Assessing Google Cardboard virtual reality as a content delivery system in business classrooms

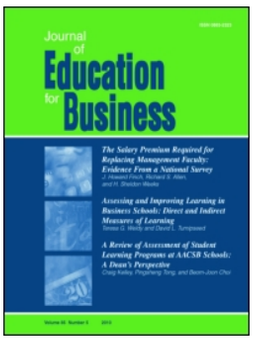
Article *in* The Journal of Education for Business · April 2017

DOI: 10.1080/08832323.2017.1308308

4 authors, including:

Ksenia Sergueeva
Drexel University
15 PUBLICATIONS **109** CITATIONS
SEE PROFILE

Maria Kandaurova
Ryerson University
5 PUBLICATIONS **49** CITATIONS
SEE PROFILE



Journal of Education for Business

ISSN: 0883-2323 (Print) 1940-3356 (Online) Journal homepage: http://www.tandfonline.com/loi/vjeb20

Assessing Google Cardboard virtual reality as a content delivery system in business classrooms

Seung Hwan (Mark) Lee, Ksenia Sergueeva, Mathew Catangui & Maria Kandaurova

To cite this article: Seung Hwan (Mark) Lee, Ksenia Sergueeva, Mathew Catangui & Maria Kandaurova (2017) Assessing Google Cardboard virtual reality as a content delivery system in business classrooms, Journal of Education for Business, 92:4, 153-160, DOI: 10.1080/08832323.2017.1308308

To link to this article: http://dx.doi.org/10.1080/08832323.2017.1308308

JOURNAL OF EDUCATION FOR BUSINESS
2017, VOL. 92, NO. 4, 153–160
https://doi.org/10.1080/08832323.2017.1308308

Routledge
Taylor & Francis Group

Assessing Google Cardboard virtual reality as a content delivery system in business classrooms

Seung Hwan (Mark) Lee, Ksenia Sergueeva, Mathew Catangui, and Maria Kandaurova

Ryerson University, Toronto, Ontario, Canada

ABSTRACT

In the past, researchers have explored virtual reality (VR) as an educational tool primarily for training or therapeutic purposes. In this research, the authors examine the potential for using Google Cardboard VR in business classrooms as a content delivery platform. They specifically investigate how VR (viewing a 3-dimensional, 360° video) differs from the traditional flat-screen (FS) format (viewing a 2-dimensional video [e.g., iPod (Apple, Cupertino, CA)]) as a teaching tool to deliver video-based content. The results demonstrate that participants in the VR condition (vs. the FS condition) rated their enjoyment and interest to be higher. However, the Google Cardboard VR platform was not superior to the iPod FS format in its content delivery with respect to novelty, reliability, and understandability.

KEYWORDS

360 videos; content delivery; Google Cardboard; virtual reality

Increasingly, technology is playing a larger role in education for millennials, the base of our current student community. Chelliah and Clark (2011) stated that millennials have "seen the rise of a pervasive, ever-present connectivity, and access to capture, process, send, and receive information through multiple devices (wireless handheld computer, smartphones, PDA-phone hybrids, and next generation handheld gaming devices) anytime and anywhere, like never before" (p. 277). This is because advancement in technology has allowed for delivery of complex information while simultaneously providing entertainment during the learning process (Chelliah & Clarke, 2011; Franz, 1998; Gardner, 2006).

Due to the changing nature in students' expectations and technological advancements, instructors are seeking for novel content delivery methods in their classrooms. Recently, virtual reality (VR) has been touted as the next big revolutionary technology in education (Estes, Dailey-Hebert, & Choi, 2016). Since the early 1990s, scholars have proclaimed that VR could offer unique prospects in the area of training and education (Potka, 1995; Regian & Shebilske, 1992). For example, Regian and Shebilske commented on how VR can shift the learning process to be more experiential, and thus more engaging. According to Potka, the sense of immediacy and control, gained through immersion, provides a new avenue of exploration in education. When integrating VR in business education, students can do more than learn about terms. Rather, they can experience the concepts and learn them first-hand through three-dimensional (3D) visualization.

In a recent survey, 83% of teachers have expressed their conviction that VR can improve learning outcomes with increased understanding of concepts (Bolton, 2016). Hence, as VR becomes more prominent in the education sector, we believe this is an apt time to explore the innovative potential of VR as a content delivery system in business education.

Conceptual background

Although virtual reality has been around for over 40 years (Minocha, 2015), it was not until recently that it became mainstream for consumer use. According to Mantovani (2001), "virtual environments can provide a rich, interactive, engaging educational context, supporting experiential learning" (p. 208). VR has the potential in enriching students' learning experience, while making it enjoyable for students (Pantelidis, 1995; Roussos et al., 1999; Stansfield, Shawver, Sobel, Prasad, & Tapia, 2000). VR's ability to immerse students into the educational process can lead to higher mastery and retention of new knowledge through an experientially engaging process (Youngblut, 1998). Concepts, discovered by students through VR, tend to be easily remembered and retained (C. H. Chen, Yang, Shen, & Jeng, 2007). Studies show that VR enhances telepresence (Steuer, 1992; Klein, 2003); a person can

CONTACT Seung Hwan (Mark) Lee lee.mark@ryerson.ca Ryerson University, Department of Retail Management, 350 Victoria St., Toronto, Ontario M5B 2K3, Canada.

feel physically present in a virtual environment via a communication medium (Steuer, 1992). Therefore, aside from providing more of visual and auditory cues, VR is a richer medium that generates a higher sense of presence and interactivity relative to traditional two-dimensional (2D)–based flat-screen (FS) mediums (Lui, Piccoli, & Ives, 2007).

VR allows the creation of realistic virtual environments, enabling students to immerse themselves into real situations (Guerra, Pinto, & Beato, 2015). Through VR, students can move and interact with a virtual world as they do in reality. VR has the unique ability to project abstract concepts through its 3D, 360° environments (Youngblut, 1998), which help to construct spatial relationships and visualize complex 3D dimensional situations (Kaufmann, Schmalstieg, & Wagner, 2000). For example, students can visit museums, historical heritage sites, and other tourist attractions that may otherwise not be accessible to the general public (Magnenat-Thalmann & Papagiannakis, 2005); it allows students to explore distant places and events, while being safe (Youngblut, 1998).

Based on the constructivism paradigm within the education realm (Huang, Rauch, & Liaw, 2010; Mantovani, 2001; Winn, 1993), knowledge is created and accumulated through direct experiences. Students have a better chance at grasping, retaining, and conceptualizing new knowledge via learning-by-doing situations (Bruner, 1966; Youngblut, 1998). VR, in this sense, allows students to be actively engaged in a task through immersive, first-person experience (Mantovani, 2001; Minocha, 2015). Winn believed that knowledge gets constructed through interaction provided by the virtual environment; VR's capacity to interact with objects through immersion and presence may assist students in this knowledge-building process. Further, Papert (1991) referred to the word *constructionism* to name the knowledge-construction process through physical interaction with objects. As Winn stated, VR allows both physical and sensorial interaction to occur within this realm. Given the immersive nature of VR, students can learn through situational involvement; this form of involvement has been shown to be more successful than traditional instructional methods (Brown, Collins, & Duguid, 1989). Overall, VR, when used as a learning tool, has the potential to engage students in experiential learning through its virtual environments that can be both instructive and pleasurable (Osberg, 1995).

In this research, we explore the use of tourism marketing content as the basis of our learning objective. Guttentag (2010) discussed the uses for VR within tourism and explained the possibilities of using VR as a substitute for tourism experiences. Today, many websites offer virtual tours of destinations. These sites feature 360° videos (designed for VR) in hopes of enhancing desire to learn and visit the destination in the future (Thomas & Carey, 2005). If VR technology is able to transport people to a simulated, virtual place where they experience events and take part in activities (Kilteni, Bergstrom, & Slater, 2013), then VR can be a low-risk tool that offers a safe environment for learning (Bellani, Fornasari, Chittaro, & Brambilla, 2011).

In the past, there has been scant effort in investigating the use of VR as a business education tool. To date, VR has been used more often as a treatment, therapeutic, or training tool (Bordnick, Carter, & Traylor, 2011). For example, VR has been used as a therapeutic tool for soldiers who experience posttraumatic stress disorder to confront their psychological triggers (Rizzo et al., 2010). VR has been used by pilots in the training purposes to simulate a flying experience (Desai, Desai, Ajmera, & Mehta, 2014). Further, there is evidence that VR (e.g., treadmill interfaces) has been useful for physical training (Gates, Darter, Dingwell, & Wilken, 2012). VR has also been used for operator and safety training in industrial/construction environments (Le, Pedro, & Park, 2015). VR has also been used as a behavioral treatment tool for anxiety, in particular to enhance a person's public speaking skills (Anderson, Zimand, Hodges, & Rothbaum, 2005). Finally, VR has also been applied to many educational disciplines such as astronomy (Barab, Hay, Barnett, & Keating, 2000; C. H. Chen et al., 2007), biology, (Allison, Wills, Bowman, Wineman, & Hodges, 1997; Shim et al., 2003), chemistry (Merchant et al., 2012), geography (Lisichenko, 2015; Stumpf, Douglass, & Dorn, 2008), mathematics (Kaufmann et al., 2000), and history (Maloney, 1997). Overall, studies have shown that VR is instrumental in enhancing student's learning experience.

As such, this seems to be an appropriate time to explore the potential for integrating VR in business classrooms. As instructors are always looking for creative ways to deliver content in their courses (Lee & Hoffman, 2014), the goal of this research was to examine the potential for VR as a content medium for business instructors. We crafted our research question as the following: How beneficial is VR (3D, 360° video) in comparison with FS (2D video) as a content delivery platform in business classrooms?

Herein, when referring to VR, we are referring to the use of VR in the form of head-mounted displays (HMDs; see Appendix A). Gutiérrez, Vexo, and Thalmann (2008) noted that the use of HMDs provides the fullest immersive experience compared to projection screens or desktop-based virtual reality. These HMDs, which often contain a sound system and a display screen with a motion tracking system, provide a mimic of the

real-world experience through computer-generated virtual reality environment (Villani, Repetto, Cipresso, & Riva, 2012). We designed the research study with the following goals in mind. Here, we wanted to see whether VR enhances students' educational experience of a particular lesson plan. That is, rather than focusing on macrolevel issues (e.g., cost, administrative hurdles, physical limitations), we investigated the issue of whether VR (vs. FS) can be an acceptable substitute as a content delivery medium.

Moreover, despite its technological advancements, high-quality VR HMDs are still expensive and complex to use, thus, making it inaccessible for many professors and students. (Burdea, 2004; Omieno, Wabwoba, & Matoke, 2013). In light of this, we explore an affordable and easy-to-use Google Cardboard HMD (Google, Menlo Park, CA) as our primarily VR platform. Google Cardboard is a low-budget, stereoscopic viewer that can be used with most smartphone devices (Google, 2016a). By 2016, it has amassed over 5 million users with over 25 million installs of cardboard apps from Google Play (Google, 2016b). Currently, Google Cardboard provides easy viewing for 360° photos and videos, which is appropriate for classroom use. While we acknowledge that there are other sophisticated VR platforms available on the market (i.e., Samsung Gear VR, Oculus), we chose this particular technology because it will be more suitable to use it in a classroom setting. Currently, other platforms would be too costly for a university (at the time of this writing, the approximate per person cost for a Samsung Gear VR with a compatible phone = approximately $800 U.S. dollars [USD]; for an Oculus Rift or HTC Vive with a proper graphic-supporting computer = approximately $3,000 USD). Hence, we chose an easily portable alternative, the Google Cardboard, which can be acquired as cheap as $10 USD.

Methodology

Forty-four undergraduate and graduate students from a business school in a large Canadian university participated in the study for a chance to win a $15 gift card to a fast-food restaurant. Given administrative restrictions, it was difficult to conduct the study within the confines of a classroom environment. Thus, the study was carried out in a one-to-one setting. In total, the sample included 15 women and 29 men. The mean age was 29.34. The study included 34 graduate students and 10 undergraduate students. The study was a one-factor between-subjects experimental design with two conditions. Each participant was randomly assigned to one of two conditions: VR or FS.

In the VR condition, participants were asked to wear a head-mounted display. In choosing the virtual reality technology, we chose to use IAMCARDBOARD (a Google Cardboard VR platform) with Apple iPod fifth generation (Apple, Cupertino, CA) as the supporting hardware as the content delivery system. Within the iPod, we downloaded an app called Jaunt VR (Jaunt VR, Palo Alto, CA). Jaunt VR is an app that is dedicated solely to developing and producing live-action VR experiences. Its mission is to bring VR experiences of the world through production of content (immersive cinematic virtual reality 360° video). For example, Jaunt VR features videos of tourist destinations (e.g., Machu Picchu, Cuba, New York), small clips of concerts or musicals (e.g. Paul McCartney, the *Lion King*), sporting events (all-star events), and others. For this study, we chose a video called *The North Face: Nepal*. This video was 3.5 min in length and it features a North Face climber on his spring adventure through Nepal in 2015. We chose this video because it provides educational content about Nepal and shows a scenic view of Nepal (e.g., mountains, inner city). In the VR condition, participants were asked to watch a video through the VR device. After watching the video, the participants were asked to complete a survey relating to the content of the video. In the FS condition, participants were asked to watch the same video but instead of wearing a head-mounted display, they watched the video through the iPod Touch. The iPod Touch was stationary, meaning the participants were not allowed to move the device around for the 360° video effects.

In constructing the survey, we adapted our items from Y. C. Chen, Shang, and Li (2014). In their survey, the focus was primarily on blog content (please see the original survey items in Appendix B). Here, we modified it for video content. For a full list of survey items used for this study, please refer to Table 1. First, we looked at the novelty of content, which represents the information about the destination that is new to the user. Second, we looked at reliability of content, which represents the degree to which the video content about the destination is perceived to be true, accurate, and believable. Third, we looked at understandability of content, which represents the degree to which the user perceives the content about the destination as easy to understand. Fourth, we looked at usage enjoyment, which represents the degree of perceived enjoyment while using delivery medium. Finally, we looked at interest, which represents the level of viewer's interest. All items were measured on a 7-point Likert-type scale with responses ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). We also asked for demographic questions such as gender, age, and level of study (undergraduate or graduate).

Table 1. Mean differences between virtual reality and flat screen.

	Virtual reality ($n = 22$)		Visual media ($n = 22$)			
	M	*SD*	*M*	*SD*	*t*	Cohen's *d* (effect size)
Novelty of content 1. There was a substantial amount of new information in this video 2. I knew little about the destination described in the video before watching it 3. This video has substantial amount of unique information that I have not come across before 4. Through this video, I discovered a new destination 5. Through this video, I learned about the destination's culture and way of life 6. Through this video, I satisfied my curiosity regarding this destination	4.68	1.45	4.23	1.23	1.12	*ns*
Reliability of content 1. I think the content of this video is accurate 2. I think the content of this video is consistent with facts 3. I think the content of this video is reliable	5.24	0.95	5.50	1.10	−.87	*ns*
Understandability of content 1. The information in this video was easy for me to understand 2. I was able to follow this video's content with little effort 3. Viewers like me should find this video easy to understand	6.31	0.80	6.13	1.46	.54	*ns*
Enjoyment 1. Watching this video provides me with enjoyment 2. Watching this video makes me feel relaxed and pleasant 3. Watching this video makes me feel happy 4. Watching this video is fun	6.23	0.64	5.40	1.09	3.12**	.93
Interest 1. I think the content of the video is interesting	6.45	0.96	5.65	1.50	2.15*	.64

Note: Cohen's *d* values > .80 are considered to be large effect sizes and between .40 and .60 are considered to be medium effect sizes.
*$p < .05$. **$p < .01$. ***$p < .001$,

Quantitative data analysis was conducted via SPSS 21.0, which consisted of two separate steps. First, descriptive statistics were calculated on all variables. Scale items were averaged and then, means and standard deviations were calculated for all relevant variables. Next, independent *t* tests were conducted to determine whether there was a statistically significant difference between the two conditions (VR vs. FS). All statistical tests were conducted at an alpha level of .05. Finally, we calculated the Cohen's *d* for all mean differences to calculate effect sizes.

Results

The summary of results can be found in Table 1. The table shows the scale items, with means, standard deviations, and effect sizes for all analyses. Cronbach's alphas were calculated to assess the level of internal consistency reliability of all variables of interest. The reliability coefficient (Cronbach's alpha) showed high consistency across the measure: novelty ($\alpha = .84$), reliability ($\alpha = .87$), understandability ($\alpha = .88$), and enjoyment ($\alpha = .88$). Interest was a one-item measure, thus no reliability test was performed. We performed separate independent *t*-tests for the five dependent variables (novelty of content, reliability of content, understandability of content, usage enjoyment, and interest). An independent *t*-test was used to compare means of VR and FS.

The results of the *t*-tests reveal the following. For novelty of content, we found no significant differences between the two groups ($M_{VR} = 4.69$ vs. $M_{FS} = 4.23$), $t(42) = 1.13$, $p = ns$. For reliability of content, we found no significant differences ($M_{VR} = 5.24$ vs. $M_{FS} = 5.51$), $t(42) = -0.87$, $p = ns$. For understandability of content,

it was also not significant ($M_{VR} = 6.32$ vs. $M_{FS} = 6.13$), $t(42) = 0.54$, $p = ns$. Significant differences were identified in the level of viewer's enjoyment and interest. For enjoyment, we found that people in the VR condition rated their enjoyment to be higher than those in the FS condition ($M_{VR} = 6.23$ vs. $M_{FS} = 5.40$), $t(42) = 3.12$, $p < .05$. The same pattern was found for level of interest ($M_{VR} = 6.32$ vs. $M_{FS} = 6.45$), $t(42) = 5.65$, $p < .05$. Overall, for content-related scale items (novelty of content, reliability of content, and understandability of content), the results demonstrate no significant differences. For enjoyment and interest, there were significant mean differences between the two conditions, and the effect size analyses (Cohen's *d*) reveal a medium to large effect.

General discussion

In this research, we explored the following question: How beneficial is VR (3D, 360° video) in comparison with FS (2D video) as a content delivery platform in business classrooms? Overall, our results showed that the content presented via 3D VR technology—Google Cardboard (vs. 2D FS—iPod) did not significantly differ with respect to novelty, reliability, and understandability of content. This is an important discovery because, given the current high cost of implementing VR technology (Omieno et al., 2013), administrators may have to weight the pros and cons of implementing the VR technology for classroom setting.

Benefits and challenges of VR

In the past, researchers have suggested the benefits of VR as an educational tool. Although much of this research has focused on training (e.g., construction) or therapeutic purposes (e.g., medical) rather than content delivery. Perhaps when VR is used for practical purposes (e.g., flight simulation), it may have noticeable benefits compared to FS formats. When VR is solely used for content delivery, we found that the benefit of content absorption may be marginal. Although, this is not to say that VR is ineffective. Despite the lack of significant effects for content-related scale items, it is noteworthy to point out that students using VR (vs. FS) reported higher levels of enjoyment and interest.

While VR may not be beneficial in terms of delivery of content, students seemed to enjoy their experience. Lin, Duh, Parker, Abi-Rached, and Furness (2002) defined enjoyment as "the feeling of pleasure or contentment during the virtual environment experience" (p. 165). In other words, VR may increase the pleasure that the students acquire from using the technology as it deviates from the old chalk-and-talk method of learning in university classrooms. VR can make participants feels as if they visited the destination themselves, while experiencing the feeling of virtually being there. Overall, we suggest that the underlying structure and the causes of enjoyment in VR should be explored in future studies.

Educators are always looking for ways to create an environment that is enjoyable for their students (Lumby, 2011). Shernoff, Csikszentmihalyi, Schneider, and Shernoff (2003) suggested that an absence of enjoyment is one of the fundamental reasons of failures in young adults to achieve their full potential. The authors also linked boredom as a cause of academic struggles among students. Thus, lack of enjoyment and feeling of boredom in a classroom setting can undermine students' ability to perform at their best. Here, we find that VR has the potential to make learning more enjoyable by allowing students to translate their personal experiences, emotions and memories to the virtual environment. As a result, such experience can lead to a more meaningful learning process (Gallo, 2002). While VR provides more interesting and enjoyable experience for its users, it may not necessary be superior to delivering content via FS formats. Thus, there are benefits and challenges to using VR technology in business classrooms.

Research limitations

There are several limitations to this study. First, for the FS condition, we used an iPod Touch to view the videos. However, in a typical class setting, it is likely that students will watch a classroom video content via their laptop or a classroom projector. Therefore, it may be appropriate to use other FS formats to see if the results replicate. Second, while our research was designed to ensure maximum internal validity, we acknowledge field studies (conducting the study within the confines of an actual classroom setting) may be necessary to increase the external validity of the results. Third, the content used in this research was specific to travel. The outcome may differ if the content had been self-help related, simulation-based, or lecture based. Thus, more research needs to be conducted using alternative content is necessary to corroborate the results. Finally, the original scale adapted from Y. C. Chen et al. (2014) was initially developed for blog content. Thus, we acknowledge the limitation that this set of scale items may not be appropriate for assessing VR content.

VR prospects and conclusion

We believe that as VR technology advances, the level of immersion into the content will significantly

increase. With greater immersion, students may better absorb the content within the virtual environment. Thus, we expect the application and relevance of content delivery with VR will increase as VR becomes more prominent. Moreover, we also expect the side effects (i.e., motion sickness) of using VR will decrease, thus increasing the comfort in which students acquire content through VR. Technology might not have the same impact as an actual visit to a museum, a national park or a historical site, but students will gain a more realistic perspective to the topic of which they are studying. Moreover, we also expect the content to be far more engaging than what is available to us today. For example, content within Jaunt VR (and similar apps alike) are predetermined videos that do not allow users to freely roam. While they do provide realism, they do not allow freedom. For current apps that do allow users to roam, the background and the setting are often animated, reducing the level of realism. In the future, we expect developers to create content that allows both roaming capabilities as well as immersive realism. This way, students will be able to mentally transport to destinations, ultimately creating a more realistic learning experience. Finally, we believe VR may be more useful for business courses that teach practical skills such as product development as opposed to courses that rely on content absorption.

In conclusion, instructors are constantly in search of a novel teaching and content delivery methods in education. In this research study, we examined the potential use of Google Cardboard VR in business classrooms as a content delivery platform. Even though the research results demonstrated that the Google Cardboard VR platform was not superior to FS formats in its content delivery with respect to novelty, reliability, and understandability, participants in the VR condition rated their enjoyment and interest to be higher. These findings suggest that VR has potential to increase engagement in learning activities through this innovative way of delivering content, benefitting student's learning experience.

References

Allison, D., Wills, B., Bowman, D., Wineman, J., & Hodges, L. F. (1997). The virtual reality gorilla exhibit. *IEEE Computer Graphics and Applications*, *17*(6), 30–38.

Anderson, P. L., Zimand, E., Hodges, L. F., & Rothbaum, B. O. (2005). Cognitive behavioral therapy for public speaking anxiety using virtual reality for exposure. *Depression and Anxiety*, *22*, 156–158.

Barab, S. A., Hay, K. E., Barnett, M., & Keating, T. (2000). Virtual Solar System Project: Building Understanding through Model Building. *Journal of Research in Science Teaching*, *37*, 719–756.

Bellani, M., Fornasari, L., Chittaro, L., & Brambilla, P. (2011). Virtual reality in autism: state of the art. *Epidemiology and Psychiatric Sciences*, *20*, 235–238.

Bolton, D. (2016, June 30). Why virtual reality education is the next frontier for classrooms. *Arc from Applause*. Retrieved from https://arc.applause.com/2016/06/30/virtual-reality-education/

Bordnick, P. S., Carter, B. L., & Traylor, A. C. (2011). What virtual reality research in addictions can tell us about the future of obesity assessment and treatment. *Journal of Diabetes Science and Technology*, *5*, 265–271.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, *18*, 32–43.

Bruner, J. S. (1966). *Toward a theory of instruction* (vol. 59). Cambridge, MA: Harvard University Press.

Burdea, G. C. (2004). Teaching virtual reality: Why and how? *Presence*, *13*, 463–483.

Chelliah, J., & Clarke, E. (2011). Collaborative teaching and learning: Overcoming the digital divide? *On the Horizon*, *19*, 276–285.

Chen, C. H., Yang, J. C., Shen, S., & Jeng, M. C. (2007). A desktop virtual reality earth motion system in astronomy education. *Educational Technology & Society*, *10*, 289–304.

Chen, Y. C., Shang, R. A., & Li, M. J. (2014). The effects of perceived relevance of travel blogs' content on the behavioral intention to visit a tourist destination. *Computers in Human Behavior*, *30*, 787–799.

Desai, P. R., Desai, P. N., Ajmera, K. D., & Mehta, K. (2014). A review paper on oculus rift-a virtual reality headset. *International Journal of Engineering Trends and Technology*, *13*, 175–179.

Estes, J. S., Dailey-Hebert, A., & Choi, D. H. (2016). *Emerging tools and applications of virtual reality in education*. Hershey, PA: IGI Global.

Franz, R. S. (1998). Whatever you do, don't treat your students like customers! *Journal of Management Education*, *18*, 63–69.

Gallo, M. (2002). Picture this: Immigrant workers use photography for communication and change. *Journal of Workplace Learning*, *14*, 49–57.

Gardner, S. F. (2006). Preparing for the Nexters. *American Journal of Pharmaceutical Education*, *70*(4), 87.

Gates, D. H., Darter, B. J., Dingwell, J. B., & Wilken, J. M. (2012). Comparison of walking overground and in a Computer Assisted Rehabilitation Environment (CAREN) in individuals with and without transtibial amputation. *Journal of NeuroEngineering and Rehabilitation*, *9*, 81.

Google. (2016a). *Google Cardboard VR*. Retrieved from https://vr.google.com/cardboard/

Google. (2016b). *(Un)folding a virtual journey with Google Cardboard*. Retrieved from https://www.blog.google/products/google-vr/unfolding-virtual-journey-cardboard/

Guerra, J. P., Pinto, M. M., & Beato, C. (2015). Virtual reality-shows a new vision for tourism and heritage. *European*

Scientific Journal, 45–54. Retrieved from http://eujournal.org/index.php/esj/article/view/5375/5174

Gutiérrez, M. A. A., Vexo, F., & Thalmann, D. (2008). *Stepping into virtual reality*. London, UK: Springer.

Guttentag, D. A. (2010). Virtual reality: Applications and implications for tourism. *Tourism Management*, *31*, 637–651.

Huang, H. M., Rauch, U., & Liaw, S. S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education*, *55*, 1171–1182.

Kaufmann, H., Schmalstieg, D., & Wagner, M. (2000). Construct3D: A virtual reality application for mathematics and geometry education. *Education and Information Technologies*, *5*, 263–276.

Kilteni, K., Bergstrom, I., & Slater, M. (2013). Drumming in immersive virtual reality: the body shapes the way we play. *IEEE Transactions on Visualization and Computer Graphics*, *19*, 597–605.

Klein, L. R. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing*, *17*, 41–55.

Le, Q. T., Pedro, A., & Park, C. S. (2015). A social virtual reality based construction safety education system for experiential learning. *Journal of Intelligent & Robotic Systems*, *79*, 487–506.

Lee, S. H., & Hoffman, K. D. (2014). The "iron inventor": Using creative problem solving to spur student creativity. *Marketing Education Review*, *24*, 69–74.

Lin, J. W., Duh, H. B. L., Parker, D. E., Abi-Rached, H., & Furness, T. A. (2002). Effects of field of view on presence, enjoyment, memory, and simulator sickness in a virtual environment. In *Virtual reality, 2002. Proceedings of the IEEE* (pp. 164–171). New York, NY: IEEE.

Lisichenko, R. (2015). Issues surrounding the use of virtual reality in geographic education. *The Geography Teacher*, *12*, 159–166.

Lui, T. W., Piccoli, G., & Ives, B. (2007). Marketing strategies in virtual worlds. *ACM SIGMIS Database*, *38*(4), 77–80.

Lumby, J. (2011). Enjoyment and learning: Policy and secondary school learners' experience in England. *British Educational Research Journal*, *37*, 247–264.

Magnenat-Thalmann, N., & Papagiannakis, G. (2005). Virtual worlds and augmented reality in cultural heritage applications. In M. Baltsavias, A. Gruen, L. van Gool, & P. Pateraki (Eds.), *Recording, modeling and visualization of cultural heritage* (pp. 419–430). Boca Raton, FL: CRC Press.

Maloney, J. (1997). Fly me to the moon: A survey of American historical and contemporary simulation entertainments. *Presence: Teleoperators & Virtual Environments*, *6*, 565–580.

Mantovani, F. (2001). VR learning: Potential and challenges for the use of 3D environments in education and training. In G. Riva & C. Galimberti (Eds.), *Towards cyber psychology: Mind, cognitions and society in the internet age* (pp. 207–226). Amsterdam, the Netherlands: IOS Press.

Merchant, Z., Goetz, E. T., Keeney-Kennicutt, W., Kwok, O. M., Cifuentes, L., & Davis, T. J. (2012). The learner characteristics, features of desktop 3D virtual reality environments, and college chemistry instruction: A structural equation modeling analysis. *Computers & Education*, *59*, 551–568.

Minocha, S. (2015). The state of virtual reality in education—Shape of things to come. *International Journal of Engineering Research*, *4*, 596–598.

Pantelidis, V. S. (1995). Reasons to use virtual reality in education. *VR in the Schools*, *1*(1), 9. Retrieved from http://vr.coe.ecu.edu/reas.html

Papert, S. (1991). Situating constructionism. In I. Harel & S. Papert (Eds.), *Constructionism* (pp. 1–11). Norwood, NJ: Ablex.

Potka, J. (1995). Immersive training systems: Virtual reality and education and training. *Instructional Science*, *23*, 405–431.

Omieno, K. K., Wabwoba, F., & Matoke, N. (2013). Virtual reality in education: Trends and issues. *International Journal of Computers & Technology*, *4*, 38–43.

Osberg, K. M. (1995) Virtual reality and education: Where imagination and experience meet. *VR in the Schools*, *1*(2), 1–3.

Regian, J. W., & Shebilske, W. L. (1992). Virtual reality: An instructional medium for visual-spatial tasks. *Journal of Communication*, *42*, 136–149.

Rizzo, A., Difede, J., Rothbaum, B. O., Reger, G., Spitalnick, J., Cukor, J., & McLay, R. (2010). Development and early evaluation of the Virtual Iraq/Afghanistan exposure therapy system for combat-related PTSD. *Annals of the New York Academy of Sciences*, *1208*, 114–125.

Roussos, M., Johnson, A., Moher, T., Leigh, J., Vasilakis, C., & Barnes, C. (1999). Learning and building together in an immersive virtual world. *Presence: Teleoperators and Virtual Environments*, *8*, 247–263.

Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly*, *18*, 158–176.

Shim, K. C., Park, J. S., Kim, H. S., Kim, J. H., Park, Y. C., & Ryu, H. I. (2003). Application of virtual reality technology in biology education. *Journal of Biological Education*, *37*, 71–74.

Stansfield, S., Shawver, D., Sobel, A., Prasad, M., & Tapia, L. (2000). Design and implementation of a virtual reality system and its application to training medical first responders. *Presence: Teleoperators and Virtual Environments*, *9*, 524–556.

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, *42*, 73–93.

Stumpf, R. J., Douglass, J., & Dorn, R. I. (2008). Learning desert geomorphology virtually versus in the field. *Journal of Geography in Higher Education*, *32*, 387–399.

Thomas, W. A., & Carey, S. (2005). Actual/virtual visits: What are the links? In D. Bearman & J. Trant (Eds.), *Museums and the web 2005*. Toronto, Canada: Archives & Museum Informatics. Retrieved from http://www.archimuse.com/mw2005/papers/thomas/thomas.html

Winn, W. (1993). *A conceptual basis for educational applications of virtual reality*. Technical publication R-93-9, Human Interface Technology Laboratory of the Washington Technology Center. Seattle, WA: University of Washington.

Villani, D., Repetto, C., Cipresso, P., & Riva, G. (2012). May I experience more presence in doing the same thing in virtual reality than in reality? An answer from a simulated job interview. *Interacting With Computers*, *24*, 265–272.

Youngblut, C. (1998). *Educational uses of virtual reality technology*. Alexandria, VA: Institute for Defense Analyses. Retrieved from http://papers.cumincad.org/data/works/att/94ea.content.pdf

Appendix A: Google Cardboard (IAMCARD BOARD) virtual reality demonstration

Appendix B: Content scale items originated from Y. C. Chen et al. (2014) questionnaire

Novelty of content

There was a substantial amount of new information in this blog.

I knew little about the destination described in the blog before I came across this blog.

This blog has a substantial amount of unique information that I have not come across before.

Through this blog, I discovered a new destination.

Through this blog, I learned about the destination's culture and way of life.

Through this blog, I satisfied my curiosity regarding this destination.

Reliability of content

I think the content of this blog is accurate.

I think the content of this blog is consistent with facts.

I think the content of this blog is reliable.

Understanding of content

The information in this blog was easy for me to understand.

I was able to follow this blog's content with little effort.

Readers like me should find this blog easy to read.