

Virtual Reality in ESL Teacher Training: Practical Ideas

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The use of technology, such as Virtual Reality (VR), has started to take place in K-16 classrooms. Research indicates potential advantages of embedding VR into the curriculum in terms of higher motivation, increased self-expression, better achievement in content knowledge, and improved linguistic knowledge and higher order thinking skills. As a response to the call that more effort is needed to examine how teachers use technology in working with ELs, this preliminary work attempts to shed some light for teacher educators by providing curriculum examples in which teacher candidates collaboratively design teaching materials using VR with K-12 ELs. Grounded in multimodality, Second Language Acquisition (SLA), sociocultural theory, and cooperative learning, the paper explains the relationship between theories and practices, provides a literature review on the use of VR in education, and shares curriculum examples. The paper discusses how VR may be implemented in K-12 ESL classroom settings and reminds teacher educators to take consideration of a variety of factors.

Keywords: English Learners, Teacher Education, Virtual Reality

VIRTUAL REALITY IN ESL TEACHER TRAINING: PRACTICAL IDEAS

Virtual Reality, or VR, is “a technical system through which a user or multiple users can experience a simulated environment” (Girvan, 2018, p.1098). VR technology is a broad term. Different researchers have different concepts on what exactly VR technology is. Christou (2010), for example, stated that VR technology includes desktop VR, immersive VR, collaborative systems, and mixed or augmented reality desktop VR. Based on its original design purposes, Sykes and colleagues (Sykes et al., 2008) divided VR into three types: open social VR, massively multiplayer online games, and synthetic immersive environment. The researchers (Sykes et al., 2008) believed the first two types are not

generally used in education while the last one, synthetic immersive environment, allows educators to carefully plan pedagogical activities in virtual spaces.

Traditionally, VR technology was commonly found in the gaming industry, and users enjoyed the entertaining aspect brought by the technology. Because of its engaging nature, educators began to incorporate VR technology into the classrooms, wondering if the increased engagement and richer sensory experience could enhance learning. Some recent studies have demonstrated the potential benefits of incorporating VR in educational settings. Dalgarno and Lee (2010) identified five main benefits of VR: (1) VR can enhance students' spatial knowledge of visual stimuli, (2) VR allows learners to experience tasks that would not be possible in the real world, (3) VR can enhance motivation and engagement, (4) VR provides opportunities for contextualized learning, and (5) VR can make collaborative learning easier. Research echoed these assertions. For example, some studies reported that participants showed higher motivation in learning (Bailenson et al., 2008; Buchner & Zumbach, 2018; Chiang et al., 2014; Chien et al., 2020; Chen, 2016; Chen, 2018; Huang et al., 2010; Parong & Mayer, 2018; Vázquez, Xia, Aikawa, & Maes, 2018). Other studies showed that the incorporation of VR increased students' content mastery (Chen, 2016; Morales, Bang and Andre, 2013; Nersesian, Spryszynski, & Lee, 2019; Utami & Lutfi, 2019).

Papanastasiou et al. (2019) categorized the benefits of embedding VR in teaching into the following aspects: retention and memory, motivation and attention, visuospatial skills, critical thinking, collaboration, communication and social skills, immersion, creativity and emotional skills. Another literature review (Kavanagh et al., 2017) mentioned that VR can be successfully used in simulation, training, distance learning and can promote students' motivation, enjoyment, personalized learning and deep learning.

In language education particularly, such as in foreign language education, the incorporation of VR can provide richer embodied and extended contexts in which language learning can be made situated and contextualized. Early work in the field showed that VR could promote "intrinsic motivation, more intercultural awareness, and a reduction of the affective filter" (Schwinhorst, 2002, p. 230).

In a literature review (Vogel et al., 2006), the authors stated that VR with interactive simulations could promote self-directed learning and provide a safe environment for learners to explore the content without failing. Another literature review conducted by Liao and Chen (2007) summarized that VR technology, along with interactive simulations, had a better effect on students' content mastery than the traditional methods.

Regardless of the potential benefits of VR and the fact that many schools are now equipped with VR technology for teachers to use with their students, ESL teacher training has not explored this topic yet. As a matter of fact, the Teachers of English as Second or Other Languages (TESOL) International Association (TESOL International Association, 2014) urged more studies to be conducted to help the field understand how different technologies may enhance ELs' language development and overall content learning. The nation-wide debate on what knowledge teachers should have to effectively work with ELs concluded that teacher training needs to address the following aspects: language, culture, instruction, assessment, and professionalism. The TESOL International Association emphasized the importance of selecting a wide variety of appropriate materials for ELs, as the TESOL standards (TESOL International Association, 2010) stated, "Candidates are familiar with a wide range of standards-based materials, resources, and technologies, and choose, adapt, and use them in effective ESL and content teaching" (p. 49).

As a response to the reality that more studies need to be carefully designed and conducted, this article aims to provide potential ideas that teacher educators may find useful in their teacher training work, which targets on helping teachers to work with ELs. The author will: 1. Explain theories behind using VR, particularly from a language teaching

and learning perspective; 2. Share current literature on the use of VR in language education; 3. Provide a toolkit for teacher educators who may be interested in incorporating VR in their teaching training courses. The author wishes that with these backgrounds, more studies with empirical data may be conducted, and further discussions on the effect of VR in teacher training may be invoked.

THEORETICAL FRAMEWORK

Language learning, no matter in English as a Second Language (ESL) or English as a Foreign Language (EFL), involves cognitive and social factors. Cognitively, students must be able to pay attention to the learning tasks, draw background information from their schema, and go through processes of assimilation and accommodation. Socially, students rely on teachers, peers, or other cultural tools to mediate their learning experience. Although all these factors work interweavably to lead to the learning effectiveness, one fundamental factor in language education is to make sure that students receive enough “comprehensible input,” as Krashen (1982) put, “We acquire by understanding language that contains the structure a little beyond our current level of competence ($i + 1$). This is done with the help of context or extra-linguistic information” (p.21). Although Krashen’s work has been criticized for over-simplified definitions of terms (McLaughlin, 1987; Mitchell & Myles, 1998), the concept of “comprehensible input” affirms the importance of comprehension in language education. This notion of making the content comprehensible to students is vital in teaching ELs. Gibbons (2002), for example, used the term “message redundancy” (p.17) (also known as “message abundancy,” Gibbons, 2003, p.259) to refer to the ways that teacher uses multiple meaning-making systems to provide repeated exposure to the content. As language learning must rely on extra-linguistic cues, the use of VR, by providing authentic and immersive experiences to students, thus may greatly enhance students’ language learning experiences. Recent research in SLA showed that virtual environment can potentially enhance language learners’ experience and overall linguistic performance (Sykes et al., 2008; Parmaxi, 2020).

The concept of “Comprehensible input” as a key factor in SLA can be examined from sociocultural and multimodality perspectives. Sociocultural theory based on Vygotsky’s (1978) work believes that learning happens as a social process and as a mediated process. Vygotsky (1978) stated that learning relies on the use of material tools and psychological tools, such as “counting fingers and tying knots” (p.26). Although Vygotsky’s work did not necessarily focus on language learning, when applying his theory in SLA, it is not difficult to conclude that his concept of cultural tools (material tools and psychological tools) provides a means for the realization of “comprehensible input.” Many classroom strategies based on the sociocultural theory, such as providing visuals, concept maps or images as cultural tools, give teachers a toolkit to better communicate with ELs.

Multimodality moves the concept of “comprehensible input” forward by examining language from a “satellite view” (Kress et al., 1998), emphasizing the “situated interplay between modes” (Jewitt, 2009, p.34). From a multimodal perspective, language teaching and learning should focus on understanding how different modes, or the “meaning-making system” (Kress et al., 2001, p. 15), with different affordances, co-represent and co-communicate the intended meaning. Here, language becomes the goals but also the means, as we “learn language, learn about language, and learn through language” (Halliday, 1993, p.112). From this perspective, language education should not aim to simply help students gain knowledge in phonology, morphology, semantics, and syntax, but engage students to focus on the pragmatic use of language as one of the means to achieve their personal and social goals. During these processes of “learning language, learning about language, and

learning through language” (Halliday, 1993, p.112), VR can function as a semiotic tool, along with language, to help ELs represent and communicate their meanings.

Many VR research done in the SLA field cited Long’s (1996) interaction hypothesis, stating that one of the characteristics of VR is that it creates a virtual environment where language learners can freely interact with real or virtual participants (e.g., Collentine, 2011; Blyth, 2018; Peterson, 2012; Qu et al., 2015). As VR technology ranges from simply the use of Google Cardboard to a more complex immersive experience of VR games, it needs to be pointed out that not all types of virtual environments naturally lead to output, which we use to determine the learning effectiveness. In language education, output is equally, if not more, important than input. Swain (1985), based on her work with French immersion programs in Canada, found out that student utterances used in answering the teacher’s questions were usually short and syntactically simple which may not provide enough opportunity for ELs to “engage in extended discourse which will push their linguistic competence to its limit as they attempt to express their ideas” (Swain, 1993, p. 162). When using VR in classrooms, teachers thus need to carefully plan for activities in which ELs are required to produce language, both oral and written, to fulfill the learning objectives.

Not only teachers need to plan for activities that require output, they need to carefully think about the quality of students’ output. Cummins (1999, 2003) brought up the concepts of Cognitive Academic Language Proficiency (CALP) and Basic Interpersonal Communication Skills (BICS) and argued that although students can quickly master BICS, usually within two years, they generally need much longer time to catch up their peers in reading and writing across disciplines. Some studies (Thomas & Collier, 1997; 2002) show that it may take even up to 10 years for ELs to catch up academically in English. Keeping this information in mind, when training ESL teachers, teacher educators need to focus on the quality of teacher-designed activities, asking them what kind of language may be derived from these activities.

One type of learning that may promote the use of academic language is cooperative learning. Johnson and Johnson (2009) defined cooperative learning as “students work together, for one class period to several weeks, to achieve shared learning goals and complete jointly specific tasks and assignments” (p.373). In a cooperative learning activity, each student is required to contribute to the group’s success and the final result relies on positive interactions among the group members. Applying this concept into language education curriculum, it will be ideal to design activities in which learners are assigned different roles, and they have to collaboratively work towards the final product.

LITERATURE REVIEW

In designing appropriate teacher training materials for future teachers who work with ELs, three research areas were consulted: 1. the benefits of applying VR technology in language education; 2. VR usage in K-12 settings; and 3. teacher’s and students’ perceptions of using VR.

BENEFITS OF APPLYING VR IN LANGUAGE EDUCATION

VR technology has become more and more common in language education. Research documented the benefits of using VR in teaching language. These benefits include increased opportunities for linguistic production, increased self-expression and self-efficacy, increased learner autonomy and motivation, increased cross-cultural competence, enhanced listening performance, and positive outcome in vocabulary acquisition (Alizadeh, 2019; Berti, 2019; Chen, 2016; Chen, 2018; Hislope, 2008; Hsiao, 2017; Hsu, 2020; Liaw, 2019; Lee, 2013; Lin & Lan, 2015; Mirzaei et al., 2018; Parmaxi, 2020; Qu et al., 2015; Rankin & Shute, 2010; Schwienhorst, 2009; Shih, 2015; Tusing, & Berge, 2010;

Solak & Erdem, 2015). Von der Emde et al. (2001) identified five pedagogical benefits of using VR in foreign language learning: (1) authentic communication and content, (2) autonomous learning and peer teaching in a student-centered classroom, (3) individual learning, (4) importance of experimentation and play, and (5) students as researchers. In Lee (2013)'s study with 5th-grade students, the researcher examined the effect of using Second Life, a free 3D virtual world, in enhancing students' self-expression in English. The study showed that both the low shyness group and high shyness group increased their self-expression score. In Chen's (2016) study with 448 college students in Taiwan, participants used an online 3D VR English language learning platform to learn English, particularly vocabulary. Results showed that students improved their linguistic knowledge in phonology, morphology, and syntax knowledge, and students increased their critical thinking skills. In another study conducted by Shih (2015), four learners engaged in virtual tours of London by using the Google Street View under the guidance of a native English-speaking instructor. The researcher examined the effects of this virtual environment on culture learning. Data, such as observation, interviews, blog entries, and cultural knowledge tests showed that VR can potentially enhance learners' cultural knowledge and their attitudes toward the target culture. Xie, Ryder and Chen (2019) conducted a study to adopt Google Cardboard and Expedition to facilitate foreign language learning, and they reported that the capability of providing real-life view through VR tools and environments allowed learners to engage in authentic context for foreign language learning.

Although many studies in language education are based on EFL learning contexts at the college level, the benefits of incorporating VR technology may be transferable to the K-12 ESL contexts.

VR IN K-12 CLASSROOMS

K-12 classrooms have their unique characteristics. One of the differences between a K-12 setting and a college setting is that K-12 teaching is regulated by a variety of teaching standards required by the State Department of Education. Quite often, K-12 teaching is also restricted by the budget limit set by the school district. Thus, K-12 teachers often have less freedom to adopt new technology. This is reflected in literature as fewer studies have been conducted at the K-12 setting and a lot of publications remain at the conceptual level.

Chiang et al. (2004) reported a study involving 57 fourth-graders in inquiry-based activities using an augmented reality-based mobile learning system. The study's purpose was to examine the effectiveness of using this new technology in terms of learning achievements and motivations. Results showed that the mobile learning system improved students' learning achievements and motivations. Johnson (2019) recorded her school's effort to bring VR and AR technologies into middle school classrooms. According to her, the technology provided differentiated learning opportunities, helped with knowledge retention, promoted critical thinking, and enhanced students' motivation.

In another study conducted by Nunes and colleagues (Nunes et al., 2018), an OpenSim virtual world was used in a sixth-grade science classroom. The pre- and post-test scores showed that the experimental group, which used the virtual world, had better performance than the control group, which used the Moodle learning platform. Shi, Wang, and Ding (2019) designed an immersive virtual reality learning environments with game-based learning elements embedded for seventh and sixth students, and they reported positive results on the middle grades students with increased motivation in learning math. Morales, Bang and Andre (2013) conducted a year-long case study to understand the virtual reality impact on high school students, and they reported virtual reality has the potential for independent and peer-supported learning in high school science classrooms.

It is noticed that all these studies mentioned above are not specifically about ELs; however, it is estimated that ELs, just like their native English-speaking counterparts, may benefit from the use of VR as well.

TEACHERS' AND STUDENTS PERCEPTIONS IN USING VR

Another set of literature used to guide the curriculum design ideas is teachers' and students' perceptions of using VR in language classrooms. Research showed that students generally enjoyed the use of VR for language learning purposes (Dolgunsöz et al., 2018; Jee, 2010; Kaplan-Rakowski, & Wojdyski, 2018; Kuriscak & Luke, 2009; Liaw, 2019; Peterson, 2012). In Dolgunsöz et al.'s (2018) study with 24 EFL college students, the researchers explored students' perceptions of using VR in an EFL writing context and VR's effect in enhancing students' writing ability. Using the mixed method, the researchers concluded that most learners enjoyed using VR, and this technology appeared to have a long-term effect on students' writing performance.

With some positive perceptions came issues and concerns. Some studies stated that participants reported frustration in dealing with technical problems and physical discomfort (Dunleavy et al., 2009; Jee, 2010; Papanastasiou et al., 2019; Vesisenaho et al., 2018). For example, in Jee's (2010) study, the researcher studied 34 high and low-intermediate college ESL students' experience using *Second Life*, a virtual environment used for language learning. Using surveys and interviews, the researcher stated that some participants showed negative attitudes towards the experience due to the unfamiliarity with the tools needed to function in *Second Life*. Tan and colleagues (2016) also warned us that although the virtual platform may provide a more authentic learning context, some multimodal resources, such as the avatar's (lack of) facial expression and body posture, may confuse the learners.

In terms of teachers' perceptions of using VR in language classrooms, research showed that teachers often have concerns. For example, Vesisenaho and colleagues (2018) reported a pilot study involving six teacher education students. The researchers explored the participants' physiological and emotional responses to their VR experiences. One participant mentioned that "I was so scared and thrilled that my hands were shaking." The researchers concluded that not all participants were ready with the new technology, but participants' experience turned out to be more positive after practice with the device.

In Swier and Peterson's (2018) study about language teachers in Japan, the researchers surveyed and interviewed teachers about their experiences and perceptions in using 3D digital games and virtual worlds in EFL teaching. The study showed that teachers were unlikely to adopt these innovative teaching methods due to the lack of technology support, administrative support, and pedagogical support. Patterson and Han (2019) examined one elementary teacher's perceived ideas and the teacher's process of incorporating virtual reality at the elementary education level, and they recommended conducting needs assessments around the learning goals for the lesson prior to incorporating the virtual reality.

Research outside of the language teaching field seems to echo that compared to students, teachers are often more conservative to try VR. Bahng and Lee (2017) explored elementary teacher candidates' experience of learning how to use VR and implementing VR-embedded lessons in a science methods course. Two hundred and twenty-nine teacher candidates participated in the study. The result showed that 29% of participants were skeptical of using VR in their teaching and only 12% were enthusiastic and eager to try. The researchers also reported that none of the teacher candidates used VR in their lesson plans and peer teaching, indicating a gap between learning experiences and practices.

Synthesizing all the literature reviewed, it is not difficult to conclude that when teacher educators introduce this innovative technology to teacher candidates, they need to focus on the pedagogical aspect of the technology, demonstrating and inviting teacher candidates to

examine different examples, discussing the pros and cons. The literature also reminds teacher educators that due to the complex nature of VR, ample practice time needs to be allowed for teacher candidates to practice using the technology as literature seems to indicate that with practice, both teachers and students become more motivated (Jee, 2014; Nissim & Weissblueth, 2017).

VR-EMBEDDED CURRICULUM: PRACTICAL IDEAS FOR TEACHER EDUCATORS

VR technology may cost from several dollars to hundreds of dollars. The examples included in the article are mainly based on the use of Google cardboard, considering its affordability and availability across different university and K-12 school contexts. Google cardboard is also easy to learn and easy to use. Mentioned in the literature review, teachers' motivation to use VR is related to the usability of technology. Complicated technology may not look attractive to teachers.

It assumed that teacher candidates are familiar with the Google cardboard device and are familiar with basic concepts in EL education, including content and language objectives, linguistic proficiency levels, and lesson planning. It needs to be pointed out that teacher educators should be aware that Google cardboard does not work with every phone. One possible solution might be having teacher candidates work in groups to share with each other.

IDEA 1: LOCATION, DIRECTION

Rationale. One of the common topics in an ESL classroom is to teach about locations and directions. Traditionally, this can be done without technology. For example, teachers can use pictures and gestures. With the VR technology, however, this experience can be made more realistic and authentic.

Useful Apps. Youtube VR channel, Google expeditions, Google street view

Description of the activity. Teacher educators can have teacher candidates in groups explore different locations using the VR viewer and design language objectives or leveled questions (and answers) based on ELs' linguistic levels (See Table 1 as an example). Teacher educator can also invite teacher candidates to brainstorm sentence patterns or key vocabulary and fill in a table like the one shown below (Table 2). With these activities, teacher educator can show teacher candidates how VR can be embedded into K-12 ESL classrooms with a strong pedagogical focus.

IDEA 2: SHOW YOUR HOMETOWN PRESENTATION

Rationale. Another common topic in an ESL classroom is to invite ELs to show their hometown. This is often done at the beginning of the semester when teachers are getting to know the students. Although pictures or PowerPoint slides can provide a visual representation of the hometown, VR can give the audience an immersive experience as it allows other students to explore the scene.

Useful Apps. Youtube, VR channel, Google expeditions, Google street view

Description of the activity. Teacher educators can ask teacher candidates to explore a location through Google expeditions or Google street view. Teacher candidates then work together to design an assignment sheet and corresponding rubric for ELs (See Appendix A and B for example). This assignment should target middle school or high school ELs with intermediate or high English language proficiency level. Since a presentation about hometown is usually done by individual ELs, teacher educators should also ask teacher candidates to brainstorm ways to promote social interactions among ELs. Possible solutions may include, for example, providing class time for peer rehearsals and requiring

a Question-Answer session after the presentation. Creating an assignment sheet and rubric gives teacher candidates an opportunity to think about the details of this VR activity.

Table 1*Idea 1 Language Objectives and Leveled Questions*

Language objective: Students will be able to use key vocabulary (e.g., north, east) to give directions.		
ELP level: low	ELP level: intermediate	ELP level: High
Is the store on the right? (Yes/No)	What do you see on the northeast side? I see a _____.	How can I get to _____? Could you please walk me to the _____?
Do we turn now? (Yes/No)	Where do we go now? We turn left.	You need to go straight and then turn at the second crossing. Why can't I turn here?
Is the building on the right? (Yes/No)		Because the hospital is not on Washington street.

Table 2*Idea 1 Language Functions, Sentence Patterns and Vocabulary*

ELP level	Language function	Sample sentence frame	Key vocabulary
Low	Giving commands	Go _____ (e.g., north) Turn _____ (e.g., left)	Location words (e.g., north)
Intermediate	Asking/answering for locations/directions	Excuse me, how _____? (e.g., how to get to the hospital) May I ask _____? Do you know where _____ (e.g., where is the hospital)	Nouns (e.g., hospital)
High	Describing	I see _____ (e.g., a lot of people talking.) I feel _____ (e.g., the atmosphere is calm.)	Describing words (e.g., calm) Sensing verbs (e.g., feel, sense)

IDEA 3: CREATING A VIRTUAL TOUR FOR EL NEWCOMERS

Rationale. ESL teachers often need to prepare for an orientation for new ELs every Fall semester. With ELs at different linguistic levels, some of them have to rely on non-linguistic cues, such as visuals, to make sense of the orientation. One idea that can help with this issue is to use VR technology to show the school environment. This gives ELs a realistic sense of the school and its surrounding environment. This project can also be done as an end-of-year project to be used for next Fall.

Useful Apps and Websites. Google maps, Google street view <https://arvr.google.com/>

tourcreator/ This website provides step-by-step instruction on creating a virtual tour. Images taken by the students and images from the Google maps/Google street view shots can also be added. <https://www.youtube.com/watch?v=2s4rhDbyYo4> This YouTube video shows how to use the Google visual tour creator listed above.

Description of the activity. This activity, comparing to the previous two, is much more time-consuming. Depending on the learning objectives, teacher educators may decide whether to give class time for teacher candidates to make the video in class, or to assign this as a group project. Teacher candidates need to be reminded to use linguistically less-complex sentences in description boxes for each scene selected for the video. In real K-12 settings, ESL teachers are also likely to include follow-up activities, such as asking questions and teaching vocabulary. Teacher educators may invite teacher candidates to list leveled question (see Table 1 for example) or vocabulary (see Table 2 for example). With these elements built into the project, teacher candidates are trained to think about language while being innovative and creative.

IDEA 4: PAIR SCAVENGER HUNT

Rationale. A pair scavenger hunt is another child-friendly activity. Scavenger hunt does not necessarily require a VR device. However, using VR adds more challenges to the hunt as students have to be alert to the surrounding environment, including the sky, the ground and other details. This activity can also be used as an introductory activity to introduce ELs to VR technology.

Useful Apps. Youtube VR channel, Google expeditions, Google street view

Description of the activity. This is a quick activity where teacher candidates can experience and learn in a teacher education course. First, teacher candidates in pairs select five or six scenes or short VR videos. Next, teacher candidates individually write down descriptors of the searching targets. Teacher educators can give different requests/language objectives and examples (See Table 3 as an example). Finally, teacher candidates ask each other and play the scavenger hunt game. This game can be used directly in a K-12 ESL setting. Used in teacher training, it helps teacher candidates build their grammar knowledge, which is an essential foundation in ESL teaching. It may also expand teacher candidates' cultural competence and cultural knowledge.

Table 3

Idea 4 Scavenger Hunt Descriptors Example

Request	Example
Use color terms	A red and white traffic cone (See Figure 1)
Use present participle	A man looking behind (See Figure 2)
Use an adjective clause	A man who is pointing (See Figure 3)

The four examples provided above show some ideas of how to incorporating VR in ESL teacher training programs. VR is an engaging technology, but it should not be used just because of its engaging and entertaining nature. No matter what VR activities are designed, teacher educators need to keep the P-12 ESL teacher training standards (TESOL International Association, 2010) in mind. Teacher educators need to think strategically to include one or more than one competency determined by the teacher training standards (TESOL International Association, 2010), including language, culture, instruction, assessment, and professionalism.

Figure 1
*Scene No. 1 Found in
Google Street View*



Figure 2
*Scene No. 2 Found in
Google Street View*



Figure 3
*Scene No. 3 Found in
Google Street View*



CONCLUSION AND OTHER CONSIDERATIONS

VR as an innovative technology has shown many possibilities and advantages in language education, including increased motivation, increased linguistic output, and increased cross-cultural competence (Berti, 2019; Chen, 2016; Hislope, 2008; Hsiao, 2017; Liaw, 2019; Lee, 2013; Mirzaei et al., 2018; Qu et al., 2015; Rankin & Shute, 2010; Schwienhorst, 2002a, 2002b, 2009; Shih, 2015; Tusing, & Berge, 2010, Von der Emde et al., 2001). Using VR at the K-12 ESL setting is still in its infancy. However, as VR becomes more and more popular among K-12 students, teacher education needs to keep up the pace to train teachers on how to incorporate this technology into their teaching.

The ideas mentioned above show examples of activities that teacher educators can use in their teacher training courses. With these ideas, it is the author's hope that more empirical research using any of the ideas may be conducted in the future, and knowledge on the effectiveness of VR in teacher training may be deepened.

Although it may sound intriguing for teacher educators to immediately implement VR into their curriculum, several factors need to be taken into the consideration. One is the age range of K-12 students who may be more suitable to engage with VR-embedded curriculum. Browsing the literature, it seems that K-12 participants generally range from upper elementary to high school (Chiang et al., 2014; Johnson, 2019; Nunes et al., 2018; Sun et al., 2010; Kalpakis et al., 2018; Utami & Lutfi, 2019). This may be due to the complex nature of the technology and possible physical discomfort mentioned in literature (Vesisenaho et al., 2018). Teacher educators should keep this in mind and know such activities may not be suitable for Early Childhood majors.

Children between upper elementary and high school are going through rapid cognitive growth as they learn from concrete experiences to more abstract concepts. Curriculum activities need to be cognitively challenging but provide sufficient scaffolding. As mentioned in the literature review, cooperative learning can be used to provide scaffolding. Among the four ideas presented above, the pair scavenger hunt involves some cooperative learning elements as students have to work together, one as a searcher, one as a questioner,

to complete the task. When having teacher candidates design VR activities, teacher educators may require them to use cooperative learning strategies.

The logistic aspect of the design needs to be considered as well. In Kavanagh et al.'s (2017) literature review about VR in education, the authors listed several major problems, including technology problems, training and cost, motion sickness, and others. At the K-12 level, since the technology support may be shared among several teachers, it is probably wise to choose easy technology that requires low maintenance.

Less expensive tools such as the Google cardboard can be used to make the experience more budget-friendly, although the true immersive experience may have to be compromised somehow. In Johnson (2019)'s article about using VR/AR at Scotts Ridge Middle School, the author shared school's experience of using Google cardboards in different classrooms. The author also provided many teacher-friendly, easy-to-access resources. It is also seen that more expensive equipment was reported in the literature (Nunes et al., 2018).

The most important in curriculum design is probably the pedagogical elements used to achieve learning objectives. The technology should only be used to enhance students' learning experience but not as a means to keep pace with the technology trend. Jowallah et al. (2018) said that the curriculum planning process should not begin with the technology, but sound design principles, such as determining learning objectives.

Parong and Mayer (2018) did a study with college students studying biology. The participants were divided into the PPT group and the VR group. The result showed that the PPT group scored significantly higher on the post-test than the VR group. Thus, the technology itself does not necessarily lead to learning effectiveness.

In summary, a sound curriculum activity for K-12 ELs should consider the following questions:

1. Does the VR activity enhance content learning? How? What if VR is not used?
2. Do students have background knowledge with VR devices? If not, how much time should be allowed to help students get familiar with the technology?
3. Does the VR activity promote language development? How? Which aspect of language development can be enhanced?
4. Does the VR activity promote social interaction among ELs or among ELs and non-ELs?
5. Does the VR activity consider the different linguistic levels among different ELs? What kind of adaptations or accommodations can be planned?
6. What kind of evidence can be used to assess students' content mastery and language development?

When involving teacher candidates in curriculum design practices, teacher educators may use these questions for reflection and deep thinking.

With the practical examples provided, it is the author's hope that other ESL teacher educators can think about similar or other VR-embedded activities to be used in their teacher education courses. Since all activities must be designed based on each institute's unique context, the author admits that these ideas may not be directly applied to all educational settings.

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APPENDIX A

Sample “Show your hometown” Presentation Assignment Sheet

For this assignment, you will use VR to give us a tour of one place in your hometown or a place of your choice. You can use Google street view to find your hometown or the place you’re interested in presenting. Here are some tips for you:

- You need to give us some basic information about this place (e.g., where is it? Why did you choose it?)
- You need to clearly guide us to go through this process. Everyone is looking through his/her VR, so you need to make sure you give clear direction. (e.g., “Now please look at the right side,” “Can everyone see the tall building with a red flag on it?”)
- You can add stories to make the presentation fun.
- Talk naturally and use your loud voice.
- The presentation should be at least 5 minutes followed by time for questions.

APPENDIX B**Rubric for Show Your Hometown Presentation**

Category	Scoring Criteria	Total Points	Earned Points
Content	Your presentation has a clear goal.	10	
	All information is related to your topic.	10	
Organization	You use clear language to guide the class through the presentation.	10	
Presentation	You use good language skills and pronunciation, including good vocabulary and grammar.	5	
	You use clear and loud voice. The class can hear you.	5	
	You give time for questions and respond to questions in a nice way.	5	
Preparation/ effort	It is evident that you spent time to prepare for the presentation.	5	
		Total Points:	50