VIWI, as can be seen in Fig. 4B, is longer and better in quality than the one he wrote in TWI. The essay said, "I see there is a station next to the school bus and public bus. The public bus

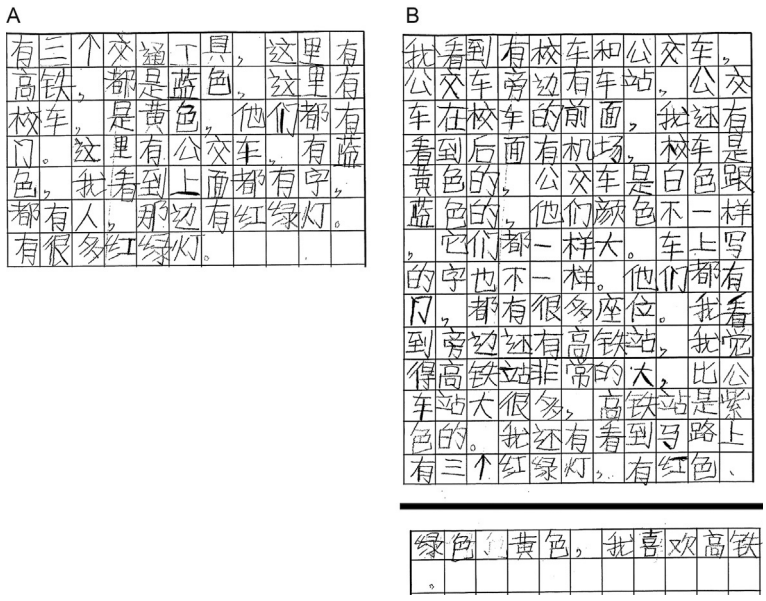

Fig. 4 Essays created by the students from the writing topic of "comparing between different types of transportation": (A) TWI and (B) VIWI.

is in front of the school bus. I also see an airport in the back. The school bus is yellow. The public bus is in both white and blue. They are different in colors, but the same in size. The words written on them are different as well. They both have doors and lots of seats. I see a high-speed rail station on the side. I think it is very big. It is much bigger than the public bus station. The high-speed rail station is purple. I also see three traffic lights on the road. They are red, green, and yellow. I like the high-speed train." It is found that the mind map on this topic is well-organized in expressing both the relationship among the objects and the attributes of the transportation he observed. Consequently, a better quality of essay was created when the student had the experience in exploring in VR.

Regarding the student's learning attitude toward learning CFL writing in VR, he stated he loved it because he loved using the computers to learn. He liked the fact that he got to "walk around in the pictures." He loved all the activities and wanted to "walk" around in the VR for the whole day. He loved "walking" around in the scenes and looking at different items in them. He said: "我想要跟媽媽坐這個公車回家。" ("I want to take the bus home with Mom.") The operation of the activities on the computer was

very easy for him. The student had no problem operating within each scene in VR. He expressed his willingness to have all his writing activities from now on to involve 3D virtual reality. He said he would work harder and do his best to earn another chance to do these activities again in VR.

The findings obtained from the study introduced in this section depict the potential of the integration of VR to improve Mandarin Chinese writing by a student with ASD, including both the learning attitudes and outcomes. The student's abilities to describe the spatial and "belonging" relationships among the virtual objects were also improved by immersing himself in VR environments. Additionally, virtual exploration seems to inspire the student with ASD to actively share his experience with his teacher and his family. It is in line with what is described in the Lan et al. (2018) study that young students with different disabilities (ASD, ADHD, and mental retardation) joyfully learned Mandarin by engaging themselves in a game-based learning environment in SL. Although the implementation only lasted for 16 h over 8 weeks, the children in the study by Lan et al. (2018) made a similar improvement to that made by the others learning for 1 year (1 h a week) without the VW gamed-based learning experiences. VR integration seems to be a potential solution for students with ASD or people with other types of disabilities. Moreover, not only students with special needs, including ASD, but also ordinary students can benefit from learning in VW, if meaningful and student-centered learning tasks are adopted (Lan, 2020).

2.2 Virtual worlds for EFL learning

English has been the lingua franca of the world for several decades, due to its widespread use in academia, business, commerce, and technology (Lan, Sung, & Chang, 2007; Spolsky & Shohamy, 1999). Many countries view citizens' capabilities to appropriately use English as one of the indices of the global competitiveness of a nation. Consequently, the number of studies on the English language has increased worldwide.

Take Taiwan as an example. English learning has been a big issue for Taiwanese students (Lan, Sung, & Chang, 2009). All the Taiwanese students must learn English at school, from the first grade in some cities, while in some other cities from the third grade. Additionally, it is one of the must-take subjects in the entrance examinations for entering high school and college. To improve their English, some students go to "cram schools" to take more English classes after school, but many students do not do so because of lack of support from their families. Consequently, there is a

massive gap in English abilities between students from lower and above-average socioeconomic families. Such a gap also exists between students from urban and rural areas. In addition to the gaps in English abilities and learning opportunities that need to be dealt with by educators and researchers, students' low achievement in English abilities and lack of motivation toward English learning, especially that of older students, are also challenges that need to be conquered.

As mentioned previously, English is an important subject in entrance examinations; English teaching in Taiwan has always been examination-oriented, especially in junior and high schools. Most of the teaching is delivered using a decontextualized approach, thereby failing to inspire students' learning motivation. To acknowledge the importance of using authentic contexts for language learning, some local governments in Taiwan, such as Taipei City, select some schools and financially support them to construct English learning contexts in schools, called the "English Village" (Lan, 2015). In addition, with financial support, one or two native English speakers are also hired to help students practice oral communication in the newly constructed contexts. Fig. 5 shows some of the corners in an English Village in an elementary school in Taipei City, Taiwan.

The English Village seems to be a good solution to the problem of students' low learning motivation. Students love to go there to play and practice English with their native English teacher. The students in a school with an English Village go to the Village twice a month, for 80 min at each visit. But the teaching activities arranged in the English Village are not always

Fig. 5 An English Village in Taipei City, Taiwan.

student-centered, like role-playing, or those focusing on oral practice, as expected. Students have to take turns visiting the English Village. The learning materials are different from those taught in their regular English classes, as they are designed by the native speaker. Therefore, in each 80-min visit, the native English-speaking teacher spends at least 60 min on teaching vocabulary and sentences needed for later oral practice. When doing this, the students are asked to sit in rows on the ground and listen-and-repeat what the teacher says or to use the handout given by the teacher to practice engaging in conversation (see Fig. 6). Yet those activities can be delivered in the traditional classroom. As a result, students are left with less than half an hour to role-play or practice communication "in" the contexts.

Moreover, due to limited funds available, only 8% of the elementary schools in Taipei City are chosen, let alone schools in rural and remote areas (Lan, 2015). Obviously, the idea of having an English Village only solves a part of the problems encountered by a small proportion of English teachers and students; meanwhile, it seems to have worsened the problem by increasing the gaps.

To fulfill the requirement of contextualized English learning, to shorten the gaps between the resources of English learning contexts in urban and rural areas, and to maximize the use of the time during students' visit in the English Village to carry out student-centered activities, Lan (2015) conducted a yearlong study focusing on using VR for enhancing English learning by Taiwanese students in the 2013–14 school year. A total of six VR contexts were constructed, including a night market with a food court and different game stalls, a clinic, an airport, two restaurants, a post office, and a convenience store. Fig. 7 shows the screenshots of the post office and the food court in the VR environment.

Fig. 6 Left: students sitting on the floor in the English Village to learn the vocabulary and sentences from a native English teacher; right: students using the handout given by the teacher to practice engaging in conversation.

Fig. 7 Authentic contexts in VR: left, the post office; right, the food court.

In addition to the authentic contexts, the learning materials, including vocabulary and conversations, were also embedded in the environments. For example, students could hear and learn to say the food offered at a western restaurant by clicking the pictures listed on the menu. They could also learn the conversation between the customer and the operator of a ring toss at a night market by clicking the nonplayer character (NPC). Additionally, students could log in the VR contexts and learn the materials repeatedly. It is worthy of notice that the learning contexts constructed in VR aim at providing the students with additional contextualized English learning opportunities and helping them to be ready before they visit the English Village; they are not constructed to replace the English Village. Therefore, VR learning can happen either after school when students are available or whenever the computer labs at school are available.

The participants of this study were 132 students from an elementary school in Taipei City. They could freely log into the VR contexts to explore and learn by playing anytime, anywhere. Their login and playing record were stored in the database; therefore, the teacher could track students' learning progress. It was interesting when the researcher met the students' parents in the VR contexts and found that those parents were playing with their kids with great joy.

To evaluate the effects of learning by playing in VR on students' English performance, the researchers collected and analyzed the performance on both a pre- and posttest and students' comments on the learning approach. According to the results of the performance test, it was found that students made significant improvement in their English performance, especially in sentences and communication. Their attitude toward learning English in VR was very positive, according to their comments. Many of them viewed the way of learning as playing a game. They were also amazed by the "real" and "beautiful" contexts and objects in the VR world. It is worthy of notice

that students did not only learn the English materials but also explored the worlds and loved to share their experience with their peers. Below are some of the students' comments, which show their excitement and joy.

"This is so beautiful! Who created this?"
"Hey, look. I can fly!"
"Hey, I am here! Follow me! Let me show you some interesting places. You can click 'run,' it will be faster!"

The participating teachers, including the native English teacher, the head of the English Village, and the director of academic affairs of the elementary school, also approved the learning approach adopted in this study (Lan et al., 2014). They thought that by incorporating virtual contexts in VR into the physical English Village, students' learning was enhanced by the self-directed and task-based learning platform without spatial or temporal limitations. They also suggested that virtual learning contexts should be included in regular EFL syllabuses for providing elementary students with an opportunity to conduct authentic and immersive English learning due to the higher flexibility, lower costs, and fewer limitations.

According to the results obtained from the study introduced in this section, controlling avatars in the VR is not a problem for those digital natives. It did not take the participating EFL elementary school students long to master the operation in the virtual contexts. This finding is in line with the argument made by Prensky (2001), who stated that today's students grow up with new technologies, such as 3C products and digital games. Educating the digital natives via VR meets their digital usage experiences, and thus it should be an issue worthy of all educators' and researchers' attention.

Briefly, EFL students can benefit from learning by playing or by carrying out tasks in VR if the learning activities and contexts are well designed. Their English performance and learning motivation were enhanced by their VR immersion experience. Given that VR contexts can be shared and freely entered, they have excellent potential to shorten the gaps between the schools in the urban and rural areas. Further investigation on integrating VR worlds into regular foreign language learning is definitely worthy of more effort and attention from FL educators and researchers.

2.3 Virtual worlds for enhancing students' autonomy by creation

Learner autonomy is the ability to take charge of one's learning (Holec, 1981). An autonomous learner reflectively engages in his or her learning

(Arnold, 2006; Benson, 2001; Little, 1994). As defined by Holec (1981), autonomy involves the skills of reflection and analysis. Therefore, students need to regularly reflect on their learning process and take control of their learning (Lan, 2018). They perform their duties of learning by planning, monitoring, and evaluating their learning progress (Yeh & Lan, 2018). By doing so, students' perceptions of learner ownership are improved. They become more independent and responsible. As a result, autonomous learners do not suffer from a lack of learning motivation. Moreover, they are usually willing to take risks during the learning process with a proactive attitude. During the process, they also tend to interact with learning peers (Palfreyman, 2011) in their social networks rather than solely rely on teachers.

It is worth noting that learning autonomy is not dichotomous, not an all-or-nothing concept (Nunan, 1997): i.e., learning autonomy is a state of strength. The perception of control over learning makes a learner more or less autonomous (Benson, 2010). When applying the concept of autonomy to language learning, six factors influence autonomous learning: (1) role of the teacher, (2) role of feedback, (3) learner independence, (4) learner confidence in study ability, (5) experience of language learning, and (6) approach to studying (Cotterall, 1995). Students own higher control over their learning more autonomously. The teachers' role is changing from dominating knowledge transformer to a facilitator focusing on developing students' self-directed learning ability.

Given that learning in VR has potential for improving students' low learning motivation and acquiring pragmatic skills (e.g., Lan, 2014, 2015; Lan et al., 2016), the research presented in this section reports the findings obtained from a study on enhancing students' learning autonomy through students' collaborative creation in VR at an elementary school in Taipei City, Taiwan.

The study introduced here actually is the follow-up investigation of the study introduced in Section 2.2. After obtaining the promising and positive results from the yearlong study (Lan, 2015), Lan considered applying the learning approach in as many elementary schools as possible. However, after she visited several elementary schools, two problems were identified that hindered her from continuing doing so: one was the limited budget, and the other was a technical issue. The VR contexts introduced in Section 2.2 were constructed on the NTNU Language Island in Second Life. The island was owned by the NTNU TELL Lab. Although the owner of the island, Lan, was willing to share the contexts with all the EFL learners

who are interested in having virtual experiences, the ideal number of login avatars is 25 to enable smooth inter-avatar or avatar-environment interactions in the VR contexts, while the largest number of login avatars at the same time was 100. This limitation implies that a better way is for every elementary school to have its own Second Life island. However, the annual fee is hardly affordable for any elementary schools in Taiwan. The technical requirements for constructing virtual objects and the VR environments are other issues. If one teacher wants to integrate VR into regular EFL teaching, then many contexts should be created. One lab cannot create all the VR contexts to satisfy all the teaching needs of all the elementary schools in Taiwan. Furthermore, only teachers know the specific teaching contexts they need. Therefore, the best way forward would be for the VR contexts to be created by the EFL teachers themselves, although it is also impossible for elementary school teachers to do so due to their lack of technical skills in 3D construction.

To deal with these problems and with the purposes of having all the students experience VR immersion for their EFL learning, a 3D authoring tool, Build & Show, was developed and evaluated (Yeh, Lan, & Lin, 2018). Build & Show is a friendly authoring tool, programmed by OpenSim, allowing students older than 9 years old to easily create their virtual worlds during a short period, around 30 min. No prior knowledge in programming or 3D modeling is needed for mastering the functions of Build & Show. More importantly, Build & Show can be installed in most of the computers in the computer labs in all the elementary schools in Taiwan. Setting up Build & Show does not require any extra cost. Therefore, what Watson and Yang (2016) mentioned in their study – that the challenge of obtaining the technique reduces teachers' willingness to incorporate games into their teaching – does not seem to be applicable to Build & Show. By using Build & Show, students can choose their avatars and create their story scenes, individually or collaboratively. When they collaborate with others during the building process, they can communicate through either voice- or text-based chat tools.

In 2015, Build & Show was installed in a computer lab at an elementary school in Taipei City. A total of 65 fourth and fifth graders participated in the 5-week study, 1 h a week. They were grouped into small teams of 4–6 students depending on the class size, forming 10 teams. All the participants had been learning basic computer skills since the third grade, including typing, drawing, and surfing the Web. In addition, some of the participants (38%) had prior experience in 3D construction and role-playing in a 3D virtual environment, such as Minecraft.

The students' mission was to collaboratively establish an airport, create the stories that happened in the airport, role-play their stories in the airport, and record the role-play into a video and share it with others. The airport they created included five scenes, namely a safety check area, a fast food shop, a duty-free shop, a customs checking area, and a toilet. Each team of students was assigned one scene of the airport, and then they had to work together to create a real-life story with their assigned area as the setting. When role-playing, one student in each team was responsible for screen recording of the entire process. The details for 5 weeks are as follows: Week 1, all the students received the training on using Build & Show; Week 2, the task was assigned to each team, and they started creating their stories and building the scene according to their stories; Weeks 3 and 4, students role-played and recorded the stories into a video; Week 5, the researchers interviewed the participants in teams and collected their written feedback. Fig. 8 shows the airport created by students.

During the study period, students' collaborative processes were observed by the researchers, and it was found that all the students concentrated on accomplishing their mission. They did not need teacher reminders of paying attention or mission goals. To create the best videos for sharing with their peers, all of them practiced role-playing, revised their stories, and repeatedly rehearsed, showing no sign of boredom. Fig. 9 shows how the students worked in a team to create and rehearse role-playing their stories.

The students' videos show their creativity by interweaving current events and their imagination. Additionally, their stories perfectly matched the contexts. Here are three examples. In the first example, one team built a fast food shop, and in their story, the staff discussed how to benefit the shop by using cheaper cooking oil to reduce the prime cost. However, food safety was an issue in Taiwan during the period of the study. They were concerned with the recent food safety issue, so they decided to be more careful when purchasing the cooking oil. The second example is a story created by the

Fig. 8 Airport created by students: left, customs check area and duty-free shop; middle, safety check area; right, fast food shop.

Fig. 9 Students worked in a team to (left) create their stories and (right) practice role-play.

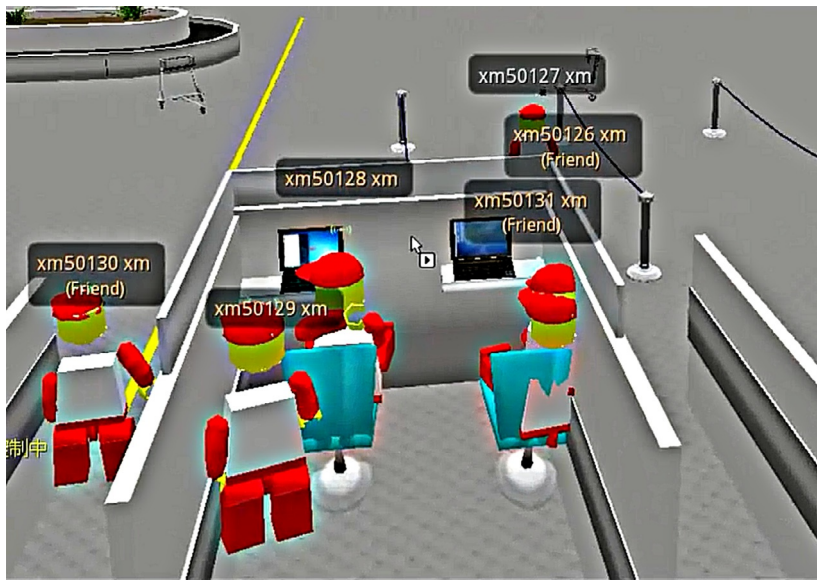

Fig. 10 The screenshot of the story of children lost and found.

team who built the customs check area. In their story, two tourists were at the customs check counter. When their passports were checked, the officer found that the two tourists were her lost children. A very happy ending of missing children later found concluded the story. The third story also happened at the customs check area. These students created their story based on the actual regulations for passports. The officer at the counter rejected a photo on the passport and stopped the adult tourist because he used a photo taken when he was a baby. Fig. 10 shows the screenshot of the second story, children lost and found at the customs check counter.

The participating students also expressed their great joy during the collaborative creation activity. Based on students' feedback, almost all of them enjoyed the learning experience and thought it was fascinating. During all the learning activities, students concentrated on working with team members. They said that it was their first experience of exploring and building objects in a 3D VR world at school. They highly valued the freedom to work collaboratively with little intervention from teachers. In addition to the interests in building objects and role-playing in VR worlds, they also expressed that the activities they were involved in motivated them to learn English.

In the study of Build & Show, it was found that the authoring tool was a medium inspiring students' autonomy. All the participants enjoyed using the authoring tool to build up their VR contexts. Additionally, it was an opportunity for them to use English to carry out tasks. This finding is in line with the results reported in the Lan et al. (2016) study, which shows that engaging in language tasks is beneficial to students' language learning. It is worth noting that the participating students learned to analyze and refine their stories via interpeer discussion and collaboration when they were collaboratively creating their works in Build & Show.

To sum up, students' creativity and learning autonomy were inspired and enhanced by engaging in collaborative creation tasks in VR worlds. They learned by collaborating with others with little support or intervention from teachers. Their stories matched the scenes they created and were meaningful, creative, trendy, and informative. The findings obtained from the study teach us, especially educators, a lesson that when students own their learning, they can be responsible, creative, and productive. What educators or researchers should do is to provide students with the tools and the opportunity to support them to create the materials for their own learning.

3. Conclusion

To successfully acquire a foreign language, a learner has to actively engage in meaningful and social interaction. It is greatly influenced by learners' motivation. Motivation is a cognitive process of instigating and sustaining goal-directed behavior (Schunk, Meece, & Pintrich, 2014), which has frequently been viewed as the most critical factor in second-language acquisition (Gardner, 2000). With sufficient motivation, FL learners can persist in pursuing long-term learning goals despite the deficiencies in one's language competence. Learners with strong motivation show a tremendous

amount of willingness to set learning goals and take actions for the goals. Therefore, how to greatly motivate FL learners and promote their engagement in learning activities is always an important issue and a challenge for FL researchers and educators.

Among numerous advanced technologies adopted to motivate FL learning, VR is an emerging but remarkable one. It allows FL learners to create an immersive environment for social interaction in a joyful state and, therefore, should not be ignored in the digital era. The existing literature shows the considerable potential of VR for FL learning; more empirical research is still needed. According to Wang, Lan, Tseng, Lin, and Kao (2019), the existing literature reporting empirical evidence that supports the benefits of VR for FL learning is still insufficient. As the VR devices and systems are becoming more accessible and affordable, more empirical and large-scale research should be conducted to extend the benefit of VR for FL learning and reduce its possible negative effects at the same time. Additionally, most of the participants in the existing literature studies are ordinary learners. Given that the challenges and difficulties faced by learners with special needs are more severe and complex than those of ordinary ones, how to use VR for enhancing FL learning by learners with special needs, such as ASD, should be a critical issue in the future research. Teacher training is another critical issue when integrating VR into FL research or educational settings. Teachers must know the principles of task design in VR worlds. They also need to be knowledgeable about measuring learners' learning outcomes from different perspectives.

Briefly, new technology is always emerging, but learner's needs and innovative learning activity design that is rooted in the sound and theoretical foundation are still the guidelines for FL research and education. When VR is adopted for FL learning, each individual should always be provided with precise feedback and scaffolding during the VR immersion and exploration. By giving learners the appropriate control over learning, they will be more aware of learning ownership, thereby becoming more autonomous.

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