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THE USE OF VIRTUAL REALITY TOOLS IN THE READING-LANGUAGE ARTS CLASSROOM

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ABSTRACT

This article presents virtual reality as a tool for classroom literacy instruction. Building on the traditional use of images as a way to scaffold prior knowledge, we extend this idea to share ways virtual reality enables experiential learning through field trip-like experiences. The use of technology tools such Google Street view, Google Expedition, and 3D glasses provides a way for teachers to engage students with content. For the reading/language arts teacher, virtual reality tools may provide an affordable way to support students through visual and experiential scaffolding.

Keywords: virtual reality, literacy instruction, experiential learning

"The coming VR-storm, so to speak, will significantly alter the landscape of every industry from the military, to healthcare, entertainment, gaming, education, fashion, and business just to name a few" (Adams, 2016, para. 8). How will virtual reality (VR) impact literacy education? Teachers often use visuals for receptive purposes, as scaffolds that help students comprehend complex information and support understanding (Cappello & Lafferty, 2015). Research indicates visuals aid in information retention (Gangwer, 2005) and vocabulary learning (Jones, 2010). The use of images helps make ideas more concrete for students. This article addresses the use of new visualization technologies for classroom literacy instruction that extend from the use of visual aids to *represent* a concept to visual aids that *show* students a concept. Today, visualization technologies include anything from still images, infographics, and 3D printing, to virtual reality tools and more (New Media Consortium, 2016). These tools enable teachers to expand on the notion of a single image to convey meaning to include virtual reality (VR) tools to provide "field trip" experiences without the travel. In this way, VR can be utilized as a tool for experiential learning (Dewey, 1938), as it reflects active construction of an environment. Through the use of technology tools such Google Street view and 3D glasses, like Google Cardboard, teachers can provide students with in-depth knowledge of the people, places, and ideas they intend to teach.

VIRTUAL REALITY AS A LITERACY SCAFFOLD

PRIOR KNOWLEDGE

Reading teachers understand that the prior knowledge students have about a topic impacts their understanding of text as they read. For example, students who have been to a beach and who are

reading text about the beach may better grasp the information than students who have never been to a beach.Evidence of the importance of prior knowledge in reading comprehension is well-documented (Richardson, Morgan, Fleener, 2012; Sousa, 2005; Verkoeijen, Rikers, & Schmidt, 2005; Marzano, 2004). Students with considerable prior knowledge of a subject can use strategies to problem solve more effectively than those with little prior knowledge, can focus on what is important in a learning task, and can ask relevant questions about a topic. However, those with inadequate prior knowledge often lack the ability to distinguish between relevant and irrelevant material. Schema theory and cognitive science support this premise through the science of how the brain structures knowledge. Piaget (1928) emphasized that learning new information depends on relating the new to something already known to students, as they draw on a schema, or mental blueprint, of the way in which reality is constructed. A classroom teacher may apply knowledge of this theory by designing lessons which build prior knowledge in order to help students make sense of new material (Sousa, 2005). Prior to having students read about the beach, an urban city teacher may show images or video clips of the beach and ocean to the class. This small bit of scaffolding may help students understand how waves roll onto the beach and how the ocean is a vast body of water. This classroom practice is not a new one—the use of images/visuals is common across all grades and disciplines. Teachers also use visuals to teach vocabulary. A picture describing *camouflage* is much easier for a student to understand than a definition of the word camouflage. Prior knowledge plays an important role in the comprehension of information, and the teacher's role in building prior knowledge is important.

Experiential Learning

VR tools enable teachers to provide more than prior knowledge about content. With VR tools, teachers can provide opportunities for students to engage with environments. This instructional strategy reflects experiential learning (Dewey, 1938). John Dewey (1938) promoted the benefits of experiential learning, explaining, "there is an intimate and necessary relation between the processes of actual experience and education" (p. 7). He asserted that experiential learning enables students to develop their own opinions of a concept based on interaction with the information. In addition, he suggested that each experience is individualized, based on past experiences. When classroom learning provides individual opportunities for experiences and reflection, varying viewpoints are supported.

Motivation

Students lacking prior knowledge may lack the motivation to learn about a topic (Richardson, Morgan, Fleener, 2012). "If learners cannot find relevance in a selection, they are likely to ignore it. Thus, teachers must become aware of their students' knowledge about and experiences with a particular topic in order to build on that knowledge" (p. 58). Visuals appeal to learners and may provide teachers with a means of motivating students. With today's technologies, we can expand on the power of visuals to include experiential learning using VR applications to promote understanding and to scaffold prior knowledge. Technology tools continue to enhance the ways teachers promote understanding of new concepts. In addition to still images, teachers use videos to demonstrate concepts. Prior to a unit on volcanos, a teacher may show students a video of a

volcano eruption and flowing lava. Not only do these videos provide visuals of the event, student enjoy watching them (Corporation for Public Broadcasting, 2004). Imagine the potential impact of an activity that enables a student to view the volcano as if they were standing in the middle of flowing lava. With new virtual reality (VR) technologies, this experience is becoming possible. VR tools enable users to experience places as if they were there. The purpose of this article is to share VR technology tools teachers may consider for use in the classroom to promote prior knowledge and experiential leaning of a topic.

Virtual Reality

Virtual reality refers to "computer-generated environments that simulate the physical presence of people and/or objects and realistic sensory experiences" (NMC, 2016, p. 42). It utilizes interactive 3D images which users can experience with a mouse and a keyboard or with headsets designed to immerse the user in a virtual environment. In addition, some recent applications enable users to "feel" and interact with objects through force feedback (NMC, 2016). So far, the most common applications for VR tools have been for military training and gaming environments (NMC, 2016). The lifelike simulations provide authentic experiences for these users. Alternative applications for this powerful tool are now being considered in other fields, including education. On an educational level, viewing and experiencing lifelike simulations complements classroom instruction in many ways. For the classroom teacher, the ability to share experiences relevant to an object or place may provide background knowledge necessary for a student to gain understanding of content or text. A teacher introducing text about the Egyptian pyramids may actually provide an opportunity for students to tour a pyramid using VR tools.

Data on the use of VR tools in K-12 education have yet to be gathered. However, companies like zSpace, Alchemy VR, and Immersive VR Education dedicate resources to providing schools with educational VR material (Reede & Bailiff, 2016). Examples of instruction with VR tools include recreations of historic or natural sites students can observe and explore. In September 2015, Google launched its Google Expeditions Pioneer Program (https://www.google.com/edu/expeditions/) which enabled schools to pilot kits which contained tools for virtual trips to places like the Great Wall of China, Mars, and more. In addition, students can experience the settings of various professions in order to learn about careers (Mak, 2016a). Google Expeditions, available at no cost to schools, provided visits to schools around the world along with materials needed to run VR expeditions for the day (Mak, 2016a). The materials required for the VR "tours" included cellphones and Google Cardboard. The Cardboard/ViewMaster devices resemble goggles—these devices/headsets, attached to the smartphone, become a VR headset that when used by students, enables them to experience far-away places as if they were actually at the site. The program also includes training for teachers in order to help them lead virtual trips for their classrooms (Mak, 2016a). Teachers may submit an interest form to determine if the program is available in their area (https://docs.google.com/forms/d/e/1FAIpQLSe5VCmte_zHm9y0gY_lAMFhs4hOBfs-PxLUXkJPosA2k71jow/viewform?pli=1). The outcome of the virtual fieldtrips has been positive, as teachers observed students' excitement as they "traveled" to remote locations such as the moon or

Mars. The realistic experiences helped "build a deeper understanding of the remote places we visited" (Mak, 2016, para.6).

The virtual experiences offered by Google Expeditions may be provided by any teacher with insight into how to gain access to the simulated experiences. According to NMC (2016), Google headsets start at around ten dollars and VR units range from $300-$999. This cost is deceiving, though. Teachers would not have to spend hundreds of dollars to create a virtual fieldtrip for their students. The experience may be produced with a mobile phone and a Google Cardboard headset. How does it work? A VR tour, or trip, requires 360º viewing so that the individual wearing the headsets can look around the scene they are viewing. The user can peer to the left or the right, they can look up or down, or they can walk closer to an object. This type of viewing experience has become fairly inexpensive (free) to provide for a classroom. There are multiple means of accessing VR content. One way is to use interactive resources available on various websites. YouTube VR video is a good example of a site (https://www.youtube.com/playlist?list=PLU8wpH_LfhmtKoee0Uv90nmscm5iezRoW) to use with Google Cardboard (the least expensive headset). The link is compatible with Google Cardboard and enables a user to view videos and pictures of 360º VR content over the Internet. The ability to view the videos and pictures is built into the website programming. Sample content available on this website includes adventures such as an underwater tour, where the viewer explores the oceans among Great White Sharks, and a pyramid tour, where the viewer can look around the inside of an Egyptian pyramid while listening to a narrator explain the hieroglyphs.

Another way to view VR content is to use Applications available from the Apple Store or Google Shop. Free apps, such as the InCell VR app (http://incell.nivalvr.com/) available in IOS and Android versions, can be downloaded to a handheld device and used with VR goggles. This particular app includes videos where the viewer explores the human body through life-like and simulated (computer generated) scenarios. For example, the viewer can take a virtual tour inside a cell in the human body as it fights a viral attack. This simulation provides information about cell function. The visuals provide knowledge a learner may not understand without this virtual demonstration. Table 1 presents several additional websites and apps for VR applications.

Teachers with moderate technology skills can create experiences for their students using basic apps available on mobile devices. Applications like Google Street View (https://www.google.com/streetview), a free website/app designed for 3d and 360º viewing and picture taking, are available on the Apple App store and Google Store for Android devices. Most of the available websites and applications for 360º viewing have a built-in capability to connect with VR devices (the headset). Using the apps, teachers or their students create their own 360º images. After the 360º image has been created, the teacher can activate it on the mobile device. The user can then select from options, which include the ability to view the scene/image using a phone or computer or insert the device into a virtual reality headset. The Google Cardboard application is one of many devices designed for use with 360º images. Other devices include the 360º Photo Playercam, which can be used to view personal 360º pictures, and 360º Photo Player, which allows both personal pictures and video viewing.

Table 1
Virtual Reality Resources

VR Website/App	Website/App address	Description
SamRohn 360 VR Panoramic Photography and Virtual Tours	http://www.samrohn.com/	Provides virtual tours of factories, museums, city buildings and public spaces mainly in the New York area.
Blakeway Gigapixel	http://blakewaygigapixel.com/	Provides ultra-high resolution 360º views for sporting venues, parks, and monuments. These shots are mainly designed for 360º computer applications but can be adapted to Google Glass/VR.
AirPano Arial Panoramaand 360 World Tours	http://www.airpano.com/	Provides visuals of locations around the world that can be viewed on a computer. At this time, VR on headsets is not supported, but adaptations can be made to use VR devices like Google Glass
World Tour 360	http://www.worldtour360.com/	Provides views from around the world. Most of these are aerial views of cities and currently do not support VR devices. They can be used on Computers and electronic notepads.
World in 360	http://worldin360.com/	Provides views from around the world.
YouTube	http://youtube.com/	Provides videos for classroom and virtual reality experiences for Google Cardboard. Because this includes video, a fast processor is required.

Sites in 3D Virtual Tours	http://www.3dmekanlar.com	Provides views of locations and cultural centers in Europe and Western Asia. Can be used with Google Cardboard.
You Visit 360	https://www.youvisit.com/	Provides videos and pictures from sites around the world, including cultural events, industries, vacation spots and much more. This site also offers college campus tours in 360º.
Vatican	http://www.vatican.va/	Provides tours and information about the Vatican in Rome. Students can enter each room with High Definition pictures. Only available for 360 views (not Google Cardboard).
Kid World Citizen	http://kidworldcitizen.org	Provides tours and views of sites around the world specifically designed to introduce children to other parts of the world and cultures.
Google Expeditions	https://www.google.com/edu/expeditions/	Provides tours of museums, urban landscapes, fieldtrip experiences, and much more.
Google Streets	https://www.google.com/streetview/	Provides 360º views of many sites around the world. The application also allows users to take and share their own 360º pictures.
InCell VR	http://incell.nivalvr.com/	Takes students with a tutorial tour of a cell inside the body.

As seen in Table 1, Google is a widely used medium for VR tools. Google has made their Cardboard device an open source so other manufacturers can mass produce headsets at low prices. In addition, teachers can make their own headsets for use in classroom activities. Google has provided instructions for making Cardboard viewing devices. These instructions can be found at the

following website: https://vr.google.com/cardboard/get-cardboard/index.html. Teachers and students can have a lot of fun viewing and creating VR experiences. However, like everything else in the world of technology, inappropriate material may cause safety concerns if the product is not monitored. As an instruction tool, VR fieldtrips have the potential to improve not only literacy instruction, but instruction across all grade levels and disciplines.

SUMMARY

With more VR apps appearing every day, "it's likely that immersive VR expeditions will eventually become an engaging way for students to explore everything from historical landmarks and distant planets to oceanic locations and even the human body" (Mak, 2016, para 1). For the reading-language arts teacher, VR tools may provide a way to support students through visual and experiential scaffolding, as Google Cardboard helps build background knowledge about content. Research indicates that what students already know about the content being learned reflects one of the strongest indicators of how well they will learn new information related to the content (Marzano, 2004). Commonly, researchers and theorists refer to what a person already knows about a topic as "background knowledge," which means the learner stores information about a topic in their schema, which can be retrieved as new information is encountered. VR tools such as those presented in this article have the potential to enhance classroom instruction by providing prior knowledge and motivating students through authentic and engaging experiences. "VR engages students in a fun and exciting way that increases retention" (NMC, 2016, p. 43).

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