



Using Interactive Virtual Reality Tools in an Advanced Chinese Language Class: a Case Study

Ying Xie¹ · Lanhui Ryder² · Yan Chen³

Published online: 25 March 2019
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Abstract

This case study explored college students' use of interactive virtual reality tools (Google Cardboard and Expeditions) for learning Chinese as a foreign language. Specifically, the purpose of the study was to probe into students' perceived benefits and challenges of using VR tools for Chinese language and culture learning. Twelve students were paired and role-played as virtual tour guides for six locations throughout a semester. Every two weeks, each dyad studied a particular Chinese tourist attraction or location and presented orally in Chinese as virtual tour guides by using the VR tools. Data collection included class observations of all presentations by each dyad, 24 reflections (two per participant, after the first and fifth presentations), and individual follow-up interviews. The study indicated that the real-life view VR tools offered an authentic context for Chinese language learning, sparked interest in the virtually presented locales, and encouraged students to further explore the target culture.

Keywords Virtual reality (VR) · Communicative language teaching (CLT) · Virtual reality assisted language learning (VRALL) · Language learning

Introduction

Today's foreign language learners have benefited from the phenomenal expansion and abundant availability of modern technologies. The literature review conducted by Golonka et al. (2014) concluded that to improve foreign language learning, newer technologies should be used to increase learners' language production and enhance motivation. Recently, one of the most notable technology tools is virtual reality (VR), which

refers to the environment in which a user is provided a near-physical experience of virtually being in a location other than where he or she actually is located (Xie 2010). VR tools can artificially transport learners to various learning environments. Such environments naturally offer authentic communication opportunities and realistic contents, both of which have been recognized as the biggest pedagogical benefits of using VR tools in foreign language learning (Von der Emde et al. 2001).

This study integrated Google Cardboard and Google Expeditions into an advanced Chinese language class. A smartphone can become a VR viewer because Google Cardboard places a smartphone at an ideal distance from human eyes so that a compatible app can create a 3-D view of a pre-loaded physical location. Google Expeditions, one of the apps that work with Google Cardboard, is preloaded with thousands of scenes of historical landmarks, cities, culture heritage sites, universities, and underwater oceans, etc. After being transported into different settings, the user can view the location in a 360-degree pattern by changing positions.

The integration of these VR tools into a foreign language class provides authentic real-life settings for the students and can virtually transport the students from the classroom setting to a variety of real-life locations. The activity transforms the traditional instructor-led learning to situated learning led by students where they role-play as tour guides in an authentic

✉ Ying Xie
yxie@niu.edu

Lanhui Ryder
lryder@niu.edu

Yan Chen
mailmailchen@gmail.com

- ¹ Department of Educational Technology, Research and Assessment, College of Education, Northern Illinois University, Gabel Hall 101D, DeKalb, IL 60115, USA
- ² Department of World Languages & Cultures, College of Liberal Arts and Sciences, Northern Illinois University, DeKalb, IL, USA
- ³ Postdoctoral Fellowship, University of New Mexico, Albuquerque, NM, USA

environment. This study aimed to explore students' perceptions of using these VR tools to advance their knowledge in the Chinese language and culture.

Literature Review

Theoretical Background

The benefit of using VR tools for learning is well grounded in embodied cognition and situated learning theories. The theory of embodied cognition recognizes that one's bodily experiences help to form and build cognition (Johnson and Lakoff 2002). The mind and the body are fundamentally linked (Clark 1998); our experiences or memories are ingrained with components of the environment, emotions, tactile and visual perceptions. With regard to situated cognition theory, Brown et al. (1989) advocated that learning should be embedded in the social and physical contexts within which it will be used so that learning could be appropriately associated with the contextual experience and the applicable environment. Many researchers (e.g. Cheng et al. 2010; Ockey et al. 2017; Peterson 2001) believed that using authentic contexts is a beneficial form of instruction for creating social environments for language acquisition, production, and communication in foreign language learning settings.

Recently, Ladendorf et al. (2019) created a speculative model, namely the Hypothetical Model of Immersive Cognition (HMIC), in the attempt to explain the learning process in a 3-D VR based environment. The model was conceived on the basis of the Information Processing Theory (Atkinson and Shiffrin 1968), Situated Cognition Theory (Brown et al. 1989), and the Embodied Cognition Theory (Varela et al. 2017). The hypothetical model conjectures that VR tools can generate an illusion that the physical stimuli are present by activating visual and motor channels. As a result, the brain is "tricked" into believing the projected surroundings are present. According to Holmes and Spence (2004), human minds tend to process objects in a person's immediate surroundings in a more profound and intricate manner. Since the VR tools can simulate an illusion of presence, one's mind could possibly perceive the projected physical stimuli being close-by and therefore urge the brain to activate the schema in physical and motor channels, resulting in an enhanced learning experience.

Use of VR Tools in the Literature

Virtual environments such as virtual world (VW) and virtual reality (VR) tools have gained popularity in various learning settings (e.g., Ahn et al. 2016; Lee et al. 2017; Le et al. 2015; Lisichenko 2015; Merchant et al. 2012; Rizzo et al. 2010; Rupp et al. 2016). In a virtual world, users can virtually interact with others as avatars (Xie 2010). Virtual reality, usually using a Goggle-like device, creates an illusion of presence by

substituting the real world with an artificial illusion filled with realistic visual, auditory, and even tactile stimuli. The field of second language learning has seen a sprout of virtual environment applications (e.g., Jauregi et al. 2011; Liang 2012; Melchor-Couto 2017; Wehner et al. 2011). Most of previous studies employed web-based VW tools, especially *Second Life*. However, it was important to note that in contrast to the VW tools, most of the VR environment, including what was used in this study, only offers rather static visuals without interactions or social cues.

Despite the increasing popularity, Lin and Lan (2015) pointed out that VR is still one of the least published research topics in the technology-based learning field. Further, the field is still in need of research studies that use the VR tools for a prolonged time and/or in language learning contexts. The present study employed the VR tools for a semester in an advanced Chinese language course, and aimed to address the following two questions: 1) How did students perceive using VR tools in a language learning classroom? 2) What benefits and challenges did they experience using VR tools for Chinese language and culture learning?

Methods

Participants

Twelve students from an advanced Chinese class at a state university in the U.S participated the study (four females and eight males). Ten of them were English-native speakers, and two were heritage learners of Chinese. The participating students were from different majors. The majority of the participants had taken three or four university-level Chinese courses. Eight out of the twelve students had completed at least one 25-day study abroad program to China prior to this study.

Course Structure

This VR-assisted Chinese language course was designed with the principle of providing the students with an immersive authentic learning environment during the 15-week semester at the university. During the first week, the instructor and research assistants introduced the VR tools to the class, demonstrated the use of the VR tools, and conducted a survey including participants' age, gender, family origins, academic major, native language, reasons for taking Chinese, and other questions specifically related to their language experience.

Starting in week two, participants were randomly paired for six presentation topics so that no two participants worked together on more than one topic. Every two weeks, each dyad first studied a particular location; and when they came back to class, they served as virtual tour guides to these selected locations. VR tools were used for four presentations (Topics 2, 3, 4, and 5).

Google Expeditions provided 3D 360-degree sceneries with textual descriptions of selected points of interests in each scene so that the learners could observe, describe, interpret, and present their “traveling” through the immersive authentic environment in the target language. When presenting, the guides could move from one scene to another on the iPad and click on various places on the scene to draw followers’ attention to the points of interest (see <https://goo.gl/Y4enzL> for a screen shot of a guide’s view). Additionally, the guides could view textual descriptions in English of each scene from a pop-up window. A video introducing Google Expeditions can be found at: <https://youtu.be/iZJPO7FVM3U>. Table 1 shows the class activities by week and the data collection procedure.

The students were required to download and explore the Google Expeditions application on their own mobile devices outside of class to prepare for their presentation. Fifteen Google Cardboards, an iPad, and 15 extra smartphones loaded with the app were provided for the students during the presentation sessions in class. When Google Cardboard and Google Expeditions were used, the presenters, using the iPad as the “guide”, had complete control, directing the other students (as “followers” on their phones) to look toward the specific areas where they were presenting. Figure 1 shows part of the class when participants were following the virtual guides using the VR tools. During the presentation, each pair was encouraged to divide the task equally. In order to make sure students stay focused during the virtual tours, the instructor evaluated the students’ learning through a short quiz based on the scenarios provided by Google Expeditions at the end of each class. The quiz consisted of 4 multiple-choice questions about major points of interests they visited during the virtual tour. According to the data, almost all participants answered these questions correctly, and the quizzes were not used for later data analysis due to a ceiling effect. The whole class was encouraged to ask questions during and after the presentations and to provide feedback to one another.



Fig. 1 Participants following the virtual guides with VR tools

Data Collection and Analysis

Data collection included six in-class observations, 24 reflections (two per participant after their first and fifth presentations using Reflection Paper Guiding Questions, see Appendix A), and 12 semi-structured individual interviews at the end of the semester (see Appendix B for Interview Protocol). All data were collected and coded by using pseudonyms. In order to enhance the trustworthiness of the research, the principle investigator and a graduate student, independent from the class, carried out data collection and analyses. The two researchers, with an observation guide (Appendix C), separately conducted the in-class observations. After each class, they compared notes, shared their own interpretations, and reached a general consensus of the participants’ activities during each class. These discussions were audio-recorded. Data were analyzed in a three-step procedure: 1) coding each individual case including the reflections and the final interview into conceptual chunks, 2) grouping open codes into categories for preliminary axial coding; and 3) comparing the open and axial codes among different

Table 1 Class activities and data collection schedule

Weeks	Topic	Activity	Data collection
1	Introduction	Introduce VR-assisted language learning to students, pair students for presentations. Provide presentation guidance & rubric	Consent form & background survey
2–3	#1 project: University campus	Presentation, and in-class feedbacks from the instructor and peers	Class observation Participants’ reflection paper #1
4–5	#2 project: The Great Wall	Presentation, and in-class feedbacks from the instructor and peers	Class observation
6–7	#3 project: Jiuzhaigou	Presentation, and in-class feedbacks from the instructor and peers	Class observation
8–9	#4 project: Beijing	Presentation, and in-class feedbacks from the instructor and peers	Class observation
10–11	#5 project: Guilin	Presentation, and in-class feedbacks from the instructor and peers	Class observation Participants’ reflection paper #2
12–13	#6 project: Xi’an	Presentation, and in-class feedbacks from the instructor and peers	Class observation
14–15	Interview	Conduct individual interview	Participants’ individual interviews

participants to arrive at composite themes (Creswell 2007; Miles and Huberman 1994). Class observations and the audio-recorded discussions between the researchers were utilized to triangulate the data analysis.

Results and Discussions

Six major themes emerged through qualitative data analysis.

Theme 1: The real-life view of the VR tools sparked interest in learning the content. Participants appreciated the unique 360-degree way Google Expeditions presented. For example, David, who had never been to China before, reflected, “*using these tools did spike an interest in learning about these places, seeing that one could explain in detail about a location while seeing it right before you.*” Florence visited China before and she corroborated that the novelty of VR tools made the class more adventurous and pushed her work harder, “*this tool pushed me, try harder... Visual is extraordinary...it was really cool, I never used before, it was different...it is kind of you are in classroom, but your mind is somewhere else, you visualize what they are saying...it is like hearing what you are taught, applied, and physically put yourself in that position.*”

Additionally, some participants indicated that VR tools relieved the cognitive burden of looking for materials for presentation, thus making it more interesting to learn. For example, Edward felt that, “*Google Expeditions provided a topic... It piqued my interest if I planned to go there this summer. It was cool and interesting to incorporate (VR tools) into classroom, than just asking us to prepare PPT (PowerPoint), it is like incorporate this tool into class, build a presentation of that, dialogue, it is really cool.*” In general, these lifelike, vivid, and interactive views of the points of interest aroused students’ enthusiasm about the locations, and they seemed to be more motivated to learn about the topics and the vocabulary associated with the content. This theme was consistent with the findings of Lee et al., (2017), in which students generally enjoyed the sense of presence and valued the content presented by VR tools.

Theme 2: Presentation topics flared up passion in the culture and encouraged further exploration. The chosen topics were real-life locations from China. Learning Chinese cities and historical sites as well as presenting them seemed enjoyable to students. For example, Amy explained that by learning unfamiliar things in the scene, she was able to learn about the culture and history of China. She stated, “*The topics themselves were interesting... It was interesting learning key facts in each section and discovering a bit of history. For me it was fun.*” In addition, Kyle further discussed learning about the historical sites of China kindled his desire to learn about the unique characteristics of Chinese culture, “*I learned more about the historical aspects of China and how they have affected the modern world because they are still relevant to the*

lives of the people there. The many national parks, world heritage lands, and reserves are a big part of the culture that makes China unique. I love it.” Information available on the VR tools is statically visual, so that it generally does not provide interactive or social cues of a culture such as human gestures, native conversations, or procedures of rituals. However, it does offer realistic images of many historical and modern artifacts and symbols, including architecture, tools, and paintings, etc. Such cultural artifacts could bring about many insights into how people had lived and worked, among other attributes, which could be drastically different from the culture the participants were familiar with. As were found in many prior studies such as Ahn et al. (2016) and Passig et al. (2007), VR tools were found to help students connect emotionally with another person and show more empathy toward the situations presented through use of these tools. The visually rich contexts on the VR tools could have potentially afforded the participants to gain an international perspective as compared to other traditional language classes.

Many participants expressed great interest in further exploration of the culture by going to China, even students who participated the study abroad program desired to return to China for another deeper immersion experience. As Jason commented that “*it was really exciting seeing these places using Google stuff (the VR tools), I surely want to return sometime in the future to see more, to dig deeper.*” Gladys simply put it, “*Oh, yes, I want to go back to China again.*” She further explained why these virtual trips through VR tools allowed her to learn more about the culture than actually being there, “*I visited those places (such as xi’an) before. We had a tour guide before but at that time, I wasn’t listening to the tour guide because I was excited to take pictures. So my focus was taking pictures and looking at the things I’ve never seen before. So now, being able to read about it, and seeing paragraphs about the history, and me researching on it, make it much more interesting. Knowing the history and the culture about it, it made it so interesting. Knowing this is very interesting than me just going there and shopping.*” In other words, the VR tools delivered appealing visual content to attract participants’ attention and arouse their enthusiasm for the culture, yet without providing distractions in order to keep the students on task. This finding was confirmed by the study of Lee et al., (2017). In their study, students in the experimental group (with the VR tools) exhibited higher levels of motivation and engagement than those without the VR tools.

Theme 3: Participants’ prior experiences prompted further scrutiny of the locale. As mentioned before, eight out of the twelve students had completed at least one study abroad immersion program to China prior to this study. Consequently, some of the topics presented in this class were quite familiar to these participants. For instance, Amy discussed how her familiarity helped her during the presentation, “*My favorite and most successful was the Beijing*

presentation. I think it was because I have been there so I was more engaged to talk about it. Also, I was more comfortable with the vocabulary used for the presentation because instead of mountains, rivers, and villages we were talking about buildings and historical sights.” Moreover, their prior visits to these locations also allowed them to quickly identify unknown information about these places. For example, Iris attested, “When I saw something that was interesting or something that we didn’t know about before...we didn’t know many details (about the Great Wall) like some towers were for generals only... When I saw something I don’t know, I started by using the descriptions provided by the app, and then I would search more on the Internet if I needed more information about it...” The built-in information on Google Expeditions helped participants become aware of the details they did not pay attention before. In turn, the newly discovered knowledge gap motivated them to carry out more in-depth inquiries about the related content.

Theme 4: Contextualized presentations equipped participants with a more sophisticated lexicon. There was a distinctive phenomenon across most participants’ presentations—they were using a more sophisticated lexicon than that normally used in oral presentations of second language learners, including Chinese idioms (e.g. 避暑胜地 for great summer resort & 名胜古迹 for places of scenic and historic interest). One possible explanation was that the participants prepared their presentations by translating the materials on Google Expeditions. As stated in participants’ reflection papers as well as their interview transcripts, many mentioned that they prepared their presentation by directly translating the materials in the app. According to Edward, “*The Google Expedition was a decent tool to use— it provided ... materials to translate.*” Because the app (Google Expeditions) provided plenty of information about the points of interests, most participants used this information to jump-start the preparation of the presentations. Florence reflected, “*It was a relief not to have to create a presentation from scratch such as in PowerPoint. You don’t have to do your own presentation. It saves time so your sole focus is creating the script, memorizing, and presenting.*”

However, the participants did not limit the content of their presentations to those provided on the app. They went well beyond what was available. Iris reflected that after she identified unknown information, she carried out many searches about the knowledge gap, “*When I saw something I don’t know, I started by using the descriptions provided by the app, and then I would search more on the Internet if I needed more information about it... Sometimes, I searched in many sites, including the blogs of those who had gone there before, trying to find what I was looking for.*” In addition, some topics or locations were completely novel to most participants. In order to adequately present on them, it was inevitable that participants had to learn about them from scratch. Amy noted,

“*The topics themselves were interesting. The areas such as Guilin did get difficult only because I was not familiar with nature-like words.*” According to the Communicative Language Teaching (CLT) approach, the objective language should be used to the largest extent in authentic situations. The requirement of immersion into the realistic scenes and serving virtual tutor guides facilitated active and discovery learning. As a result, participants’ vocabularies were reportedly improved.

Theme 5: The use of VR tools helped ease nervousness during presentations. In-class observations found that most of the participants seemed more relaxed when delivering the presentations with the help of VR tools. In other words, it appeared that some participants’ anxiety about presenting in this foreign language was alleviated. An individual’s feeling of nervousness and/or apprehension, usually described as mental block when using or learning a foreign language, was called foreign language anxiety (FLA). FLA has been a well-recognized and widely studied issue hindering the mastery of any foreign language (MacIntyre and Gardner 1989; Marcos-Llinás and Garau 2009). One of the major research focuses was about the FLA associated with authentic communication (Wesely 2013). This was mainly due to the pressure and threat posed by learners’ amateurish command of the foreign language and the need to communicate effectively (Horwitz et al. 1986). In this study, several facts seemed to have contributed to the reduction of FLA when using the VR tool. First, some participants indicated that their anxiety during the presentations decreased because they felt the audience focused on the scenery and grandeur of the imagery on the screen instead of their oral presentations alone. Bruce reflected during the interview, “*It was a huge relief having something that was already set up for you and an interesting tool that could distract people from if you did poorly or not... For Powerpoint, all eyes are on you. With these tools, you have a Cardboard to distract and you also know what you are talking about... having the audience being distracted, you feel a bit more relaxed when you go up there.*” Second, since Google Expeditions provided relatively detailed information about major points of interests, participants were not very concerned about their Chinese vocabulary, even when introducing each specific historical cultural site or famous tourist scene. As mentioned earlier, they used translation app to prepare for their presentation. These tools reduced their anxiety levels when preparing for the presentations. For example, Florence mentioned, “*I did not feel anxious using them (translation tools) when it came to translating words.*” Gladys further explained, “*using PPT (PowerPoint) makes more nervous, because I never know if it is accurate, especially if you are not familiar with the place, you Google it, and pick up the pics popped up. But when you use this (VR tools), I am more relaxed, because the information I know are correct, and it guides you through what you should talk about. Like Beijing,*

there are so many things to talk about, and this narrows down, this is definitely more fun for learning.” In addition, using these tools provided them extra time and space to relax during the presentations. For example, Henry noted, “I was not nervous. The tour gave a slight buffer or pause so presenters could find their words.” Similarly, Jason said, “It [using these tools] gives you time to think when you are looking for the next spot you are talking about.” As a result, by the end of the semester, participants appeared to become even more relaxed when speaking to the audience in Chinese. Bruce attested in his interview, “I feel more confident now than I did when I started. This is because I now have more practice with speaking in front of a group in Chinese: a thing that I was once unaccustomed to.”

Theme 6: The participants perceived some disadvantages or difficulties with the VR tools. *First, inaccurate pronunciation or unfamiliar vocabulary hindered followers’ interactions with the presenters.* The participants had varied level of pronunciation of Chinese language, thus when one pair guided the tour, it was challenging for the other students to understand and follow them during the presentation. In these situations, wearing VR glasses while not knowing where to look at would be more frustrating for students compared to watching PowerPoint presentations on the classroom screen. Some students also indicated that it was unproductive to sit in the class without knowing what the speakers were saying. For example, Larry commented, “I felt I was distracted a lot of times, and it was hard to pay attention to what the presenters are speaking about, maybe there are some new vocabulary that I could have learned.” Similarly, Florence reflected, “If I don’t understand 5 words out of one sentence spoken by the presenters, I would go somewhere else.” Additionally, since each group presented the same topic, some students found the repetition boring, but some found the repetition of the same topic helped learning. For example, Henry noted, “of course I could get bored, but meanwhile, the constant presentation on the same topic actually help, or force you to learn, it is internalized.”

Second, several participants reported experiencing physical dizziness while using Google Cardboard and Google Expeditions. It was observed that several participants, after the initial trial, resisted using the Google Cardboard when sitting in the classroom as “followers” instead of virtual “guides.” Google Expeditions app can work in either of the two modes: phone only with full screen or phone plus Google Cardboard mode (turning into a 3-D 360-degree view). It seemed that not all participants felt comfortable with the 3-D mode. For example, Larry reported, “I don’t think I liked Google Cardboard. I think using the phone on full screen mode is much better. Google Cardboard made me pretty dizzy after look at it for a few seconds. So it is hard to keep it on my face through the duration of the presentations.” Jason added, “I thought they had very little use and were glorified 360 drone shots. The Cardboard gave me a headache to the point

that I did not wish to use it in lieu of controlling it with my finger.” Feeling dizzy or lose of balance through VR viewers has been well documented and discussed (Chiarovano et al. 2015; Menzies et al. 2016; Robert et al. 2016). Neurologists and cognitive technologists are still looking for ways or techniques to help people maintain balance. Generally, at this point, it is recommended that people should leave the environment to avoid motion sickness or physical discomfort (Ladendorf et al. 2019). Moreover, some participants complained about the requirement of changing positions while following the presentations with the app. Charles stated, “I found it difficult at times to follow the presentation on these apps. This is because the markers that were being selected were often out of view of the app, thus requiring me to rotate 180 degrees: a difficult position whilst sitting in a desk.”

Third, technical difficulties persisted. It seemed that not all participants enjoyed the introduction of newer technologies in the classroom. Some seemed intrinsically resistant to novel technologies. Kyle confessed, “I struggled with getting used to different technologies. I never could figure out how to get the tablet to zoom in the way I wanted it to.” In addition, it seemed that some participants struggled staying connected to the router, “It was challenging to set up the app and connect the router. If you don’t know how to use it. You will have the presentation on the same picture over and over again.” (Gladys). However, after they became accustomed to the technology tools they generally enjoyed the experience instead of feeling frustrated by the technical difficulties. For example, Kyle continued, “I was a little pressed because I don’t like using a lot of technology in general and I didn’t want to mess up. But when we put them to work during the presentations it was fun to point out the things we were talking about.”

Conclusions and Recommendations

This case study indicated that integration of VR tools in a Chinese language class contextualized students’ new learning and eased the cognitive burden. Participants have shown heightened interest in the target culture and were motivated for further exploration. However, despite the learning benefits mentioned above, this study also suggests that the complex nature of VRALL demands active involvement of instructors to help participants stay engaged.

Instructors must be aware that students usually have varied levels of pronunciation of the Chinese language and vocabulary, as it was found that inaccurate pronunciation and unfamiliar vocabulary during presentation tended to hinder students’ engagement with class activities. Instructors could create an online file for each topic in which students could list the vocabulary along with pinyin, the official system for transcribing Standard Chinese with the Latin alphabet, for their presentation and for other students to study in advance. At the

beginning of the semester, the participants expressed preference for independence and autonomy; however, at the end of the semester, they wished for more scaffolding from the instructor, including more preparation for grammar and pronunciation, and vocabulary. Instructors may set aside class time to schedule each pair to meet with the instructor for more individualized tutoring. Furthermore, it was suggested that instructors should conduct a mid-term survey with a purpose of discovering any emerging issues in order to address the issues during the semester in a timely manner.

In addressing the target language proficiency gap, instructors need to consider appropriate strategy to pair students for best results. For the purpose of eliminating possible inequality, we randomly paired up the students for six presentation topics so that no two participants worked together on more than one topic. Future research may explore alternative pairing strategies. For example, an English-native speaker might be paired up with a heritage learner, or learners who have travelled to the target location might be paired up with learners who have not.

The study was limited due to the data collection strategies. Due to the limited number of participants and lack of a comparison group, no quantitative data, including the instructor's rating of students' oral presentations, were collected or analyzed together with the qualitative data. We observed some improvement of participants' vocabulary use and possible reduction of participants' foreign language anxiety. In addition, some participants mentioned that other aspects of their presentations seemed to have improved as well. For example, according to Gladys, "*I noticed that my pronunciation skills have improved vastly and my ability to cope with the idea that I will be presenting every other week has improved. I have also improved my eye contact/presentation skills. Still not great at memorization but at the very least I do not fumble or get lost in sentences anymore. My ability to create the script got faster as well as the time it took to present it.*" However, these findings were all based on observations and participants' reflections. Further research should provide empirical evidence about whether these VR tools could improve students' oral proficiency in various aspects, such as pronunciation, fluency, grammar and vocabulary, or reduce their anxiety with a quantitative, experimental design.

Since the technology tools are still new to the higher education classroom, instructors need to be prepared to react to unforeseeable problems when using the VR tools. On multiple occasions, the class encountered technological glitches when the university wireless system did not fully support the in-class presentations. In order to deal with the issue, a separate and dedicated router was used to make sure the devices could remain constantly connected to the wireless network different from the university's system. Additionally, since a couple of students experienced dizziness from using these VR tools, they were allowed to use the cellphones alone without Google Cardboard to reduce the physical discomfort.

Various classrooms are increasingly adopting VR tools. A panoramic query of learners' interactions and perceptions with these tools could be conducive for future research and implementation. For emerging yet potentially productive tools like VR, recognizing their limits and affordances in higher education has significant implications for practitioners including instructional designers and instructors, as well as researchers. This study also served to illuminate one possible way of how to use VR tools to vitalize classrooms for foreign language learning.

Compliance with Ethical Standards

Conflict of Interest There is no potential conflict of interest with the study we reported. All authors declare that they have no conflict of interest.

Ethical Approval The application of using human subjects was approved by the University's Human Subjects Committee on January 17, 2017 (Study Number: HS17-0008). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Appendix A Reflection Paper Guiding Questions

- Describe how you and your team member tackled the task: what tools you used, the process your team went through etc.
- How did you feel about the task (difficult/easy, fun/boring) and why?
- How do you like your presentation? If you had to do it differently, what would you do?
- How did you like the google tools? Were you anxious or nervous when using them when you were the guide? Why and why not?
- When using google tools as an audience, how did you feel? Were you able to follow the guide? Why or why not? Did you feel it became easier or harder to learn the content, language and/culture and why?
- Did you learn anything from this project? What are they (use examples)
- Do you feel more confident now than when we started? Why and why not?

Appendix B Interview Protocol

1. You used Google Cardboard and Google Expeditions for several of your in-class projects. Could you please describe

- a. How you and your partner prepared your presentations?
- b. What you did when presenting with the tools?
2. When you were using the tools as an audience (while others are presenting), how did you like this experience?
3. How did you feel about the projects?
4. How did you like the projects and why?
5. How did using these tools affect your Chinese learning?

Appendix C Observation Guide

Date: _____ Location _____ Pair # _____ Participant # _____ and # _____.

General impressions:

Points of interests selected for presentation:

Supporting materials:

Composure:

Special notes about the presenters:

Notes about audience:

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