Twentieth Century Virtual Reality Education Reprise: Stereographs to Google Cardboard

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Abstract. Could today's teachers use methods from over 100 years ago in their classrooms with smartphone virtual reality? This article examines the historical context of virtual reality in the classroom as early as the 1900s beginning with the stereoscope and then looks to the future with the use of smartphone virtual reality devices in the classroom similar to the Google Cardboard. In addition to this historical overview, new teachers, unfamiliar with the early stereograph use in the classroom, were asked to develop virtual reality strategies using a Google Cardboard device. In a surprising twist, the teacher-developed methods were nearly interchangeable between the 1900s and today!

Keywords: stereograph, virtual reality, visual education, Google cardboard, teaching with technology, stereo views in education; VR headsets, SAMR model

The NMC/CoSN Horizon Report: 2017 K-12 Edition states, "Virtual reality: time-to-adoption is two to three years" in schools. This statement is a bit perplexing in that the Horizon Report, as well as others, often asserts that virtual reality in the classroom is a new and upcoming trend. While it is very clear that new virtual technologies are far more advanced than before, virtual reality is really not new. The 1850 stereograph was the earliest technology to trick viewers into seeing images in the third-dimension. While it began as an entertaining pastime, it was soon applied to education in 1906. The "virtual reality" used in the 1900s was explained as having the experience of seeing an object in the round, exploring a setting as if one was there, and imagining the day-to-day life of others (Keystone View Company, 1906/1922). In addition, the Visual Instruction Movement of the time also encouraged visual learning in the schoolroom to make education authentic for all children that otherwise had no means to see or experience the real occurrence (Saettler, 1990/ 2004). The 1900 education theorists believed that virtual reality would engage learners, make experiences memorable, and deepen learning. Is this much different than today? By mid 1930s, the educational virtual reality of the turn of the century was all but forgotten for about 75 years until reimagined by Google. In 2014, a Google product developer reproduced his childhood memories of a View-Master using his smart-phone and a cardboard viewer (Mattel, Inc., 2016). This 3-D revival sparked a new interest in stereoscopic viewing and virtual reality in today's classrooms.

Since the stereograph was used in the classroom and the new smartphone virtual reality is entering schools today, it seemed likely that the two technologies could be compared. To examine the parallel that teacher methods can be recycled (despite technological advancements), current teachers were asked to develop strategies using a smartphone virtual reality device. The teachers were not aware of the 1900 methods for using the stereograph and had little knowledge about the smartphone virtual reality device, a Google Cardboard. They were asked to experiment and devise a strategy as well to pilot their idea with a student from their class. This article shares some

of the strategies teachers developed and their reflections of these strategies. Surprisingly, many of the strategies the teachers developed using Google Cardboard were very comparable to strategies used at the turn of the century with the 1900-stereograph. The surprising similarities of strategies and reflections suggest that 100 year old virtual reality teaching methods, when applied to the future, may still actually work!

Virtual Visual Instruction through the Ages

Nearly every virtual reality media regardless of its format was born into the arms of the entertainment industry to produce amusement and enjoyment for affluent customers looking for a trendy pastime. Consistent with many trendy amusement innovations, these technologies sometimes land in education to enhance motivation and learning. The first technology that attempted to reproduce life-like, three dimensional experiences was that of the stereoscopic device invented in the 1850s. The Victorians enjoyed entertaining their guests with these stereoscopic images of exotic lands, unfamiliar sites, and staged poses (Goldsborough, 2007). The concept of stereoscopy was that of Sir Charles Wheatstone, an English scientist and inventor, in which he demonstrated how the mind sees three dimensions through each eye seeing a slightly different view (Wing, 1996).

Sir Charles Wheatstone developed a box-type English stereoscope viewer that was later patented by M. Jules Duboscq and Sir Davd Brewster in 1856 (Wing, 1996). Eight to nine years after Wheatstone's design of a stereo-scope, Dr. Oliver Wendell Holmes, an American physician, poet, and essayist, became fascinated by the stereo view "mania." He designed an inexpensive hand-held viewer that would later become affordable to the general working class around the 1890s (Darrah, 1977). Holmes improved on the earlier styles by making his stereoscopes adjustable for different head sizes and making them very portable. By the turn of the century, many American households enjoyed the less-expensive stereoscopes and images produced by companies such as Underwood & Underwood, H.C. White, and the Keystone View Company (Wing, 1996).

Stereographs in Education

It was the design of Holmes' stereoscope and the advancements in photography that opened the door for stereoscopy to enter the classroom (Wing, 1996). After several improvements by other stereographers, a sturdy stereoscope emerged that would later serve schools along with the thousands of images provided by the three competing companies (see Figure 1). The Underwood & Underwood Company was the first to directly market instructional stereo views and scopes to the classroom (Wing, 1996). In 1892, a former Underwood and Underwood salesman, B. L. Singley, founded the Keystone View Company that led the charge throughout the early 1900s for school use (Darrah, 1977).

Figure 1. Schoolroom stereoscope with Keystone View Company stereographs. Keystone View Company, Meadville, PA. c. 1906.

The Keystone View Company established an “education department” around 1906 with the release of a teacher’s manual to accompany the Keystone’s *600 Set* and to support the use of stereoscopy in the classroom. The Keystone’s *“600 Set* was a collection of stereographs selected to offer a variety of images that every student should study (Darrah, 1997). The “*600 Set”* images consisted of 600 stereographs of wildlife and agriculture, natural and man-made scenes, industries around the world, cultural lifestyles, etc. Well-known school advocates of the time were asked to contribute to the manual entitled *Visual Education: Teachers’ Guide to the Keystone 600 Set (Saettler, 1990/2004)*. The three prominent contributors were Charles W. Elliot, William C. Bagley, and Frank M. McMurry. The manual includes William C. Bagley’s essay titled, “Concreteness of Edu-cation,” which sums up the use of stereographs as a superior method for teaching the authentic experience in a classroom (Keystone View Company, 1906/1922, p. x). He believed that actual experiences are impractical and if possible, become very uncontrolled. The theory suggests that stereographs would narrow the scope of learning to only the essential three-dimensional experience that is needed for learning. Bagley explained that students could interact directly with an actual “concrete” experience by viewing a stereograph under the direction of the teacher. The final essay by Frank McMurry touts the value of virtual experiences as a method to increase interest, improve student engagement, offer students experiences otherwise not possible, and to support creative thinking. The remaining sections of the manual index the “600 set” and suggest methods for stereo views use in instruction by creating scenes and settings for stories, providing advanced organization for an upcoming lesson, participating in seat work and group work, visualizing historical problems, increasing vocabulary, and improving express-ion in written and oral modes. Some actual 1906/1922 methods from the *Visual Education Teachers’ Guide to the Keystone “600 Set*” (Keystone View Company) are listed below:

> *One or two rows passing:* A signal is given, and scopes are passed every 20-90 seconds until the whole class observes the image group.
>
> *Double desk study*: One student views the other student reads the description printed on the back of the card.
> *Dramatization:* Students act out the scene or an event that is or could occur with the image.
>
> *Written expression:* Students write their emotions when looking at the image, empathizing with characters, or sharing perspectives.
>
> *Study hour:* Students use the images to gather information that will be tested.
>
> *Home study*: Students take the stereoscope and images home to extend the lesson from the classroom. (Keystone View Company, 1906/1922)

In addition to the Keystone View Company’s teacher resources, the teacher preparation in visual instruction was also on the rise in the United States. Several teacher’s normal schools used textbooks that included the use of stereo-graphs and how to better use the technology to have strong lesson achievement (Saettler, 1990/2004). One of the most popular visual education textbooks was *Visual Instruction in the Public Schools* written by Anna Verona Dorris in 1928. This textbook devotes a section to stereographs and provides both positives and negatives of the classroom device.

Dorris (1928) clearly cautions teachers on poor and overuse of stereographs. She states that free viewing or multiple brief observations are not appropriate methods for stereograph use. She asserts that every teacher using stereo views in instruction should plan and allow deep

reflection, Figure 2. She recommends that every image should have accompanying quest-ions or pedagogy that will require deeper processing of visual cues and information. For instance, primary students should describe what he or she sees, and the class can write what the child recites. She also suggests that a child can write on the board what he or she observed, and the class can correct grammar, spelling, or handwriting. Last, she recommends that any vocabulary associated with the image should be introduced, thus the child will have a greater memory of the words.

Figure 2. Girls in classroom viewing stereographs through stereoscopes. Reprinted from *Underwood and Underwood Company*, Arlington, NJ, number 112985, c. 1908. Copyrighted Underwood and Underwood Company.

The stereograph remained popular until about the mid-1930s when school consolidation reduced the need to supply individual sets to schoolrooms. Sets during this time were given to libraries and soon were used less and less. In addition, the advancement of automobile and other means of transportation and travel reduced the desire to view images that could be seen easily. Last, filmstrips and emerging motion pictures technologies were entering the classrooms making large group visual instruction easier for the consolidated and large classrooms. The Keystone View Company remained as the last stereograph supplier as late as the 1960s but halted its production for education in 1939 (Darrah, 1977). The virtual qualities of stereoscopy seemed to completely vanish from the classroom in the 1940s.

The View-Master: A Modern Stereoscope

After the stereograph's popularity began to diminish, the debut of a sleeker hand-held View-Master stereoscopic device occurred in 1939 with the hopes that it would replace the stereograph market in entertainment and education (see Figure 3). The View-Master's design was dev-eloped to be an improvement on the single, black and white, and image view-ing of the stereograph. William Gruber and Harold Graves believed the device could position well in educational and tourists' markets. William Gruber was an avid stereoscopic photographer who happened to meet the president of the Sawyer postcard company, Harold Graves in 1938 (Clatworthy, 2016). The

Figure 3. Sawyer's View-Master and image reel. *Sawyer's Inc.* Portland, OR, c.1951.

two combined their ideas to invent the View-Master device to enable multiple stereoscopic images (seven images) to be controlled by one viewer without single image exchanging. In addition to this advancement in image handling, the View-Master imagery capitalized on the Kodiak's new color transparency film, Kodachrome (Wald-smith,1991). This resulted in colorful images that made the device attractive.

In 1940s, the US Military capitalized on the training value of the View-Master devices and commissioned sets of reels (over one million) to assist in training pilots and anti-aircraft/ships' specialists in artillery and aircraft identification (Clatworthy, 2016). The US Military purchased thousands of viewers and then had commissioned companies to make World War II artillery and aircraft models to be photographed for self-study and testing reels (Miller, 2010).

Even though the View-Master was initially positioned to be educational and had significant US military use in the 1940s, the entertainment value of the device shifted the product to be-come more of a children's toy before it ever took hold in the classroom. By the mid-1950s, the Sawyer Company purchased a rival competitor with licenses to Walt Disney Studios and anima-ted titles resulting in many entertainment image reels of Disney productions (Clatworthy, 2016). As a result of this merger, the View-Master fixed its place in the toy market and its educational value was further dismissed. Since the 1980s, the View-Master series changed ownership several times landing it today as a Mattel, Inc. toy that is marketed by Fisher-Price (Miller, 2010). Much of the image and story content is for children or sold as tourist's souvenirs. The View-Master continues to be sold today as a vintage toy.

Google Cardboard: Smartphone Virtual Reality

Since the emergence of the View-Master device, little has been done to modernize the handheld three-dimensional stereoscopic viewer over the past 30 years until Mattel, Inc. and Google partnered in 2015. While expensive headset virtual reality was slowly developing in laboratories and universities, a low-cost version of virtual reality was needed to save the technology for the average consumer (Mattel, 2016). One year prior to the Mattel and Google partnership, a prototype of the Google Cardboard shown in Figure 6 was exhibited at the Google's annual developer conference in San Francisco. The prototype used the visual, auditory, and haptic features of the smartphone serve as the media in which would deliver stereoscopic experiences when viewed by the headset. David Coz, a Google employee in Paris, France, developed the prototype (Metz, 2015) reflecting on memories of the View-Master images (Mattel, Inc., 2015). David Coz worked with a team of virtual reality specialists and a colleague, Daimian Henry, to refine the handheld cardboard device and accompanying applications for a smartphone. Once this device was distributed, the low-cost viewer construction, open software, and uses for the device began to gain popularity. Like many of the early stereoscopic viewers, Google marketed the device for entertainment. In a similar manner, it was quickly modified into education.

Figure 4. Google Cardboard smartphone virtual reality viewer. Reprinted from Google Inc., December 28, 2017, Retrieved from https://store.google.com/ product/google_ cardboard/ (Google and the Google logo are registered trademarks of Google Inc., used with permission).

Since the smartphone virtual reality introduction in 2014, educators have been becoming more interested in its use due to its multimedia elements, benefits to student motivation, and it affordability for schools. Even though virtual reality training and teaching methods are still in infancy, methods on best practices are appearing more and more on teacher resource web-sites and in workshops. Again, similar to the earlier virtual reality devices, teacher adoption is crucial for its success and long-term use.

Classroom Virtual Reality. Much of the research and pedagogical support presented by the Keystone View Company in the early 1900s in favor of using stereographs in education remain true for the use of smartphone virtual reality experiences. The research supporting virtual reality in today's classroom, which consequently are some of the same benefits also mentioned in the 1906/1922 Keystone View Company manual for teachers, include in-creased student interest in the content, improved student engagement, giving students experiences otherwise not possible, and sup-porting creative thinking. Today's support for using smartphone virtual reality experiences adds two additional areas to this list, improving student digital skills and allowing greater customization in learning (Greve, 2017).

As expected, the advancement in technology in 2014 surpasses that of the 1900s. Today's stereoscopic virtual reality classroom devices do require greater sophistication of digital skills. Students will gain digital confidence when working with virtual environments that require sophisticated manipulation (Greve, 2017). These skills are crucial for today's connected world and provide students with opportunities where they can apply their skills in a safe environment before they utilize it in the real world.

The second area that differs from the 1900s, is the growing trend of customized learning in which students can reach educational targets through the personalized selection of learning events and without the constraints of a predetermined time. Charles Schwahn and Beatrice McGarvey (2014) are the authors of the theory and further explain mass customized learning as a system in which "each learner becomes an active, engaged partner with real voice in how he or she learns and how he or she demonstrates knowledge or skill" (p. 92). Throughout Schwahn and McGarvey's work, technology tools such as virtual reality are suggested for improving customized experiences. Specific classroom virtual reality applications assist in this new trend by permitting students to use the device to further explore concepts based on their own investigations and interests. The smartphone's gyroscope sensor (a sensor which is used to maintain and control the position, level or orientation of the device) takes the simple stereoscopic image into the 21st century by allowing user manipulation. The smartphone gyroscope uses viewer movement, direction, and sensations to provide 360-degree perspectives when placed into the virtual reality headset (Holly, 2015). These multimedia experiences involve learners' different senses; therefore, the device increases engagement.

Using Smartphone Virtual Reality in the Classroom Today

Theoretical and Pedagogical Implications and Framework. The following comparative study examines how current teachers suggest using smartphone virtual reality in the classroom compared to those of the 1906/1922 Keystone View Company's suggested methods. The SAMR (Substitution-Augmentation-Modification-Redefinition) model is a popular taxonomy that examines the growth of using technology in the classroom (see Figure 5). This comparative study is theoretically based on the premises suggested by Dr. Ruben Puentedura in 2013. Puentedura developed the SAMR taxonomy to help teachers think deeply about applying new technology. In addition to determining the depth of technology use, this framework sets a context in which the methods from 2016 and 1920 can be aligned even though the teachers responding to this study had no knowledge of the earlier stereo view methods. The model has four levels in which technology is intergraded. "S" represents the substitution level which is the most rudimentary in that the technology substitutes a system already in use. In other words, a new technology merely

replaces a tool with little substantial improvement. One of the current teacher's strategies suggested in this study is at the "S" level. In this comparison and unbeknown to the current teacher, the smartphone virtual reality device is directly substituting the stereograph of the early twentieth century. However, most of the strategies suggested by the current teachers incorporated the enhanced smartphone haptic experiences in addition to three-dimensional visuals which would classify them at the next level.

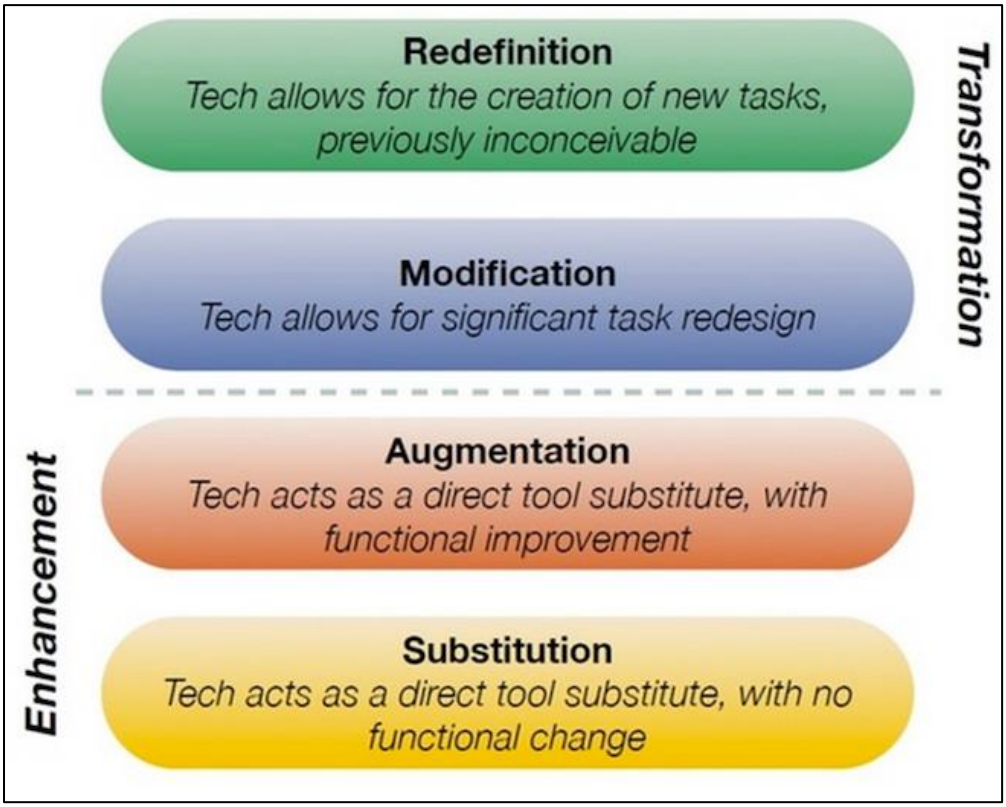

Figure 5. Puentedura, R. (2013). The SAMR Model. Reprinted from Hippasus, Inc., April 20, 2018, Retrieved from http://hippasus.com/rrpweblog. Creative Commons Attribution 2.0 Generic License.

The next level of the SAMR model is the "A" referring to technology that is augmented or improved from an earlier use. This level could be suggested as a base for the new smartphone virtual reality technologies' use in today's classroom over the earlier use in the 1900s. One of the suggested strategies below is at the augmented level on the taxonomy. However, the teacher proposing this strategy was not currently using the earlier devices so this would not be entirely an augmentation of an "in use" tool as defined by Puentedura (2013). Yet once the 1920s strategy was matched to the 2016 use, it would appear as a new technology augmentation of an earlier stereo view device with many improvements.

The third level of the SAMR model is "M" for modification. This level is considered transformative whereas the earlier levels were enhancements. Using technology at the M level suggests that a learning task is redesigned and offering a greater experience (Puentedura, 2013). Two of the strategies developed by the teachers in this study transformed learning with the smartphone virtual reality applications. The teachers using the smartphone virtual reality device were able to expand the classroom walls to have students investigate other locations and objects for deeper

learning. This level also occurred in the 1900s as students learning was enhanced by the stereographs. In the two strategies below, the students were asked to modify their learning to have greater understanding and concept achievement.

The final level of the SAMR model is "R" for redefinition. There is little evidence that students in the 1900s would create and use their own stereographs. The ability to develop film or own stereoscopic cameras was not a possibility for a teacher in the 1900s. However, today's teachers have access to camera functions and applications that would enable students to create their own smartphone virtual reality images and media. As a possible benefit to this comparison, teachers now exposed to smartphone virtual reality could begin creating their own content with students.

The comparison study included eight current in-service teachers with approximately two to six years of experience selected from kindergarten to twelfth grade who were asked to explore the use of the Google Cardboard in their classrooms and to devise a strategy for others to use. Each teacher was provided a Google Cardboard and a list of example smartphone applications. The design of the study was to allow the teachers to explore on their own the device and how they would use it in their classroom. Eight teachers provided suggested strategies and were asked to pilot their ideas with students. Since several of the strategies were similar, four were selected to be listed as a sampling based on the SAMR model taxonomy. Below are the four strategies aligned to current Pennsylvania Academic Standards, PA Core Standards, and various levels of instruction. It is important to restate that prior to the development of their strategies, teachers had no know-ledge of the Keystone View Company, its teacher's manual, or how stereographs were once used in education. Each 2016 description is followed by the comparable exercise that would have occurred in the 1920 classroom based on the 1906/1922 instructional manuals of the Keystone View Company and the work of Anna Verona Dorris in 1928. The *SAMR* level is also indicated for each pairing.

Teacher A: Third Grade Teacher.

Title: Animals and their Habitats

Ages: 8-9 years old

PA Academic Standard: 3.1.3.A2 Describe the basic needs of living things and their dependence on light, food, air, water, and shelter.

VR Smartphone Application: Animals and Their Habitats

2016 Description: Each student is assigned a different zoo animal. After viewing the habitat of their animal using the application with the Google Cardboard, the student will give a brief presentation and/or demonstration of the physical characteristics that help this animal survive.

1920 Description: Each student is assigned a stereograph with a different animal in its habitat. The student will describe to the class what the animal is doing in the image and why.

SAMR Level: **Substitution**

Teacher B: Seventh Grade Social Studies Teacher.

Title: Exploring Stonehenge (see Figure 6)

Ages: 12-13 years old

PA Academic Standard: 7.2.7.A Explain the characteristics of places and regions.

VR Smartphone Application: Google Expeditions

2016 Description: This is a partner activity. Student A and Student B will be given a list of previous learned vocabulary terms. Student A uses the Google Cardboard device to navigate the application and locate the items from the list of vocabulary terms. As Student A locates them, they should describe them aloud to their partner, Student B. If Student B agrees that the description is accurate, then Student B checks that vocabulary term off of the list. Student A will complete the activity once they find and describe all of the vocabulary terms. Once Student A has completed the activity, Student A and Student B switch roles.

Figure 6. Stonehenge, Wiltshire, England. Reprinted from *Google Expeditions*, December 28, 2017, Retrieved from https://edu.google.com/ expeditions/ (Google and the Google logo are registered trademarks of Google Inc., used with permission).

1920 Description: While seated in a double desk, two students turn toward each other. Student A views the image of Stonehenge (see Figure 7). Student B reads the description on the back of the stereograph to Student A who seeks to find the vocabulary in the image. Once complete, Student A and Student B switch roles.

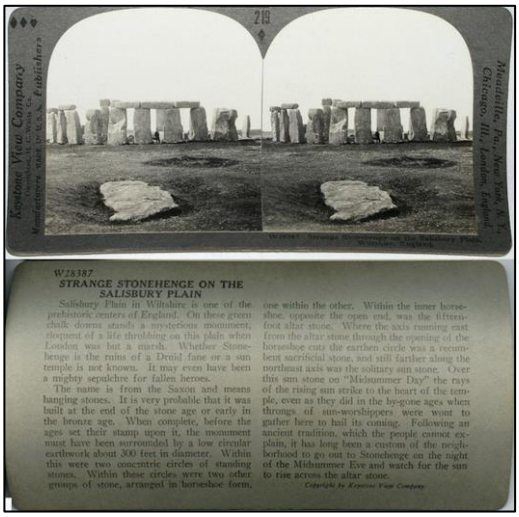

Figure 7. Strange Stonehenge on the Salisbury Plain. Reprinted from *Keystone View Company,* Meadville, PA, number W28387, c. 1901. Copyrighted H. C. White Company.

SAMR Level: **Augmentation**

Teacher C: Tenth Grade Art Teacher.

Title: Differentiate the Characteristics of Neoclassical Architecture

Ages: 17-16 years old

PA Academic Standard: 8.5.11-12.G Integrate and evaluate multiple sources of information presented in diverse formats and media. (e.g., visually, quantitatively, as well as in words)

VR Smartphone Application: Google Street View

2016 Description: Students are given a list of famous examples of neoclassical architecture that can be viewed on Google Street View. Students are expected to explore the various building examples and then identify and explain what they believe to be the basic themes and characteristics of neoclassical architecture.

1920 Description: Carefully view the three given stereographs with examples of baroque, neoclassical and Victorian architectures. Using proper penmanship, write the characteristics of each.

***SAMR Level:* Modification**

Teacher D: Twelfth Grade English teacher.

Title: Descriptive Writing

Ages: 17-18 years old

PA Academic Standard: 1.4.11-12.E Write with an awareness of the stylistic aspects of composition.

VR Smartphone Application: Urban Hike

2016 Description: Students will find and write a descriptive narrative of a cultural site using appropriate vocabulary including the perspectives of the residents or spectators using the Google Cardboard demonstration application “Urban Hike” (see Figure 8).

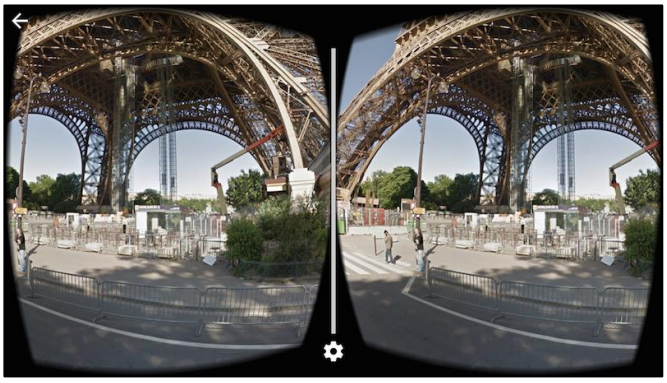

Figure 7. Avenue Gustave Eiffel, Paris, France. Reprinted from *Urban Hike*, December 28, 2017, Retrieved from https://vr.google.com/ cardboard/ (Google and the Google logo are registered trademarks of Google Inc., used with permission).

1920 Description (Figure 9): Students will recreate a scene that could occur at the site shown on a stereo view. In small groups, students will write a scripted dramatization with emotion using the back description found on the stereograph and act out the scene to the class.

***SAMR Level*: Modification**

Figure 8. Looking Under the Great Eiffel Tower. Reprinted from *Underwood and Underwood Company,* Arlington, NJ, c. 1900. Copyrighted Underwood and Underwood Company.

As mentioned above, the four teachers asked to provide the strategies had no know-ledge of the 1900 methods. The parallels be-tween the strategies are very interesting and demonstrate that while the technology tool has changed the pedagogy has not.

The teachers were also asked to pilot their strategy with a student. The teachers reported interesting observations.

> *Teacher A states, "I would definitely use VR in the classroom, but as I found in this trial, students require multiple experiences to "try." In my own experiences, I lost track of what I was doing in the novelty of using the VR. I think multiple VR devices are required for a successful classroom experience due to the number of students in a class. I could predict everyone wanting to partake in this experience, and for longer VR experiences it would take a large amount of instructional time."*

Dorris (1928) cautioned teachers in the 1900s of how students could be easily distracted with the stereoscope and the images. Teacher A alludes to this same dilemma when using the Google Cardboard. Teacher A agrees with Dorris in 1928 that instructional time is important to use the technology correctly.

> *Teacher B states, "I could really see using this device to expose students to places that we cannot physically travel with them. Rather than looking at pictures or videos, let the students explore these locations. I think that they would be more engaged, and the activity would be more memorable."*

Teacher B agrees with the same thoughts of the essayists in the 1906 Keystone View teacher's manual. It seems that the benefit of travel with-out leaving the classroom was desired then and now. It also confirms that traditional pictures are not as beneficial in comparison to the virtual reality experiences. This was another point discussed in 1906.

> *Teacher C states, "I thought the Google Cardboard device was a great way to engage students in a history or science related topic. Students could "visit" famous places or*

> *museums rather than just looking at a picture in a book. However, I was not very successful in finding an App in another subject area that I really liked."*

In the early teaching documents for using stereographs, it seemed that most of the lesson examples were related to commerce, geography, and history (Dorris, 1928 and Keystone View Company, 1906/1922). Teacher C points out that the applications for the Google Card-board seemed to be most centered on humanities and science and not on math or languages. This suggests that content areas that benefit the most from virtual reality maybe be those of social or science nature taught in the 1900s and today.

> *Teacher D states, "The content was not overshadowed by the technology in this case. Yes, the students were excited to try something new, but they were on task the entire time. This was extremely meaningful to them, and they voiced this to me."*

This reflection suggests that given the correct setting, the Google Cardboard can be helpful and can support or augment the use of other tools or strategies in the classroom. Dorris (1928) asserts that multiple visual instructional methods should be used over just one. In addition, Teacher D indicates that his/her students were actively engaged and motivated. This is one of the benefits emphasized in the support documents for using stereographs in the classroom made by the Keystone View Company in 1906.

The above strategies and reflections further confirm that virtual reality is not a new teaching technology and carries with it the same challenges and benefits. While it has advanced since the 1900s, its theoretical foundations have seemed to remain the same. The *2017 NMC/ coSN Horizon Report: K-12 Edition* reports that virtual reality of the low-cost nature (Google Cardboard, etc.) is a currently a 13.9 million dollar industry. Despite this large market, the report indicates that in 2017 one-half of educational institutions are experimenting with virtual reality but only one quarter are actually using it. The report also suggests the adoption time to be two to three years from today given the need to train teachers and diffuse the devices to the classrooms. The report predicts that by 2025 over 15 million learners will have used virtual reality in the classroom. Based on these pre-dictions, it seems likely that virtual reality will enter back into the classroom and the benefits once again maybe used in education.

Conclusion

At the turn of the century Victorians enjoyed the use of stereographs for entertainment. The amusement of three-dimensional images enthused viewers for hours. The images were of sights never seen by many and the fascination of foreign worlds seemed to dominate much of the content. It was not long until this entertainment was repurposed for education. By the 1920s, the stereoscope and "educational" stereographs became popular in many class-rooms to help teach topics of geography, culture, commerce, and history. The Visual Instruction Movement was also taking hold in American teacher education, thus, maintaining the sustained use of visuals in 20th century teacher pedagogy.

Upon the introduction of films and motion pictures, the fascination with static images seemed to drop in popularity. Larger console-dated schools of the 1940s put resources toward motion pictures and films in order to teach the growing class sizes. For the next 75 years, three-dimensional, stereoscopic imagery was rare in the classroom regardless of the efforts to save the market by the Sawyer's View-Master Company. After several years, the View-Master found its place in the toy market and was regarded as a child's entertainment as opposed to an educational resource. Nevertheless, it was View-Master's childhood memories that influenced a Google team of developers to create a new virtual reality device. In 2014, Google pioneered the smartphone virtual reality viewer as a new product, Google Cardboard. This viewer uses a lens similar to that

of the stereo-scope and the viewer-controlled media similar to that of the View-Master. Combined with an open market of application developers, Google was successful in building a popular device trend that is used in entertainment (like its predecessors) but also, in education.

As was the case in the past, today's teachers are encouraged to embrace new technologies in the classroom. When several teachers were asked to experiment with the Google Cardboard viewer their responses were interestingly similar to those that occurred in the 1900s with the stereoscope. Teachers, unfamiliar with early visual stereoscopic education, devised strategies to use the smartphone virtual reality for teaching. These strategies and react-ions to its use provided interesting parallels into our teaching past. Today's teachers desire to make learning memorable, expose students to places they have never gone, and encourage deeper understanding the same as they did in the 1900s. The use of virtual reality in the class-room then and now seems to be invaluable to teaching.

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