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Virtual Reality in the Language Classroom: Theory and Practice

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Abstract

Virtual reality (VR) has turned into a buzzword among educators over the past few years as tools and devices continuously get cheaper and better. Google Expeditions, for instance, is a VR educational tool that allows teachers to take students on virtual field trips without leaving the classroom. The teacher can lead a tour guiding students in the VR environment and monitoring their actions while calling their attention to specific points of interest in a virtual space. There are numerous ways VR apps such as Expeditions could be integrated into EFL/ESL lessons. This write-up begins with a brief introduction to virtual reality, in comparison with augmented reality, and VR devices available in the market. This theoretical section will be followed by instructions on setting up an Expeditions kit and ways to take students on virtual tours built around lessons designed to develop language skills. For those interested in creating their own customized VR tours, Tour Creator, another VR platform also developed by Google, will be introduced. This practice-oriented paper could be useful to teachers interested in energizing their teaching and engaging their students in ways they have never ventured before.

Keywords: Virtual Reality, Google Expeditions, Tour Creator, Virtual Field Trip

Introduction

Virtual reality (VR) is defined as "an immersive computer-enabled technology that replicates an environment and allows a simulation of the user to be present and interact in that environment." (Lloyd, Rogerson, & Stead, 2017, p. 222) The term virtual reality was coined by John Lanier, the founder of VPL Research, a pioneering VR company in the 1980s. Despite the fact that many popular definitions of virtual reality refer to hardware such as computers, VR headsets, more technically called head mounted displays (HMDs), and haptic gloves in describing the term, Steuer (1992, pp. 76-77) breaks away from a hardware-dependent description of virtual reality and defines it as "a real or simulated environment in which a perceiver experiences telepresence."

The origin of virtual reality is debated, but it emerged in the form we know today during the latter half of 20th century. Previously, the VR industry for the most part provided devices for limited applications such as flight simulation and military personnel training (Sherman & Craig, 2003; Craig, Sherman, & Will, 2009). Virtual reality technologies later found their way into a range of areas such as entertainment and gaming as well as advertisement and marketing. Some fields of education including science and medical education have also been revolutionized with the introduction of virtual reality; however, VR in language education is not yet a fully-fledged field of research, given that a growing number of papers have been published only over the past several years by researchers and practitioners interested in investigating the affordances of these less familiar technologies (Bonner & Reinders, 2018; Hastings & Brunotte, 2017; Lege & Bonner, 2018). Virtual reality can be a useful addition to L2 teaching and learning as it has the potential to bring a whole new dimension to the realm of language education resulting in enhanced learning and increased motivation and engagement,

as evidenced in the literature (Chen, Smith, York, & Mayall, 2019; Godwin-Jones, 2016; Lloyd et al., 2017; Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014). For example, Chen et al. (2019) found that incorporating Google Earth virtual reality into writing experiences of young learners of English resulted in improved expository writing skills. The learners were also more engaged in the new learning environment and reported positive attitudes toward Google Earth VR. Similar to these findings, Gadelha (2018) and Lloyd et al. (2017) maintain that virtual reality can provide students with immersive learning experiences by merging the boundaries between the worlds inside and outside the classroom.

Since virtual reality is still a relatively new technology in L2 education, it is not commonly practiced by language teachers, and initial adoption rates are slow, mostly due to the fact that some teachers are reluctant or intimidated by incorporating VR-powered learning tools and resources into their classes (Bonner & Reinder, 2018). In order to encourage more teachers to experiment with using VR in language education, this paper presents a brief review of the basic concepts of virtual reality in comparison with augmented reality, as well as ways to experience VR and how this new technology aligns with learning theories. Next, a free VR mobile application named Expeditions developed by Google is introduced, and details are provided on the steps of setting up an Expeditions kit and taking students on virtual tours alongside ideas for virtual reality-enhanced classroom tasks and activities. In addition, Tour Creator, a more recent VR breakthrough also by Google, is presented by means of which customized virtual reality content can be created. Finally, for those interested in further exploring the potentials of virtual reality for language pedagogy, the Mixed, Augmented, and Virtual Realities in Learning (MAVR) special interest group (SIG) within the Japan Association for Language Teaching (JALT) is introduced with reference to the activities of this group.

The ABCs of Virtual Reality

What is the Difference between Virtual and Augmented Reality?

In order to distinguish virtual reality from its sister technology, augmented reality (AR), it is best to consider the reality-virtuality continuum proposed by Milgram, Takemura, Utsumi, and Kishino (1994), as displayed in Figure 1. Imagine a continuum with the real environment on one extreme and the virtual environment on the other. The real environment, as the name suggests, is the world humans live in whereas the virtual environment completely immerses users in a simulated world filled with unreal, virtual objects. Moving to the central parts of the continuum, there are environments which are a mix of the real and the virtual, thus known as mixed reality (MR). Such environments could be close to augmented reality, where there is more of the real environment with the presence of digital objects interacting with real ones, or they could have more of the virtual world with some real objects present, thus augmented virtuality (AV). In Table 1, augmented and virtual reality are compared and contrasted by providing responses to some commonly asked questions about these technologies.

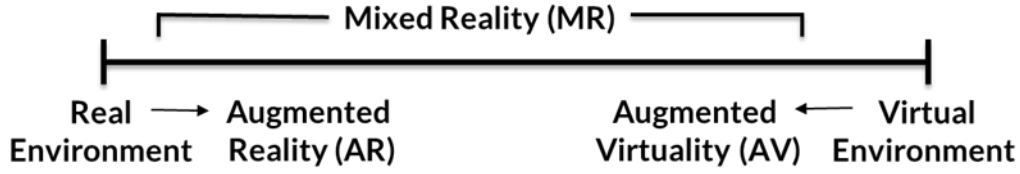

Figure 1. Reality-virtuality continuum, adapted from Milgram et al. (1994).

Virtual reality applications are gaining popularity among ELT practitioners and researchers (Hawkinson, Mehran, & Alizadeh, 2017), since their use is aligned with several learning theories explained in the following section. As already noted, this paper deals with virtual reality and aims to explore its affordances in language learning as far as Google VR applications are concerned.

Table 1

Comparison of Augmented and Virtual Reality

	Augmented Reality	**Virtual Reality**
Are AR and VR the same?	No, AR enhances the existing real world by adding digital objects to it in ways that make users believe those objects actually exist	While VR takes users to a simulated environment completely separated from the real environment
Can the user interact with the real environment in AR and VR?	Yes, since digital objects are overlaid onto the real world and the user can experience both	No, since VR transposes users to a virtual environment entirely distinct from the real world
How can each be experienced?	Smartphone cameras, smartglasses such as the Microsoft Hololens	Stand-alone, computer-powered, or mobile-powered VR headsets
Is the experience 100% immersive in AR and VR?	No	Yes

What Do Learning Theories Say about VR in Education?

There are several pedagogical theories supporting the use of interactive media such as virtual reality, including constructivist learning, situated learning, inquiry-based learning, game-based learning, and engagement theory (Chen, 2009; Chen et al., 2019; Rahimi & Pourshahbaz, 2019). The first theory aligning with VR integration into education is constructivist learning. In contrast to older learning theories such as behaviorism, constructivism considers learning as an active, contextualized process of knowledge construction and encourages learners to construct their own understandings and to validate them through social negotiation (Ertmer & Newby, 1993). Virtual reality supports the constructivist approach to learning in that it allows learners to construct knowledge from meaningful and enriched experiences.

In order to gain a deeper understanding of how virtual reality supports constructivist learning, it is worth revisiting Jonassen's (1994) summary of the implications of constructivism for instructional design in light of VR integration in education. According to Jonassen, knowledge construction may be facilitated in learning environments which:

- provide multiple representations of reality; thereby:
- avoiding oversimplification of instruction by representing the natural complexity of the real world;
- represent the natural complexity of the real world;
- focus on knowledge construction, not reproduction;
- present authentic tasks (contextualizing rather than abstracting instruction);
- provide real-world, case-based learning environments, rather than pre-determined instructional sequences;

- foster reflective practice;
- enable context- and content-dependent knowledge construction; and
- supporting collaborative construction of knowledge through social negotiation, not competition among learners for recognition. (p. 35)

In response to the need for constructivist learning environments, virtual reality is capable of (1) providing multiple representations of reality by immersing learners in virtual learning environments in ways that 2D multimedia content cannot; (2) representing the natural complexity of the real world by exposing learners to immersive content that focuses on the big picture of phenomena while paying attention to details and which is able to depict the complex interactions among the components of a system that are often underrepresented in mainstream Web 2.0 learning content; (3) focusing on knowledge construction by allowing learners to interact with one another so as to discover facts on their own instead of solely being presented with facts related to a certain topic such as rock formation and human skeletal system; (4) presenting authentic tasks by virtually transporting learners to different contexts, such as allowing them to practice presentation skills in the presence of a simulated audience to overcome public speaking anxiety; (5) providing real-world, case-based learning environments by allowing for personalized learning and the accommodation of various learning styles as well as allowing learners to discover and construct knowledge at their own pace following their own preferred order, thus leading to the creation of individual learning paths; (6) fostering reflective practice by appealing to several different senses—visual, aural, tactile, and others depending on how well configured an VR learning environment is—thus facilitating reflection on and in action (Schön, 1983); and (7) enabling context- and content-dependent knowledge construction by providing context-rich content and gamified problem-solving tasks while making appropriate use of learners' prior knowledge, far from what older methods of knowledge transmission tend to involve.

Besides allowing for constructivist learning, virtual reality also gives learners the ability to engage with peers in social interactions within a natural learning environment, thus situated learning. Moreover, by appealing to learners' sense of curiosity, VR-supported learning can get learners involved in inquiry-based learning, and instead of merely being presented with facts provided by the teacher, they can experience discovery learning with the assistance of a facilitator. In addition, the game-like features of VR learning tasks can more easily get the learners engaged and can often "edutain" (Buckingham & Scanlon, 2000) them beyond what traditional classroom tasks and activities do. Last but not least, VR integration is also supported by engagement theory proposed by Kearsley and Shneiderman (1998), according to whom "students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks" with technology as the main facilitator of engagement (p. 20).

What Are the Affordances of Virtual Learning Environments?

Dalgarno and Lee (2010) have investigated various studies from the 1990s and 2000s to show the merits associated with learning in immersive environments. They have come up with five major affordances of 3D virtual learning environments including "the facilitation of tasks that lead to enhanced spatial knowledge representation, greater opportunities for experiential learning, increased motivation/engagement, improved contextualisation of learning and richer/more effective collaborative learning." (P. 10) In other words, virtual learning environments enable learners to comprehend concepts and practice tasks that are often difficult or impossible to do in the real world while providing them with ample opportunities to engage in collaborative interactions with their peers within a media-rich learning context, thus leading to higher motivation and engagement levels. Given all the benefits that virtual reality affords

for education, the following sections deal with practical aspects of integrating VR into classroom activities.

How Can Virtual Reality Be Experienced?

In order to fully experience virtual reality, VR headsets are necessary. There is a wide range of VR headsets in the market, from the inexpensive Google Cardboard to more advanced yet costly head mounted displays (HMDs) such as Oculus Rift, Oculus Quest, and HTC Vive. The latter HMDs are capable of providing users with a more immersive, real-world-like type of experience through tracking user motion and simulating a virtual environment in which one can move around and perform different actions using controllers pretty much in the same way as the real environment; however, this level of immersion comes at the expense of costly gear, large physical space, loss of portability, and complicated setup, often very difficult, if not impossible, to access and arrange for in educational settings.

Google Cardboard, however, is an inexpensive VR viewer than can be purchased in large numbers at moderate costs at online stores such as Amazon (see Figure 2). It was first released in 2014 and has been highly favored by teachers due to its affordability, easy assembly, and stand-aloneness. It is worth mentioning that the virtual reality experience brought by Google Cardboard differs from the type provided by more advanced VR head mounted displays such as the Vive or the Rift, in that the VR content viewed with Cardboard is in fact a spherical or 360° video or photo. In such an environment, users cannot walk to approach the objects around. Nonetheless, this lower level of immersion is sufficiently engaging and more importantly affordable for classroom use.

Figure 2. Google Cardboard (photo by Evan-Amos—own work, public domain, https://commons.wikimedia.org/w/index.php?curid=45580283).

Google Expeditions

Expeditions is a VR educational platform developed by Google. With Expeditions, teachers can take their students on virtual trips all over the world, to museums, mountains, historical monuments, festivals, oceans, and outer space only to name a few, without having to leave the classroom. Utilizing Expeditions in educational settings roughly translates into taking students on field trips on a magic school bus, similar to what Ms. Frizzle did in the animated children's television series, The Magic School Bus.

At the time of its release in 2015, there were about 500 tours available on Expeditions, and over twice as many have been developed since then. The expeditions consist of 360° photos annotated with descriptions and marked with specific points of interest called “spaces.” What makes the expeditions engaging is that they are not just tours to majestic places like Mount Everest, Machu Picchu, the International Space Station, or the Great Barrier Reef. The app can

take teachers and students to places they may not be able to visit in person due to lack of time, geographic distance, or safety issues. For instance, visiting nuclear disaster sites such as Fukushima in Japan and Pripyat in Ukraine is impossible due to their poor accessibility and insecure environments. Perhaps, the best a teacher could do is to use news articles, 2D images, and film footage to explain to students what has occurred, but now with Expeditions, they can take students to the heart of the disaster to give them a first-hand experience beyond merely reading texts, seeing images, or watching videos.

In order to set up Google Expeditions, all that is needed is a tablet for the teacher, smartphones for the students (a bring your own device or BYOD approach should work in most contexts), VR goggles such as Google Cardboard, and a router that allows the app to run over its wireless local network. A potential technical issue in many schools or universities is the lack of a stable Wi-Fi connection to download all the heavy assets simultaneously on student devices, yet that is fortunately not a problem with Google Expeditions. The developers have already found a way around this issue by making the virtual tours downloadable on the teacher's device. That device then operates as a local server for each of the connected student devices, as can be seen in Figure 3.

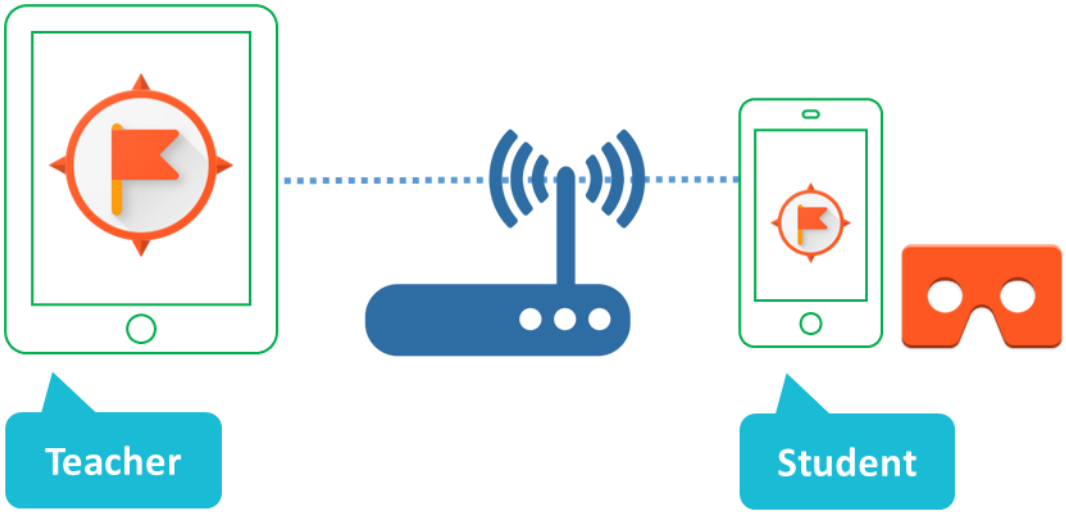

Figure 3. Google Expeditions kit.

Just like in a face-to-face class, teachers need to direct students in the VR environment, get their attention, and monitor what they are working on. To this end, the Expeditions app has a guide menu and a pause button on the teacher's device. By pushing the pause button, students' screens go black, and the teacher is able to get their attention when necessary. Moreover, in order to check what students are focused on, smiley faces on the teacher's screen act as a sight indicator, signifying students' gaze to stimuli (see Figure 4). The teacher's menu also includes a description of the location along with several points of interest referred to as scenes. When the teacher points out a given space on their device, arrows appear on students' devices directing them to look in a particular direction. Given these features, the Expeditions experience is far from being an isolated activity. It is worth mentioning that even without VR goggles, students can still join a virtual tour by looking at their smartphone screens in the so-called "magic window" mode (as shown in Figure 5); however, with a Cardboard or other similar VR viewers, the experience will be much more immersive.

There are many ways teachers could integrate Google Expeditions into their lessons. The expeditions used to be tagged with target groups and subject matters, but these tags were later removed to allow teachers to utilize the tours as creatively as possible. Thus, the same

expedition could be used in different ways with children in a school, university students, or adults in lifelong learning programs, depending on their needs and learning objectives. For instance, the Mount Everest expedition can be utilized in a geography class with school students to help them learn about the geographical features of the highest mountain on Earth, in a university class to get the students to discuss the dangers threatening climbers, and also with adult learners of English to teach them new words related to mountain climbing.

With regards to language education, career-related expeditions can be integrated into EFL/ESL lessons with the theme of jobs and future career. Expeditions can take students on virtual internships allowing them to get an immersive experience of various occupations and their advantages and drawbacks. They could be later asked to share what they found out about different jobs with their classmates. Another classroom idea is to make use of Expeditions in EMI (English-medium instruction) classes focusing on subject matters such as science, history, and literature. Moreover, Expeditions can be useful in practicing the use of a grammatical form such as *there is* / *there are* while asking students to describe what they see in the VR environment.

Figure 4. Screenshot of the teacher's menu on Google Expeditions.

Figure 5. Magic window mode on Google Expeditions.

Tour Creator

In May 2018, Google released yet another platform called Tour Creator (https://vr.google.com/tourcreator/), which allows anyone to create customized VR tours on their computers using Google Street View or their own 360° photos taken with spherical cameras. With Tour Creator, users can generate quality VR content without any knowledge of coding, add points of interest to their tours, and overlay 2D images to those points of interest so that viewers can further explore them in more detail. The tours created can then be publicly published or unlisted (i.e., privately shared) on Poly (https://poly.google.com/), Google's 3D content library, and viewed on mobile devices, desktop computers, or Cardboard. Currently, it is possible to access such self-generated tours on the Expeditions app, where they appear under "My Tours."

New tours can be created at https://poly.google.com/creator/tours/ as shown in Figure 6. As an example, student-generated VR tours can be used for digital storytelling tasks in L2 classes or for creating student-generated 3D campus tours targeting international/exchange students.

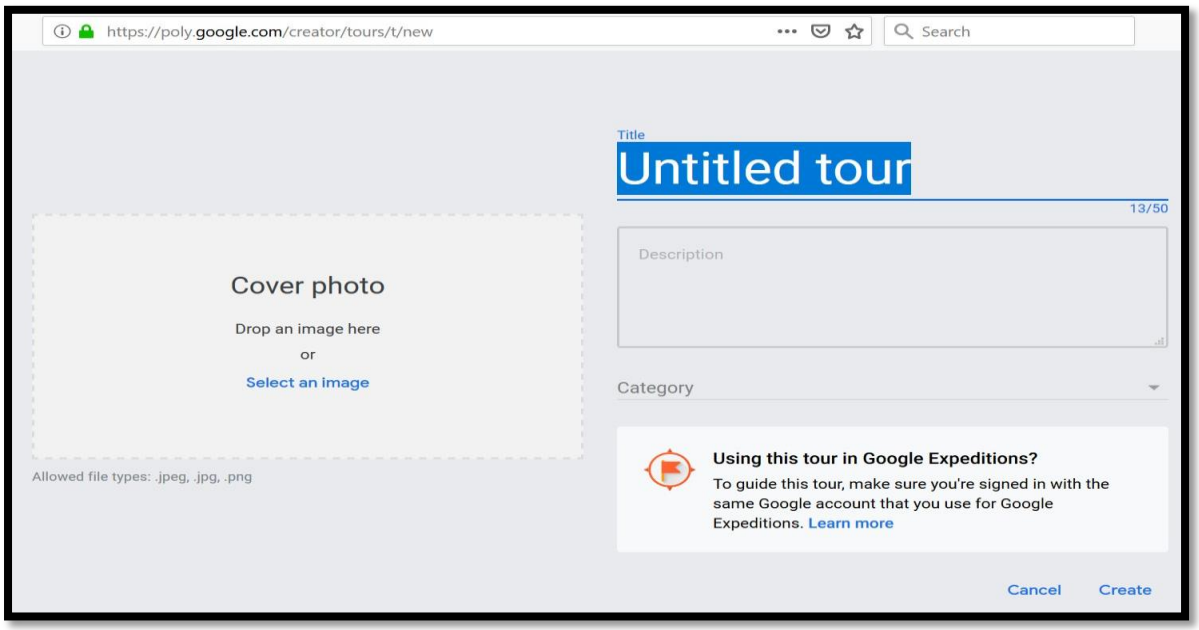

Figure 6. Step one in creating a new tour on Tour Creator.

AR/VR Community: MAVR SIG

Finally, for those who wish to further explore the potentials of VR in language education, the MAVR SIG may be of interest. This SIG was established in 2017 as part of JALT, with the majority of members based in Japan. The SIG officers have been attempting at organizing virtual and face-to-face events to connect researchers and practitioners involved in VR uses in language education. Some of the recent events include a tweet chat organized in collaboration with the IATEFL (International Association of Teachers of English as a Foreign Language) LT (Learning Technologies) SIG and a workshop on virtual reality in English academic writing with speakers from Xi'an Jiaotong-Liverpool University, China. Moreover, the SIG newsletter and podcast are open for submissions from members and non-members. Further information about this group can be found at http://mavr.site and on MAVR SIG social media pages.

Conclusion

This paper presents the basic concepts of virtual reality in comparison with augmented reality while introducing two VR apps developed by Google and discussing their use in educational contexts. Virtual reality technology is still new to language educators; nonetheless, there are many potentials in incorporating these technologies into language learning and teaching, such as enhanced motivation and engagement as well as contextualized learning. Although virtual reality in L2 education is still in its infancy, it will not be too long before its presence and use is normalized, similar to earlier tech tools and resources used on a daily basis or for educational purposes. There is no doubt that more research is needed before drawing further conclusions regarding the effectiveness of VR integration in language learning; however, a major part of a successful integration is dependent upon creative and meaningful task design on the side of the teacher.

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