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EFFECT OF VIRTUAL REALITY ON MOTIVATION AND ACHIEVEMENT OF  
MIDDLE-SCHOOL STUDENTS

by

Mary Michelle Bowen

A Dissertation Submitted in Partial Fulfillment of the  
Requirements for the Degree of  
Doctor of Education

Major: Instruction and Curriculum Leadership

The University of Memphis

May 2018

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## Acknowledgement

Without my faith in Jesus Christ and His strength, I could have never finished this journey. This manuscript is a tangible example of Philippians 4:13.

## Abstract

The introduction of low-cost hand-held devices has provided K-12 educators with the opportunity to teach using virtual reality (VR). However, the efficacy of VR in K-12 classrooms for teaching and learning has not been established. Therefore, the purpose of this quasi-experimental study was to examine the influence of virtual reality field trips on middle-school students' social studies academic achievement and motivation. The district chosen for the study is in a rural, economically depressed county, where generational poverty persists. However, the district has a history of being an early adopter of technology. Participants included 76 seventh-grade students at two middle schools, who participated in social studies instruction using either the traditional lecture method or a virtual reality system. The virtual reality system used in this study was the Google Expeditions Virtual Reality System, which uses smartphone technology and iBlue Google VR 3-D Glasses. Before and after the instruction was provided, participants were assessed using the Instructional Materials Motivation Survey (IMMS) and teacher designed social studies test. The results of the two one-way ANCOVAs, demonstrated that students using virtual reality scored significantly higher than students participating in traditional instruction on both their academic achievement and motivation. These findings provide support for the use of virtual reality in middle-school social studies classrooms.

*Keywords:* virtual reality, Google Expedition, middle-school, social studies, poverty, motivation, academic achievement

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## **List of Abbreviations**

Analysis of Covariance (ANCOVA)

Application (app)

Attention, Relevance, Confidence, and Satisfaction (ARCS)

Cave Automatic Virtual Environment (CAVE)

Head Mounted Displays (HMD)

Instructional Materials Motivation Survey (IMMS)

Institutional Review Board (IRB)

Kindergarten through twelfth grade (K-12)

Virtual Reality (VR)

## **CHAPTER ONE: INTRODUCTION**

### **Introduction**

Social studies curriculum in the middle-school classroom involves memorizing copious numbers of names, dates, and facts that are traditionally taught using lecture and notetaking (Aidinopoulou & Sampson, 2017). Studies suggest that this traditional method for instruction resulted in poor academic motivation and poor academic achievement (Scheuerell, 2015; Wolters, Denton, York, & Francis, 2014). Emerging technologies are sparsely used in science and math curriculums to enhance motivation and academic achievement, because educators are reluctant to employ technology in the social studies classroom (Aidinopoulou & Sampson, 2017; Scheuerell, 2015). Consequently, there are limited investigations on the use of emerging technologies, such as virtual reality in the social studies classroom (Curcio, Dipace, & Norlund, 2016). Therefore, this study explores the effect of virtual reality technology on academic achievement and motivation in the middle-school social studies classroom.

### **Background**

#### **Virtual Reality and Low-Cost Viewfinders**

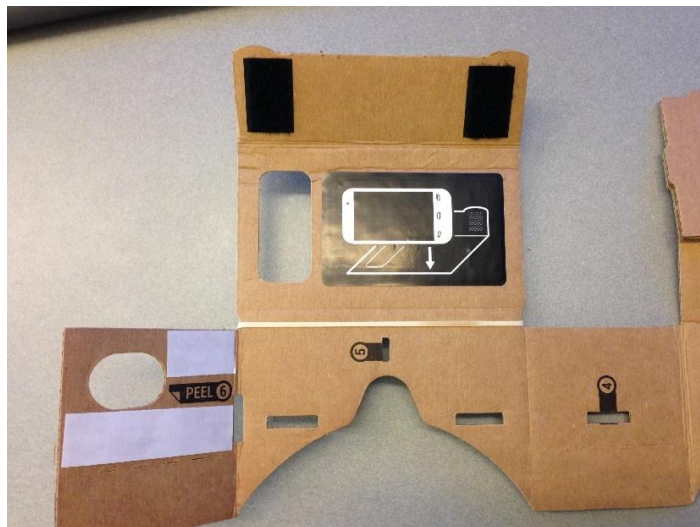
As technology has evolved, so has virtual reality (VR). Virtual reality currently includes desktop virtual reality, non-immersive virtual reality, wearable technologies, immersive virtual reality, and conventional virtual reality, with some researchers considering gamification a type of virtual reality (Barfield & Caudell, 2001; Lau & Lee, 2015; Lee & Wong, 2014; Lorenzo, Pomares, & Lledo, 2013; Nechvatal, 2009; Samsudin, Rafi, Ali, & Rashid, 2014). Although each form of VR is conceptually different, and the definition of some forms is ambiguous, all virtual reality involves interactivity with simulated environments. For the purpose of this study, the overarching term, virtual reality is used.

The literature defines the term virtual reality as a computer-generated, three-dimensional environment that creates a feeling of *presence* for users, as they explore a simulated environment (Lee & Wong, 2014; Lorenzo et al., 2013; Lorenzo, Lledo, Pomares, & Roig, 2016). VR works to create a psychological sense of presence in a synthetic environment (Slater, 2017). Central to the definition of VR is the concept of presence, a “multifaceted concept defined in a variety of ways by different authors” (Gautam, Williams, Terry, Robinson, & Newbill, 2018, p. 119). For this study, presence is defined as the “perceptual illusion of being in the place rendered by the virtual reality system” (Slater, 2017, p. 20). There are two types of illusion necessary to create the perceptual illusion of presence: place illusion and plausibility illusion (Klampfer, 2016; Slater, 2017; Steinicke, 2016). Place illusion is defined as the illusion of being in virtual places; while plausibility illusion is created when the virtual environment responds to the actions of the participant (Slater, 2017).

To create a sense of presence, some virtual reality systems use head-mounted devices, desktop computer software, or multiple projector screens to transport the user into a computer-generated environment. Today’s mobile VR systems utilize head mounted devices (HMD) for visual immersion, with VR speakers or headphones providing spatial audio. Wired gloves often provide tactile information, increasing interactivity in the replicated environment (Curcio et al., 2016; Olmos, Cavalcanti, Soler, Contero, & Alcaniz, 2018). Although the earliest use of VR was for entertainment, this technology is now used in medicine, avionics, and adult training, because of its ability to replicate difficult or dangerous environments and situations (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014; Ott & Freina, 2015). The use of VR in educational settings was previously limited to specialized university laboratories.

Until recently, several barriers prohibited virtual reality (VR) technology from being used in the K-12 educational setting. Some of the barriers included, but were not limited to, high software and hardware costs, low-quality instructional design, and problems such as motion sickness associated with the early VR systems (Olmos et al., 2018; Zantua, 2017). Therefore, schools only used desktop virtual reality applications for learning (Merchant et al., 2014).

Recent advancements in smartphone and tablet capabilities have mitigated some of these barriers and provided low-cost alternatives to past resource-intensive VR technology (Brown & Green, 2016; Zantua, 2017). The 2014 introduction of the Google Cardboard viewfinder is an example of this low-cost VR revolution (Pierce, 2016; Simonite, 2015). The Google Cardboard viewfinder consists of a folded sheet of cardboard with two plastic lenses and a small magnet to control the touchscreen. The front flap of the viewfinder folds open to allow users to insert a smartphone device. The front flap closes and is secured by a strip of hook and loop fastener material attached to the top of the viewfinder (see Figures 1 and 2).

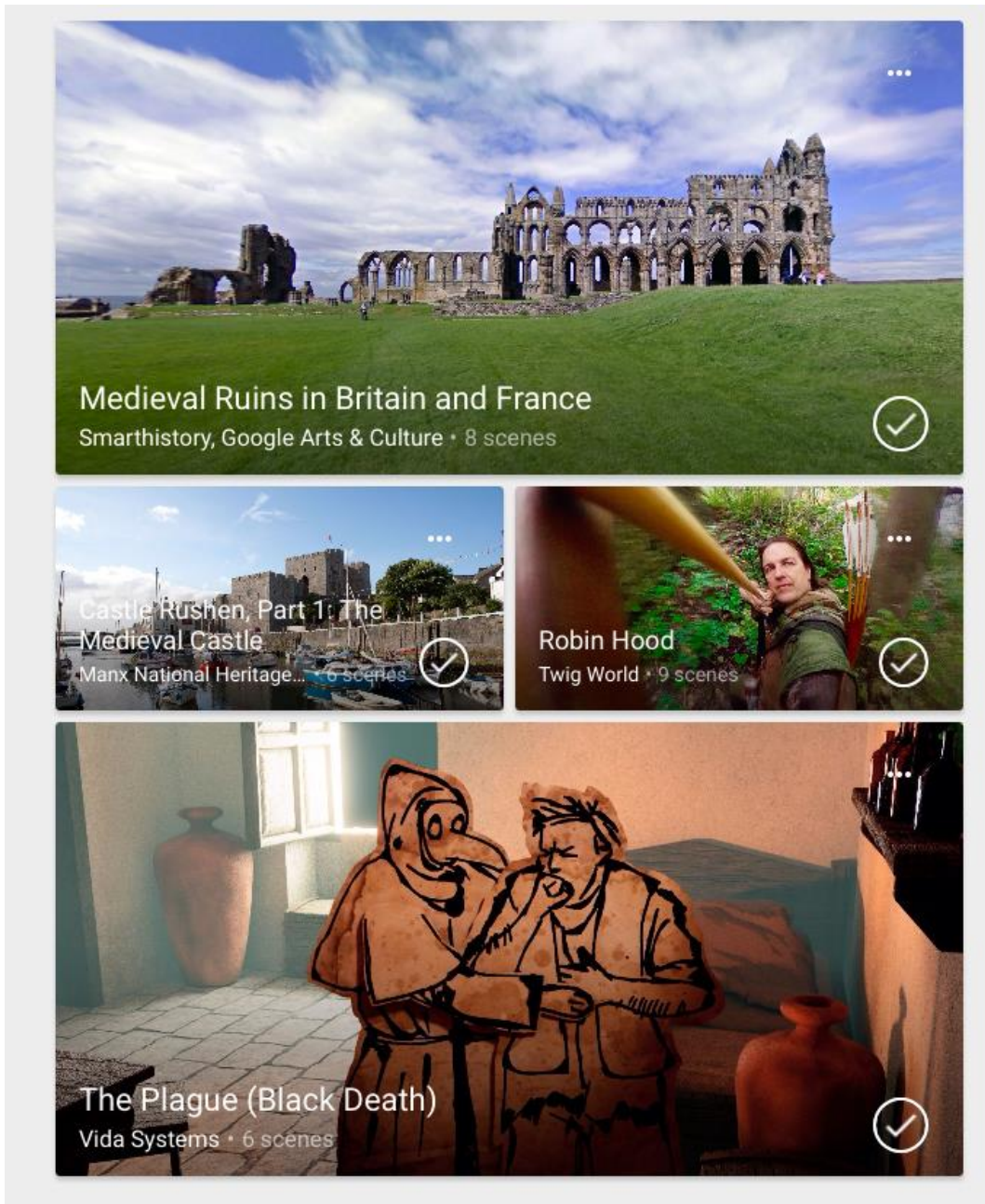


*Figure 1.* A Google Cardboard viewfinder fully unfolded. (Runner1928, 2014)

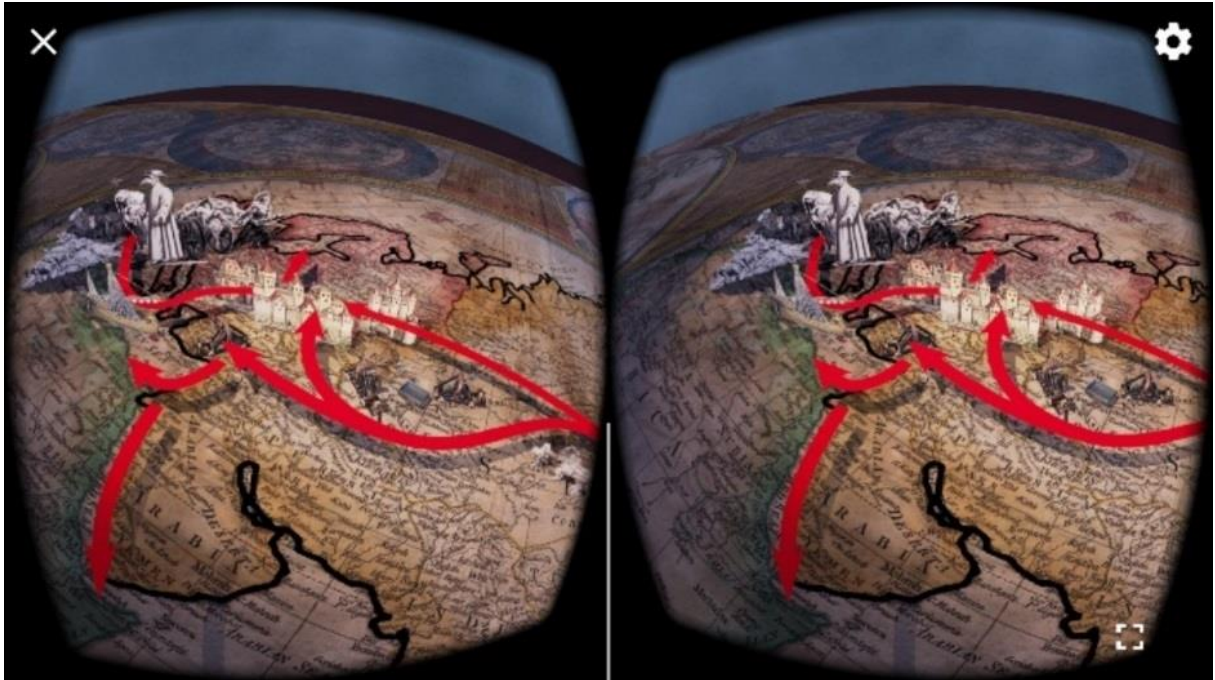


*Figure 2.* A Google Cardboard viewfinder assembled, with a smartphone inserted. (Amos, 2015)

In 2015, Google introduced the Expeditions VR system which provides affordable virtual field trips for the K-12 classroom (Brown & Green, 2016). Although the Google Cardboard app, Google StreetView, 360-degree YouTube videos, and various VR apps provide a single-user VR experience, Google Expeditions is a virtual reality system for classroom use. It provides a communal, multiuser experience. To conduct a virtual field trip, the Expeditions app is downloaded on a smartphone, placed in a viewfinder, and connected to the router. Each student is provided with a viewfinder with an inserted smartphone opened to the Expeditions app. The teacher selects the field trip location (e.g., Medieval Ruins in Britain and France, The Plague (Black Death), or Robin Hood) on the tablet (see Figure 3). Students then see the opening scene for the field trip and the teacher proceeds to guide students through the virtual environment, asking questions, identifying points of interest, and providing a scripted narration of the location (see Figures 3 through 5). Over 500 virtual field trips are available to both current locations and historical time periods. Students can visit a pharmaceutical biochemistry lab, tour the 9/11 Memorial and Museum, journey along the Great Barrier Reef, or visit medieval Europe during the Black Death.



*Figure 3.* A screenshot of Google Expeditions that appeared on the teacher's tablet. (Vida Systems, 2017)



*Figure 4.* A screenshot from The Plague (Black Death) expedition, showing the map of how the Black Death spread across Europe, that students see in their viewfinders during the teacher-led field trip. (Vida Systems, 2017)



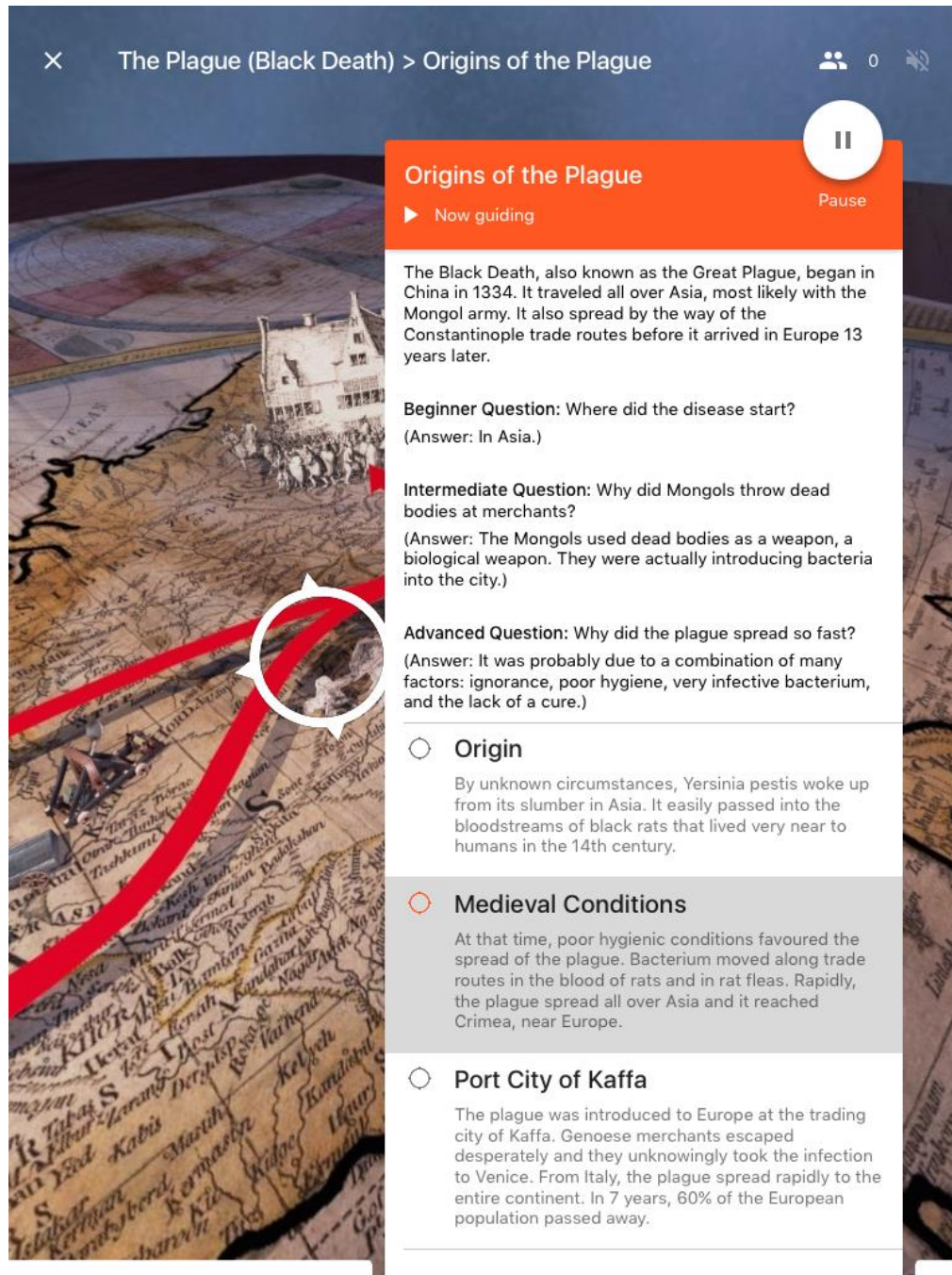


Figure 5. A screen shot of The Plague (Black Death) expedition script and questions that appear on the teacher's tablet.

Recent advancements in smartphone and tablet capabilities, providing low-cost VR in educational environments, are only beginning to be examined. However, previous research on

desktop virtual reality demonstrates that students construct a deeper understanding of concepts studied and enhanced knowledge acquisition because they’ “drive[sic] their own learning process” (p.2) (Herrington & Oliver, 1999; Zantua, 2017, p.2; Zheng, 2010). Therefore, this new media potentially offers “opportunities for enhancing motivation and learning across a range of subject areas, student development levels, and educational settings” and should be investigated further (Olmos et al., 2018, p.134).

### **Education and the Adoption of New Technologies**

Teaching means extending the classroom beyond the four walls of the classroom and the two covers of the book. It means immersing students in direct experiences with people and places in order to learn the content of realistic community situations (Davis, 2017, p.170).

Educators continually seek effective and engaging tools to promote the maximum learning potential for their students. This search often includes using the newest disruptive technologies (Donaldson, 2017). Disruptive technologies are defined as any technology that “radicalized the field as opposed to evolutionary ones, which iterate upon (but largely enforce) the status quo” (Noonoo, 2013, p. 2). From instructional films and radio during the early 1900s, desktop computers in the 1980s, and laptops in the 2000s, each disruptive technology promised the potential to revolutionize the way that students learn (Dede, Jacobson, & Richards, 2017; Lim, Zhao, Tondeur, Chai, & Chin-Chung, 2013; Olmos et al., 2018; Rieser & Dempsey, 2012). Currently, the disruptive technology entering the classroom is virtual reality, which “has the potential to increase engagement in learning activities ... benefitting students’ learning experiences” (Lee, Sergueeva, Catanguí, & Kandaurova, 2017, p. 158).

Empirical research demonstrating the effectiveness of disruptive technologies lags behind the technology's adoption in the classroom (Donaldson, 2017). This delay is attributed to the rapid introduction, evolution, and often disappearance of these technologies from the classroom, before researchers can design, develop, and determine their effectiveness in educational spaces (Donaldson, 2017; Gardner & Sheaffer, 2017). Although some technologies enhance student learning, some prove ineffective, even after widespread and costly adoption. For example, devices such as student-response systems, SMART televisions, Chromebooks, iPads, and interactive white boards have been adopted in classrooms, before any quantitative research studies examined the impact on student achievement and motivation (Blasco-Arcas, Buil, Hernandez-Ortega, & Sese, 2013). The few studies conducted on VR, focus on learning social skills and language acquisition in a K-12 environment. However, they are limited by small sample size and the absence of mobile VR technology (Curcio et al., 2016; Dede, Jacobson, & Richards, 2017; Freeman, Becker, Cummins, Davis, & Hall-Giesinger, 2017; Lorenzo et al. 2013, 2016). Overall, a dearth of research remains.

To determine VR's effectiveness in the classroom, empirical research on VR's benefits to academic achievement and motivation must be conducted (Richards, 2017). Research on effectiveness can assist administrators in making fiscally responsible decisions. Although the Google Expeditions VR system requires less financial commitment than previous VR systems, school administrators need data supporting the efficacy of the technology to improve student learning and motivation, prior to making an investment decision (Brown & Green, 2016; Pilgrim & Pilgrim, 2016; Zantua, 2017).

### **Problem of Practice**

The emergence of the Google Expeditions VR system stimulated growth in the use of virtual reality education, especially in the K-12 classroom. Empirical research currently does not adequately evaluate the effectiveness of VR field trips on seventh-grade, middle-school students' academic achievement and motivation (Lorenzo et al., 2013, 2016; Merchant et al., 2014). Therefore, it is necessary to further assess the effectiveness of Google Expeditions VR system on K-12 students' academic achievement and motivation within the classroom environment.

### **Purpose Statement**

The purpose of this pretest, post-test non-equivalent control group study was to examine the efficacy of virtual reality (VR) field trips on seventh-grade, middle-school social studies students' academic achievement and motivation. Seventh-grade, middle-school social studies students who were exposed to virtual reality field trips, were compared to seventh-grade, middle-school students who were exposed to traditional instruction in a social studies classroom. The independent variable was the type of instruction. The instruction for the treatment group, included the use of VR field trips within the Google Expeditions VR system. Virtual field trips were selected based upon locations being studied in the instructional unit. In addition to the virtual field trips, students in the treatment group also participated in instruction using the district-provided textbooks, content-specific videos, instructional content notes, lectures, and practice worksheets. The instruction for the control group included use of the district-provided textbooks, content-specific videos, instructional content notes, lectures, and practice worksheets. The content and textbooks used were the same for both groups. The only difference in the instruction was the treatment groups' use of the VR fieldtrips.

This study had two dependent variables. The first dependent variable was social studies academic achievement, which was measured using the social studies test (see Appendix A). It is an exam that is designed and validated for content validity by four educators selected to serve on the expert panel. The questions were derived from the teacher-created notes from the textbook, videos, worksheets, and the textbook test bank. The second dependent variable was student motivation to learn social studies. Student motivation was measured using the Instructional Materials Motivation Survey (IMMS) (Keller, 2009) (see Appendix B). For this study, the situated learning theory and the ARCS theory of motivation were chosen to guide the research, because of their focus on authentic learning and motivation. This is discussed further in Chapter Two.

The results of this empirical study are useful to practicing educators who need insight on integrating VR into their existing or new curriculum. The results provide insight into alternative methods of teaching and learning that are possible through the use of VR technology. The results of this study also provide supporting evidence on the efficacy of VR technology to encourage the investment of school resources.

### **Questions**

The problem and purpose of the study were addressed with the following research questions.

**Research Question One.** While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction, compared to traditional instruction, influence the social studies academic achievement of seventh-grade, middle-school students?

**Research Question Two.** While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction, compared to traditional instruction, influence the motivation of seventh-grade, middle-school students?

### **Null Hypotheses**

The null hypotheses for this study were:

**Null Hypothesis One.** While controlling for a pretest, the use of virtual reality field trips integrated into social studies instruction, compared to traditional instruction, does not influence the social studies academic achievement of seventh-grade, middle-school students.

**Null Hypothesis Two.** While controlling for a pretest, the use of virtual reality field trips integrated into social studies instruction, compared to traditional instruction, does not influence the motivation of seventh-grade, middle-school students.

## Definition of Terms

**Cave Automatic Virtual Environment (CAVE).** Specially designed glass cubicles that project on the walls of a room (Merchant et al., 2014).

**Google Cardboard.** A 3-D virtual reality viewfinder constructed of cardboard that holds a smartphone and uses installed applications to display a stereoscopic view (Computer Language Company, 2017).

**Google Expeditions.** A virtual reality teaching tool that allows the user to lead or join virtual trips all over the world (Google, 2017).

**Immersive Virtual Reality.** The perception of being physically present in a non-physical world that is created through images, sound, or other stimuli (Nechvatal, 2009).

**Motivation.** The internal conditions of an individual that result in the pursuit of specific goals (Keller, 2009 p. 12).

**Non-immersive Virtual Reality.** A 3-D image generated in a multimedia environment on a personal computer, which can be explored interactively by using a keyboard, mouse, joystick or touch screen, headphones, shutter glasses, and data gloves (Lee & Wong, 2014).

**Virtual Field Trips.** A digital alternative representation of reality that allows the user to observe, without being on the actual site (Stainfield, Fisher, Ford, & Solem, 2000).

**Virtual Reality.** A computer-simulated environment that can simulate physical presence in places in the real world as well as in imaginary worlds (Lorenzo et al., 2013).

## CHAPTER TWO: REVIEW OF LITERATURE

### Introduction

Over the past thirty years, technology has revolutionized the K-12 classroom and changed the pedagogy of educators, who now seek the latest technological advancements to modify the traditional textbook curriculum (Richards, 2017; Ross, Morrison, & Lowther, 2010). Each disruptive technological device introduced into the educational environment, was expected to enhance the learning experience, increase student motivation, and improve knowledge transference from classroom learning to real-world application (Dede, Jacobson, & Richards, 2017; Olmos et al., 2018). Although the efficacy of some technologies has been established, efficacy studies often trail the adoption of innovative technologies, given its rapid evolution (Blasco-Arcas et al., 2013; Dede, Jacobson, & Richards, 2017; Donaldson, 2017; Gardner & Sheaffer, 2017). Virtual reality is not an exception. VR adoption is currently surpassing the research.

For decades, virtual reality (VR) headsets have been used to train military, medical, and technical personnel (Steinicke, 2016). Recent developments in low-cost devices and an institutional push to develop educational VR applications, provide the opportunity for VR to revolutionize the way students are taught in the K-12 environment (Bellini et al., 2016; Brown & Green, 2016; Dede, Grotzer, Kamarainen, & Metcalf, 2017; Freeman et al., 2017; Liu et al., 2017; Zantua, 2017). Through low-cost virtual reality systems, the development of K-12 curriculum and instruction is on the precipice of a revolutionary change (Dede, Jacobson, & Richards, 2017).

We live at a time of rapid advances in both the capabilities and the cost of virtual reality... which potentially offer extraordinary opportunities for enhancing both



motivation and learning across a range of subject areas, student development areas, and educational settings. (Dede, Jacobson, & Richards, 2017, p. 1)

A literature search was performed using ProQuest databases and Google Scholar.

Keyword searches contained the terms *virtual reality*, *elementary education*, *motivation*, *K-12 education*, and *achievement*. The purpose of this chapter is to review the literature to address the problem of limited research on the influence of virtual reality field trips on the social studies academic achievement and motivation of seventh-grade, middle-school students. This chapter discusses the theoretical context of the study, and reviews current and seminal literature.

### **Theoretical Context**

For this study, the situated learning theory and the ARCS theory of motivation were chosen to guide the research, because of their focus on authentic learning and motivation. Classroom educators seek to create authentic learning situations for students because of the importance authentic learning has on knowledge acquisition, knowledge transfer, and motivation (Dede et al., 2017). These authentic situations are often created through field trips. By design, field trips take place in an informal location and provide the opportunity to create authentic and meaningful learning experiences (Basten, Meyer-Ahrens, Fries, & Wilde, 2014; Krakowka, 2012). According to Basten et al. (2014, p. 1035), “learning in an informal location is situated and characterized by authenticity,” which supports the use of the situated learning theory as an appropriate framework for this study. This study utilizes the latest virtual reality (VR) technology to conduct virtual field trips inside the classroom, rather than the traditional field trip that occurs outside the classroom. Based on the situated learning theory and the ARCS theory of motivation, it was hypothesized that virtual field trips, over traditional instruction, would positively influence the learning and motivation of seventh-grade, middle-school students.

## Situated Learning Theory

Situated learning theory states that learning best occurs, in an authentic environment where students are given the opportunity to investigate, meditate, and discuss with others who had the same experience (Herrington & Oliver, 1999, 2000; Lave & Wegner, 1991). Tenets of the situated learning theory originated in the constructivist movement of the 1960s and the educational theory evolution from behaviorism to cognition theories in the 1970s and 1980s (Cobb & Bowers, 1999; Herrington & Oliver, 2000; Zheng, 2010). In the 1980s, educators began evaluating the effective elements of the apprenticeship model - learning that occurs through the social interaction of novices and experts (Brown, Collins, & Duguid, 1989; Dennen & Burner, 2008). In 1991, Lave and Wegner proposed the situated learning theory, noting, “much of what is learned is specific to the situation in which it is learned,” and individuals acquire and transfer knowledge more effectively, when they are immersed in an authentic environment (Anderson, Reder, & Simon, 1996, p. 5; Lave & Wegner, 1991).

In their 2000 study of situated learning and web-based learning, Herrington and Oliver expanded the tenets of the situated learning theory to include nine elements necessary to create effective learning environments: authentic context, authentic activities, access to experts, access to multiple viewpoints, collaboration to construct knowledge, reflection on the content, presentation of learned content, teacher scaffolding, and authentic assessments (Herrington & Oliver, 2000). *Authentic context* is defined as providing an environment that “preserves the complexity of the real-life context with rich situational affordances” (Herrington & Oliver, 2000, p. 180). *Authentic activities* are single tasks that have real-world relevance requiring student investigation (Herrington & Oliver, 2000). *Access to experts* is defined as the availability of individuals with varying levels of expertise in the subject matter to be present during the activity

for questions and discussion (Herrington & Oliver, 2000). *Access to multiple viewpoints* is defined as discussion and collaboration with peers to express differing viewpoints during or after the learning experience (Herrington & Oliver, 2000). *Collaboration to construct knowledge* is defined as the organization of students into “pairs or small groups and involves appropriate incentive structures for whole group achievement” (Herrington & Oliver, 2000, p. 181). *Reflection on the content* involves the expression of learned content through the creation of authentic tasks (Herrington & Oliver, 2000). *Presentation of learned content* requires students to explicitly articulate their understanding of the concepts in collaborative groups and then in public presentations (Herrington & Oliver, 2000). *Teacher scaffolding* identifies the role of the teacher as a facilitator, who provides support at critical times to aid in students’ understanding (Herrington & Oliver, 2000). *Authentic assessments* are the “ways in which the learning outcomes are assessed and evaluated” (Herrington & Oliver, 2000, p. 182). Virtual reality systems coupled with teacher facilitation can include each of these elements of the situated learning theory. For this study, the Google Expeditions VR system employed for social studies instruction includes each of these elements: it creates an authentic learning environment that engages students in a collaborative learning experience, and teachers provide narration and questioning while navigating students through a VR experience (see Table 1).

Table 1

*Relationship of the Situated Learning Theory and the Google Expeditions VR System*

<b>The Element of Situated Learning Theory</b>	<b>The Element of Google Expeditions VR System</b>
Authentic context	Authentic virtual environments
Authentic activities	Exploring scenes related to the instructional content
Access to experts	The teacher facilitates the field trip

Table 1 (continued)

<b>Element of Situated Learning Theory</b>	<b>Element of Google Expeditions VR System</b>
Access to multiple viewpoints	Informal conversations with peers
Collaboration to construct knowledge	Small group discussion during and after a field trip
Reflection on the content	Embedded questions in each Expeditions scene
Presentation of learned content	Whole group discussion after a field trip
Teacher scaffolding	Teacher narrates the field trip
Authentic assessments	Instructional closure activity

Virtual learning environments are “associated with opportunities to enhance community, presence, and authentic situated learning experiences” (Gautam et al., 2018, p. 119). The immersion into authentic virtual environments using virtual reality (VR) systems provides an authentic context for students to acquire knowledge and skills, thereby creating a more meaningful learning experience (Dede, Jacobson, & Richards, 2017; Klampfer, 2016; Lee et al., 2017; Pilgrim & Pilgrim, 2016). Through narration and questioning, the teacher associates the instructional content to the authentic virtual environment creating a visually rich, loosely structured, authentic experience that encourages students to make meaningful connections (Dede, Jacobson, & Richards, 2017; Johnston, Olivas, Steele, Smith, & Bailey, 2017).

Therefore, the situated learning theory was an appropriate framework for the study to illustrate the potential academic achievement associated with implementing VR in seventh-grade, middle-school curricula. Based on this theory, it was hypothesized that the use of VR fieldtrips would influence the social studies academic achievement of seventh-grade, middle-school students.

## **ARCS Theory of Motivation**

The ARCS theory of motivation was developed by Keller in 1987, as he sought methods to improve the motivation of instructional materials and to “find more effective ways of understanding the major influences on the motivation to learn ...” (Keller, 1987a, p. 2). According to Keller (2009), motivation is “the internal conditions that result in the pursuit of specific goals” (p. 12). Keller grounded his theory in the research of Tolman and Lewin and the expectancy value theory, which states that an individual will be motivated, if the perceived personal needs will be satisfied (Keller, 1987a). The ARCS theory of motivation states that for a person to be motivated, four needs must be met: attention, relevance, confidence, and satisfaction (Keller, 1987a, p. 2).

The first condition for motivation is attention. It is defined as directing “attention to the appropriate stimuli,” which is sustained by responding to “the sensation-seeking needs of students and arousing[sic] their knowledge-seeking curiosity” (Keller, 1987a, p. 3). The second condition, relevance, refers to “the way something is taught” and “does not have to come from the content itself” (Keller, 1987a, p. 3). Confidence, the third condition, means to “foster the development of confidence” and assist the student in associating some level of success with effort (Keller, 1987a, p. 5). The fourth condition, satisfaction, means to incorporate strategies that “make people feel good about their accomplishments” such as natural consequences, unexpected rewards, positive outcomes, and scheduling (Keller, 1987a, p. 6).

The unique properties afforded by VR meet each of the four conditions. The 360-degree properties of VR provide a sense of presence for students that directly stimulated their sensation-seeking needs and gained attention. The narration and questioning provided by the teacher, the multiple locations in each field trip, as well as the continuous motion, maintain the attention of

students throughout the field trip (Liu, Bhagat, Gao, Chang, & Huang, 2017). The interactive nature of VR requires students to move about their physical environment. This mobility creates a unique method for teaching the instructional content and fostering relevance for students. Throughout the field trip, the teacher relates the scenes to the unit's instructional content, in addition to asking questions throughout the field trip. This repetition of content material provides the opportunity for students to build confidence (Keller, 1987a). When related to the instructional content, the virtual reality field trip creates a unique and meaningful learning activity for students (Keller, 1987b). The successful completion of the activity and the overall experience afforded by VR foster a sense of satisfaction in students (Keller, 1987b). With these four conditions of the ARCS theory of motivation met, the implementation of VR field trips was expected to increase student motivation.

Virtual reality provides content-specific, engaging, authentic learning experiences that have the potential to affect the academic achievement and motivation of seventh-grade, middle-school students. The uniqueness of the virtual reality technology captures and maintains the students' attention throughout the experience, potentially affecting students' confidence and satisfaction. Therefore, the tenets of the situated learning theory and ARCS theory of motivation support the use of virtual reality with seventh-grade, middle-school students.

## **Review of the Literature**

### **Field Trips**

Educators' desire to inspire students' interest in a subject, and field trips are a valuable resource for children to engage in curriculum content outside the traditional classroom environment (Krakowka, 2012; McCabe, Munsell, & Seiler, 2014). Students have the opportunity to interactively explore the environment and form a deeper understanding of the

content (Bauerle & Park, 2012; Johnston et al., 2017). Educators often use field trips to provide background experiences for yet-to-be introduced, formal content (Behrendt & Franklin, 2014; National Research Council, 2009; Richards, 2017). Through the experience of field trips, students can make meaningful connections to the content and internalize the concepts, because they are experiencing the content in a *real world* (Gautam et al., 2018). A well-structured field trip has positive effects on student achievement and motivation to learn the instructional content (Basten et al., 2014; Bauerle & Park, 2012; Behrendt & Franklin, 2014). For effective field trips that result in knowledge building, the event must be well structured and build upon the content being studied in the classroom (Behrendt & Franklin, 2014; National Research Council, 2009).

Physical field trips consist of taking students to physical locations. The feasibility of this is often difficult, due to finances as well as a school's location. Therefore, implementing VR field trips provides a safe and practical alternative to experiencing environments that are very expensive, environmentally damaging, dangerous, or difficult to access (Johnston et al., 2017). Although fewer than 2% of classroom educators have engaged in VR field trips with students, 85% of classroom educators feels that a virtual field trip would be as beneficial to student motivation, engagement, and academic achievement as a physical field trip (Lee et al., 2017; Samsung Electronics America, 2016; Samsung Electronics Germany, 2017; Zantua, 2017).

### **History of Virtual Reality**

While the conversation about virtual reality has increased over the past decade, the concept of physically and cognitively immersing oneself in an alternative environment is not new. The earliest documentation of alternative environments can be traced to the early 19th century, when 360-degree paintings encompassing buildings began to appear (Barber, 1991). Until the early part of the 20th century, virtual reality consisted of viewing photographs through

binocular-type devices (Barber, 1991; Steinicke, 2016). The advancements in cinematography changed the concept of virtual reality to encompass moving pictures. In 1960, Heilig patented the Telesphere Mask consisting of a headset tethered to a machine that provided the user with stereoscopic television and sound (Steinicke, 2016). In 1961, Comeau and Bryan patented a helmet device called the Headsight that allowed a person to view the video feed from a separate location, using goggles and motion sensors connected to a video camera (Steinicke, 2016). In 1962, Heilig advanced the concept of virtual reality by patenting the Sensorama simulator, the first immersive virtual reality device (Steinicke, 2016). Sensorama simulators were large arcade-style machines with panels that surrounded the users' heads, as they faced a projector screen. Sensorama simulators produced auditory, visual, aromatic, and physical stimuli, as users experienced short five-minute films, such as riding a motorcycle through Brooklyn, New York (Steinicke, 2016). Since then, the concept of immersion and VR headsets has evolved for training purposes in medicine, aeronautics, and the military (Merchant et al., 2014; Ott & Freina, 2015).

**Virtual Reality in the 1990s.** Following the invention of the stereoscopic Telesphere Mask, Sensorama simulator, and Headsight, the technology used to produce VR has continued to develop. During the 1990s, virtual reality environments were achieved using a variety of simulators and devices that were available only at select universities and laboratories. One such simulator was a large-scale VR system called the Cave Automatic Virtual Environment (CAVE). The CAVE involved a dedicated environment where surfaces, including the floor and ceiling, were projection screens. The user would wear specialized 3-D glasses to experience VR (Merchant et al., 2014; Ott & Freina, 2015). The next development was the Mini-CAVE, which was a smaller VR system. The Mini-CAVE also required a dedicated environment and used 3-D



glasses. However, only the floor and the front wall had projection screens to simulate the VR experience (Merchant et al., 2014). Both the CAVE and Mini-CAVE utilized tracking software and required a computer designed with advanced specifications to ensure that the experience happened in *real time*. Throughout the 1980s and 1990s, designers developed various virtual reality systems to integrate with the gaming systems of the era. The available technology created a lag in visual representation of physical movements and did not allow for realistic graphics (Steinicke, 2016).

In 2013, VR headsets such as the Oculus Rift, the HTC Vive, and Samsung Gear VR were developed. These systems enabled a person to experience VR, without being tethered by a cord to a computing device. Although these headsets were designed for the consumer market and were less expensive than previous VR technology hardware, the price of each device ranged from \$99 to \$800. This high price tag left VR technology beyond the budgets of most public schools.

**Smartphone Era of VR.** The smartphone era of VR is marked by the advancement of smartphones and tablets, the introduction of low-cost viewfinders, as well as corporations that are focused on developing virtual reality software (Bown, White, & Boopalan, 2017; Liu et al., 2017; Steinicke, 2016). Virtual reality can be experienced by anyone who downloads a virtual reality app and inserts a smartphone into an inexpensive stereoscopic viewfinder. Although a low-cost viewfinder, such as Google Cardboard, lacks the high-end graphics that are available on expensive devices, such as Oculus Rift, the device meets the goal set by Google: to “...make the immersive experiences available for everyone” (Simonite, 2015, para. 2).

As explained in Chapter One, Google’s 2015 launch of the Expeditions virtual reality system enabled educators to lead students through VR field trips using a tablet, wirelessly

connected to the students' viewfinders. To promote the VR experience, Google began the Expeditions Pioneer Program that offered "free complete Expeditions kits to schools around the world, including the UK, Brazil, New Zealand, Australia, and the US" (Hadjipanayiotou, 2015, para. 2). Since its introduction to K-12 classrooms in 2015, the number of VR field trips available to educators in Google Expeditions now exceeds 500 (Google, 2017). However, the research on VR field trips is limited, and, indeed, VR education, in general, is limited.

### **The Use of Virtual Reality in Education**

Prior to the smartphone era of VR, educators utilized desktop virtual reality, in which students used personal computers (Lee & Wong, 2014). A desktop virtual reality environment could be explored interactively using a keyboard, mouse, joystick, touch screen, headphones, shutter glasses, and/or data gloves (Lee & Wong, 2014). Desktop VR software created the illusion of objects being in a 3-D space using 3-D graphic technology, personalized avatars, and the ability to interact and modify objects within the environment (Barbalios, Ioannidou, Tzionas, & Paraskeuopoulos, 2013; Lindgren, Tscholl, Wang, & Johnson, 2016; Merchant et al., 2014). Common software programs included Second Life, MAT 3-D, DimensionM, Vfrog, River City, and Mr. Vetro. Although the objects and computerized environments were three dimensional on the computer screen, users' perceptions were not decoupled from the *real world*.

Several studies produced favorable results, when focused on desktop VR's effectiveness on student learning and motivation. Barbalios et al., (2013) conducted a water resource management environmental study using desktop VR. In this study, fifth-grade students were required to share a water resource, when cultivating their virtual farms and maximizing profits. The results showed an increase in achievement and knowledge retention for students in the proposed virtual environment, compared to students receiving instruction in environmental

classes (Barbalios et al., 2013). A pretest-post-test design study showed that using Vfrog, a virtual frog dissection program, enhanced motivation and achievement in high school students (Lee, Wong, & Fung, 2010). Students perceived the use of Vfrog to increase memorization and a better understanding of the concepts (Lee et al., 2010). The studies on desktop virtual reality show an increase in motivation, engagement, improved contextualization, knowledge representation, experimental learning, and effective collaboration. The assumption is that these affordances will also be apparent with smartphone VR, due to the similar features (Olmos et al., 2018).

Prior to the smartphone era of virtual reality, the research on virtual reality (VR) with school-aged children and adolescents was conducted at laboratories and select universities, thus limiting the study of its effectiveness. Nevertheless, the limited emerging studies show the positive effects of VR use in a K-12 environment to teach difficult concepts, such as abstract thought, as well as a significant increase in learning and knowledge retention (Passig & Schwartz, 2014; Passig, Tzuriel, & Eshel-Kedmi, 2016). Passig et al. (2016) studied the effect of VR instruction, using virtual glasses tethered to a computer, on the analogical reasoning ability of 117 first- and second-grade children. Groups of children received instruction through VR, 2-D computerized instruction, tangible blocks, or photographs. Children who received VR instruction exhibited the highest cognitive modifiability at the post-test, and again when tested two weeks after instruction (Passig et al., 2016). Passig and Schwartz (2014) studied the effectiveness of VR instruction on the analogical thinking of 56 immigrant children, aged four to seven years, from developing countries. The children received instruction via VR hardware or picture cards illustrating environmental relationships or related shapes. Children receiving VR instruction demonstrated greater modifiability, as compared to children who received pictorial

instruction (Passig & Schwartz, 2014). The children who received VR instruction on the relationship of objects and shapes scored higher and displayed a greater retention of the instructional material on the follow-up test given three weeks after instruction, as compared to the students who had pictorial instruction (Passig & Schwartz, 2014).

Studies on the effectiveness of VR for student learning have also been conducted with children on the autism spectrum (Lorenzo et al., 2013, 2016). The studies immersed children in various social environments that required specific social interactions and social cues. Lorenzo et al. (2016) studied the effectiveness of VR in instructing students on appropriate social cues and subsequent responses. In this study, 40 students with autism spectrum disorders experienced ten social situations using VR. These students were required to identify the emotion and formulate a proper response (Lorenzo et al., 2016). The results showed that children who experienced VR simulations gained 4.4 points on the post-test, but children in the control group gained 2.3 points on the post-test (Lorenzo et al., 2016). Lorenzo et al. (2013) studied the effectiveness of VR to “support the learning of social skills and executive functions” in the school environment for children with Asperger syndrome, and the child’s ability to transfer the learned skills to the real school environment (Lorenzo et al., 2013, p. 92). The results of the ten-month study indicated a slow but significant improvement in the scores of the 20 students who participated in VR instruction (Lorenzo et al., 2013). The results of these single-subject designs show that there may be potential to increase social intelligence and social skills of children with autism spectrum disorders. In each instance, participants who were exposed to VR exhibited an increase in learning potential, as they observed the situation surrounding them, acclimated to the stimulus, and performed the expected task.

Limited emerging studies of smartphone virtual reality systems, some product-sponsored, also demonstrated the potential to enhance academic achievement, social and emotional skills, attitude, and learning efficiency. The Beijing iBokan Wisdom Mobile Internet Technology Training Institution compared the influence of traditional celestial physics instruction with VR-based instruction on academic performance, attitude, and learning efficiency in a high school setting. The 10 students who received VR-based instruction scored 15.7% higher on assessments, than the 10 who received traditional instruction. On the retention assessment, the 10 students who received VR-based instruction scored 32.4% higher than did students who received traditional instruction, with 80% of students indicating positive attitudes about using VR for learning (Beijing Bluefocus E-Commerce Co., Ltd & Beijing iBokan Wisdom Mobile Internet Technology Training Institutions, 2016; Lin, Wang, Kuo, & Luo, 2017). Zantua (2017) also studied academic achievement and students' enthusiasm to learn by utilizing smartphone technology and the Google Cardboard virtual reality system with sixth-grade social studies students. The ten students who received virtual reality instruction scored 17% higher than the ten students who received traditional instruction. Furthermore, 95% of the students who received virtual reality instruction reported an increase in enthusiasm about the topic (Zantua, 2017). Although the sample size in each study was small, the results revealed a potential for VR use in the classroom to enhance student motivation and academic performance.

In 2017, Parmar conducted three studies relating the effect of immersive virtual reality (IVR) on the cognition and perceptions of middle-school students. Immersive virtual reality was defined as the perception of being physically present in a non-physical world created through images, sound, or other stimuli (Nechvatal, 2009). In the first study, Parmar focused on the effect of IVR on the satisfaction, engagement, enthusiasm, and motivation of female middle-

school students' perceptions of computer science using a pretest-post-test study design. Through the use of VEnvI software and Oculus Rift VR goggles, 54 female middle-school students performed tasks related to the field of computer science. Parmar (2017) concluded that the use of IVR altered the perceptions of middle-school students regarding computer science and increased their interest in computer science fields. Parmar (2017) also conducted a second study with 50 male and female middle-school students and used VEnvI software and Oculus Rift VR goggles. Findings revealed that the use of IVR enhanced the interest and motivation to learn computer science (Parmar, 2017).

In a third study, Parmar (2017) compared the use of desktop virtual reality, immersive virtual reality, and immersive embodied-view virtual reality metaphor (IEVR) on the cognition and sense of presence of 40 male and female middle-school students, as well as their perceptions of computer science. Immersive embodied-view virtual reality metaphor (IEVR) is different than immersive virtual reality in IVR. IEVR contains a self-embodiment, self-avatar that tracks the students' bodies, providing a higher sense of presence during the activity (Parmar, 2017). Results revealed a statistically significant difference in cognition, sense of presence and perceptions of computer science when using IEVR over using IVR and desktop virtual reality (Parmar, 2017). There was also a statistically significant difference in cognition, sense of presence, and perceptions of computer science when using IVR over using desktop virtual reality (Parmar, 2017).

When using VR, abstract concepts transform to concrete concepts, and impossible can become practical (Slater, 2017). The implementation of VR into the K-12 classroom provides an experimental learning experience that “supports challenged learners, works well to bypass language literacy and improves[sic] retention of learning material” (Johnston et al., 2017, p. 2)

through embodied learning, high levels of interaction, and students' individualized learning style (Liu et al., 2017). With the adoption of VR technology, students' experiences are not limited by socioeconomics or location. Students are able to participate in exotic events, explore foreign lands, and investigate previously unknown career opportunities (Dede, Jacobson, & Richards, 2017; Parmar, 2017; Zantua, 2017).

The positive results of desktop virtual reality studies and the limited product-sponsored virtual reality studies reveal the potential for virtual reality field trips to affect student academic achievement and motivation. Each of the studies that were conducted had small sample sizes that hinder the generalization of findings. Although the potential of VR technology seems unlimited, empirical studies are needed to corroborate the assumptions and further demonstrate its efficacy.

### **Summary**

The evolution of virtual reality technology over the past century has resulted in a low-cost device that provides a virtual reality (VR) experience to anyone with a smartphone. While a dearth of VR studies exists, especially with primary and secondary school students, the limited emerging studies exhibit the potential to increase motivation and enhance learning outcomes, when the VR content is aligned with educational goals (Barbalios et al., 2013; Kramer, 2017; Lee et al., 2010). Barbalios et al., (2013) showed in his experimental study that virtual instruction on desktops can improve the academic performance of middle-school students. Zantua (2017) showed in his experimental study that smartphone virtual instruction can improve the motivation to learn for middle-school students. With the ubiquitous availability of high-speed Internet connectivity and the adoption of 1:1 computing devices, VR capabilities are moving into the K-12 environment (Richards, 2017). The Google Expeditions VR platform

provides an integration path for utilizing this technology in the K-12 classroom to build upon the emerging studies (Olmos et al., 2018).



## **CHAPTER THREE: METHODOLOGY**

### **Introduction**

Due to a dearth of empirical research on the use of virtual reality (VR) in the K-12 environment, this study investigated the possible influence of VR field trips on the academic achievement and motivation of seventh-grade, middle-school students. The design of this study was a quantitative, quasi-experimental, pretest-post-test non-equivalent control-group design. This study addressed two specific research questions: (a) While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction compared to traditional instruction, influence the social studies academic achievement of seventh-grade, middle-school students? (b) While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction compared to traditional instruction, influence the motivation of seventh-grade, middle-school students? Instruments used to measure social studies academic achievement and motivation were the teacher-designed social studies test (see Appendix A), and the Instructional Materials Motivation Survey (Keller, 2009) (see Appendix B). This chapter discusses the design of the study, participants, setting, instrumentation, data collection, data analysis, and limitations.

### **The Design**

A quantitative, quasi-experimental, pretest-post-test non-equivalent control group design was used to compare two groups of seventh-grade, middle-school students, a treatment group and a control group. The independent variable was the type of instruction. The students in the control group received traditional instruction, whereas students in the treatment group received a combination of traditional instruction and virtual reality field trips to the locations referenced in

the traditional instruction. Random assignment was not possible. Therefore, intact groups were used for the treatment group and the control group, based on the class assignments of students.

After participation in the instruction, students were assessed on their academic achievement and motivation to learn. The first dependent variable, social studies academic achievement, was measured by a teacher designed social studies test. Its validity was established through a review by content area experts, using an item analysis checklist described further in this chapter. The second dependent variable, motivation to learn, was measured by the Instructional Materials Motivation Survey. Students also took a pretest for academic achievement (see Appendix A) and a pretest for motivation to learn (see Appendix B). Because the groups were intact and assumed to be non-equivalent, the use of a pretest was essential to control for threats to validity (Tuckman & Harper, 2012). More specifically, to minimize the selection threat of validity, the covariates of academic achievement and motivation to learn were included in the statistical analysis to control for preexisting differences between the groups.

The quasi-experimental, pretest-post-test non-equivalent control group design is a rigorous design that confirms the “essential equivalence of the control and experimental groups” (Tuckman & Harper, 2012, p. 151), prior to manipulation of the independent variable to “assess the degree of change in the dependent variable” (Tuckman & Harper, 2012, p. 154). This design was an appropriate design for this study not only because it is a rigorous design, but because it is used in virtual reality and augmented reality research with students (Estapa & Nadolny, 2015; Kim, 2006; Passig & Schwartz, 2014).

### **Participants**

The study used the convenience sampling technique because of the proximity and convenient accessibility of the students (Creswell, 2015). Participants for this study were

selected from two schools in a rural school district in a county in West Tennessee. The socio-economic conditions of this county create a unique setting for this study. First, the educational attainment for adults is below the state average. According to U.S. Census Bureau data, the county is ranked 58th in the state for education attainment (statisticalatlas.com, 2018). The 2018 Tennessee Higher Commission and Tennessee Student Assistance Corporation indicates 86% of the adults in the county obtained a high school education, compared to the state percentage of 88%. In addition, only 12% of adults obtained a bachelor's degree, compared to the state average of 27%.

Schools within District X have been classified as 'high-needs' schools, due to the percentage of students who come from families with incomes below the poverty level. According to the 2018 Tennessee Higher Commission and Tennessee Student Assistance Corporation, the \$32,000 median household income is well below the state average of \$46,500 median household income. The poverty rate is 23.1% with an unemployment rate of 7.5%, which are above the state average (Tennessee Higher Commission and Tennessee Student Assistance Corporation, 2018). A lack of employment opportunities exists in this county, due to the absence of large corporations or manufacturing facilities. As a result, the school system is the largest employer in the county.

There were several students in the sample population who were from families with a high incidence of generational poverty. Generational poverty is defined as being in poverty for two generations or longer (Payne, 1998). Food insecurity, "which is a condition in which a household lacks access to adequate food because of limited money or other resources" (Gundersen & Ziliak, 2015, p. 1830), was also a concern. A total of 78% of the students qualified for the school's free or reduced lunch program. Students from generational poverty

lack the socialization present in middle-class homes, which contributes to success in school (Lee & Buxton, 2008; Payne, 1998). It has been observed that where generational poverty exists, education is often not valued, and students exhibit poor attendance and lack of motivation to learn (Van der Berg, 2008). Food insecurity also affects student learning, since these students have a higher percentage of tardiness and absenteeism, thereby reducing their exposure to instruction (Jyoti, Frongillo, & Jones, 2005; Lee & Buxton, 2008; Winicki & Jemison, 2003).

The convenience sample for this study consisted of 87 seventh-grade, middle-school students ages 12 to 13. The middle-school population was chosen for this study based on virtual reality product safety warnings. Although studies had been conducted using virtual reality with young children, product safety warnings explicitly state that children under the age of 13 should not use virtual reality, due to the potential disruption in the critical period of visual development (Lorenzo et al., 2013, 2016; Oculus, 2017; Passig, 2015; Passig et al., 2016; Passig & Schwartz, 2014).

For this study, there was volunteer rate of 85% ( $N=76$ ). Of the 76 volunteer students, 42 students were assigned to the treatment group, and 34 students were assigned to the control group. The 42 students in the treatment group were from School 1, and 34 students in the control group were from School 2. Each school had two seventh-grade classes used in the study, and all students were invited to participate in the study. In both the treatment school and the control school, there were two separate classes that were taught on the same day by the same teacher. The students were taught the same materials, but at separate times. The students at the two schools had similar in demographic characteristics. The ethnicity of the sample population was 91% Caucasian and 9% African American. In this study, 45% of the participants were male, 55% participants were female, and 21% of the participants receive special services (see Table 2).

Special services at the participating school, include modification of the learning environment, extended time limits on assignments, peer tutoring, support from a special education teacher’s assistant, and 30 minutes of additional instruction in reading and mathematics each day.

Table 2

*Participant Demographics (N=76)*

Characteristics	Treatment	Control
Total	42 (55%)	34 (45%)
Males	18 (43%)	16 (47%)
Females	24 (57%)	18 (53%)
Caucasian	40 (95%)	29 (85%)
African American	2 (5%)	5 (15%)
SPED / 504	11 (26%)	5 (15%)

To determine the needed sample size for this study, an a priori power analysis was conducted using the G\*Power 3.0.10 software. The a priori analyses provided “an efficient method of controlling statistical power before a study is actually conducted” (Faul, Erdfelder, Lahg, & Buchner, 2007, p. 176). The effect size for this study was .5 with an alpha = .05 and power = 0.80. According to the results, the needed sample size for this study was 27 students in the control group and 27 students in the treatment group. Each school chosen to participate in this study had 35 or more students enrolled in the 7th grade. Therefore, the needed sample size of 27 students per group was met.

**Setting**

The study took place at two elementary schools (i.e. School 1 and School 2) within the same school district (i.e., District X) in a rural county in West Tennessee.

Although located in an economically disadvantaged county, District X is considered an ‘early adopter’ of technology in its schools. In 2007, District X instituted a ‘one-to-one’ laptop

initiative and provided extensive professional development for ‘one-to-one’ classroom teachers. By 2012, there were at least two ‘one-to-one’ classrooms in grades four through eight at every school, and each high school had at least one computer lab and one mobile laptop cart. By 2017, every third through eighth grade classroom in District X has at least one mobile Chromebook cart per grade.

School 1 has also led the district in the early adoption of technology. In 2005, School 1 received a technology grant that provided laptop carts, document cameras, student response systems, projectors, smartboards, and funds for teacher professional development. By 2008, School 1 exceeded the district with five ‘one-to-one’ classrooms in grades four through eight. In 2012, School 1 purchased two classroom sets of iPad 2s for use with students in kindergarten through third grade. By 2017, classroom projectors and smart boards were being replaced with 65” smart TVs, and there was a video journalism class publishing daily newscasts via the Internet. There were two computer labs in the school, as well as two mobile Chromebook carts to use in the first through third grades. In addition, every classroom in grades six through eight have a set of Chromebooks.

District X was chosen for this study due to its proximity and the district’s reputation for implementing innovative technology and learning strategies into the classrooms. School 1 and School 2 were selected for the study due to their proximity to one another, similarity in terms of geographic location, and student body demographics, as described above. Both School 1 and School 2 had a population of approximately 412 students in grades pre-kindergarten to eighth grade, and each school had one head principal and one assistant principal.

The study took place in the seventh-grade social studies classroom at School 1 and School 2. To control for threats to validity, such as diffusion of treatment, the two seventh-grade

classes at School 1 served as the treatment group, and the two seventh-grade classes at School 2 served as the control group. School 1 and School 2 had slightly different classroom arrangements. However, the classrooms were similar in terms of size, décor, and resources. School 1 had rows of individual desks facing the front that were moved into groups of four during instruction. School 2 had tables arranged into groups for independent work and instruction. Teachers at School 1 and School 2 had access to similar technological devices. Each classroom utilized whiteboards and multimedia projectors linked to computers for instruction (see Figures 6 and 7). The School 1 (treatment group) and School 2 (control group) each had two classes that participated in the study. The class size for School 1 averaged 24 students per class, and the class size for School 2 averaged 21 students per class.



*Figure 6.* A photograph of Teacher A's classroom at School 1.



*Figure 7.* A photograph of Teacher B’s classroom at School 2.

## **Teachers**

The seventh-grade teachers implementing the study were both highly qualified and certified to teach seventh-grade social studies in Tennessee. Teacher A at School 1 had nine years of teaching experience in West Tennessee, and Teacher B at School 2 had eight years of teaching experience in West Tennessee. Neither teacher had teaching experience outside of West Tennessee. Teacher A and Teacher B had access to Internet connected technologies to use in their classrooms for instructional purposes and for individual student use.

## **Intervention**

Both teachers implemented the 7<sup>th</sup> grade Tennessee Social Studies Standards for 2018-2019, which focused on World History and Geography. The curriculum content selected for this study was Medieval Europe from A.D. 500 to 1475. This correlated with the 2018-2019 Tennessee Seventh Grade Social Studies Standards 7.27 – 7.39 (see Appendix C). The



instructional content in this study included the geographic, political, economic, and cultural structure of Europe during the Middle Ages. The treatment group at School 1 and the control group at School 2 received explicit instruction regarding “Medieval Europe A.D. 500 to 1475” through the use of the grade seven textbook, *Tennessee Discovering our Past: A History of the World Modern Times*, published by McGraw-Hill Education. The study took place during the Medieval Europe A.D. 500 to 1475 unit for the duration of 21 school days. The instructional time for the control group and the treatment group of 19.25 hours was equivalent.

In this study, the control group of seventh-grade, middle-school students at School 2, with Teacher B, received instruction through traditional teaching methods (i.e. textbooks, notetaking, instructional videos, and lecture). For this study, traditional teaching methods were defined as the predominant use of direct instruction as a teaching strategy.

In this study, the treatment group of seventh-grade, middle-school students at School 1, with Teacher A, received instruction through traditional methods (i.e., textbooks, notetaking, instructional videos, and lecture). In addition, virtual reality (VR) fieldtrips were used during three lessons for approximately 33 minutes per lesson totaling 109 minutes of VR during the instructional unit. The 109 minutes of VR instruction was included in the 19.25 hours of instruction for this study.

To conduct the VR field trips, the teacher used an ACER Iconia 10 tablet with the Google Expeditions application installed, 12 iBlue Google VR 3-D Glasses, and 12 Zenfone Zoom smartphones with the Google Expeditions application installed (see Figure 8). The target audience of this research study was 12 to 13 years of age, which met the suggested participant age from the product safety warnings provided by the manufacturer of the VR viewfinders. The warnings published by the manufacturers cautioned using VR viewfinders for extended time

periods (Oculus, 2017). To control for this threat, the head straps were removed from the viewfinders, and users were required to hold the viewfinder to their faces. The students also lowered their viewfinders during the field trips to talk to one another about the experience, as well as between field trips for whole group discussion. This reduced the length of time for full engagement with the screen.



*Figure 8.* The ACER tablet, 12 iBlue Google VR 3-D Glasses, and 12 Zenfone Zoom smart phones loaded with the Google Expeditions application.

During this study, Teacher A conducted 14 virtual field trips related to Medieval Europe studying topics pertaining to the time period (see Table 3). The VR field trips were conducted at the beginning of the instructional time prior to beginning the lesson using devices referenced above. Using the ACER Iconia 10 tablet, the teacher selected the virtual field trip from the Expedition app home screen (see Figure 9), and students raised their viewfinders. When the teacher pressed the play icon on the tablet, the first scene of the field trip appeared in the viewfinders of the students with an arrow directing the students where to focus (see Figure 10). Students who experienced focusing problems with the iBlue Google VR 3-D Glasses during a virtual field trip, were given an iPad 2 in place of the viewfinder.

Table 3

*Title, Scenes, and Duration of Virtual Field Trips.*

Expedition Title	Number of Scenes	Duration in Minutes
Cistercian Monastery of Veruela	6	7
Field Trip to Belgium	8	7
Arbeia Roman Fort and Museum	5	6
Historic Places: A Brief History of the UK	10	12
Pomp and Pleasure: Palaces & Gardens of French Nobility	10	12
Field Trip to Switzerland	7	8
Famous Landmarks Around the World	6	7
Ancient Roman Ruins in England and France	7	9
Medieval Ruins in Britain and France	8	7
Castle Rushen, Part 1: The Medieval Castle	6	8
Holy Places of Jerusalem	6	7
Robin Hood	9	5
The Silk Road	5	8
Venice	5	6

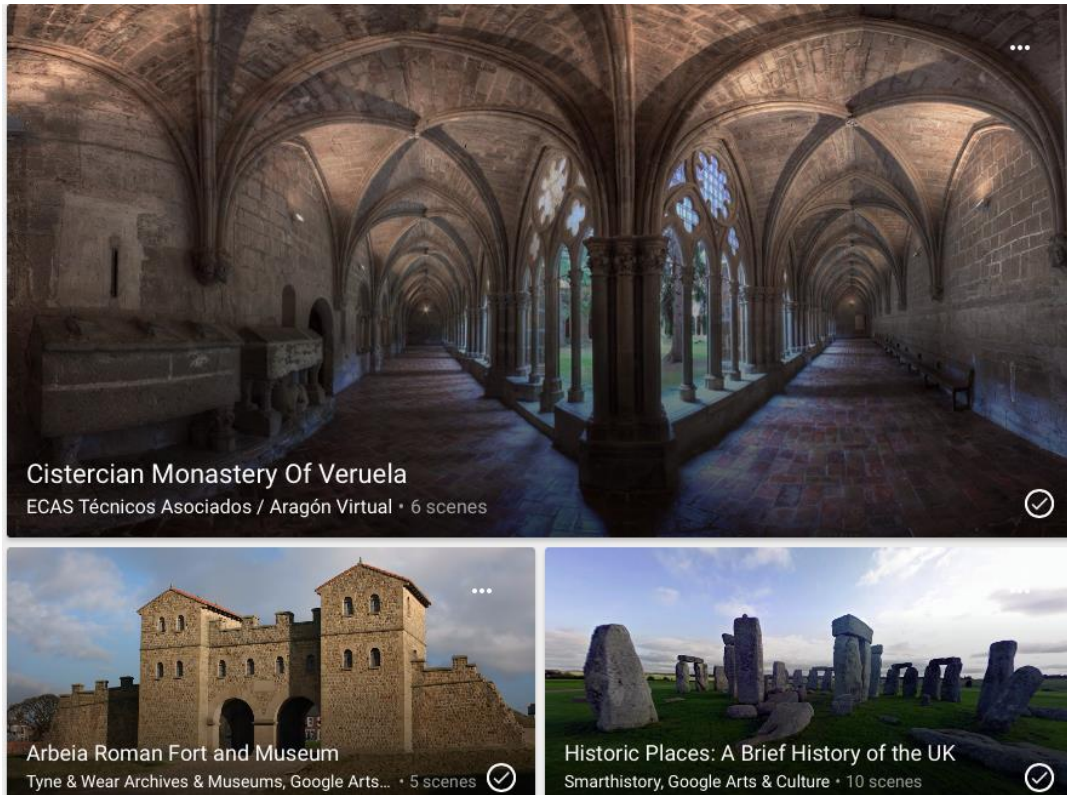


Figure 9. A screenshot of Google Expeditions that appeared on the teacher's tablet. (Vida Systems, 2017)

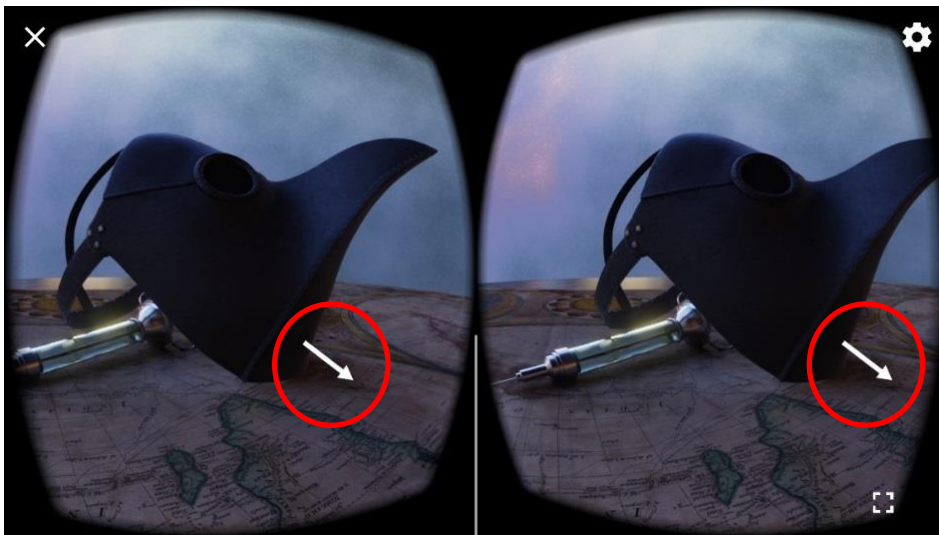


Figure 10. A screenshot from *The Plague (Black Death)* expedition showing the arrow directing students where to turn. (Vida Systems, 2017)

During the field trip, Teacher A read the script accompanying each scene, as students followed the arrow in the viewfinder to the location of discussion (see Figure 11). Smiley icons appeared on the teacher's tablet to indicate the location of students' attention.

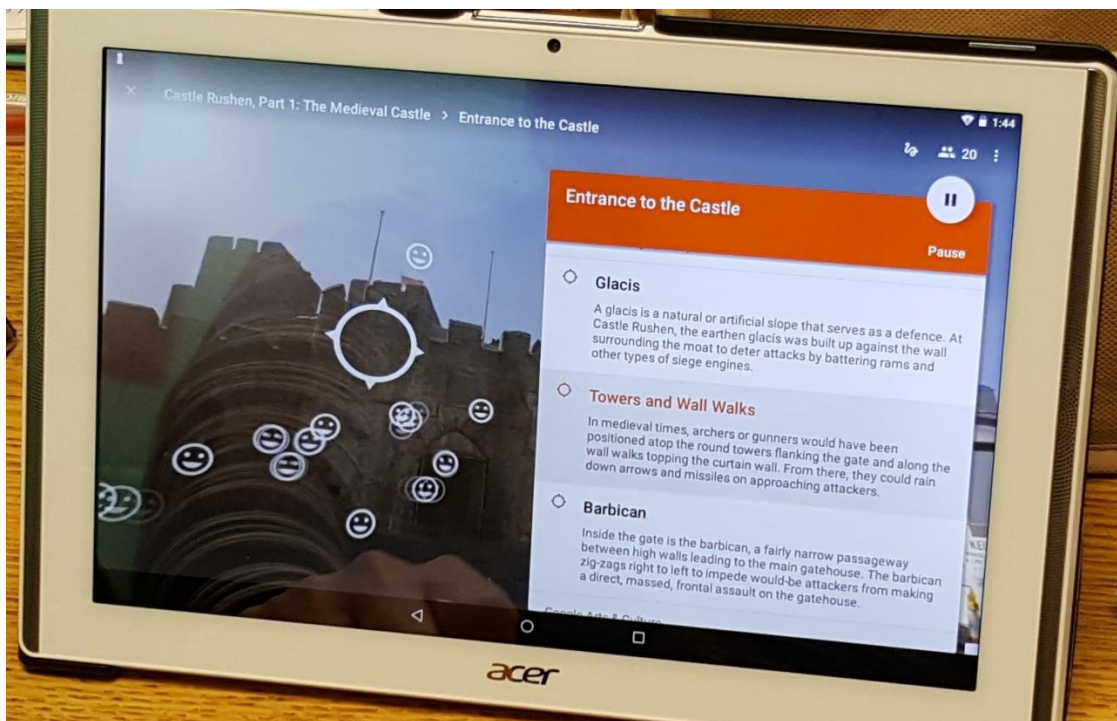


Figure 11. A screen shot of the Expedition script with smiley icons indicating the location of students' attention.

## Instrumentation

### Social Studies Academic Achievement

Prior to and after the Medieval Europe unit, the control group and treatment group were assessed using two measures. To measure the first control and dependent variable, academic achievement, a social studies test was used (see Appendix A). This instrument was a 36-question multiple choice social studies test designed by the teachers to address the content covered in the instructional unit. Thirty-six questions were developed to correlate with the State of Tennessee Seventh Grade Social Studies Standards 7.27 through 7.39 (see Appendix C) and

derived from the lecture notes and the McGraw-Hill Connect Ed question bank for the Grade Seven *Tennessee Discovering our Past: A History of the World Modern Times* textbook. The instrument was administered via pencil and paper and was scored on a scale of zero to 100 with each item worth 2.78 points.

To ensure content validity, an expert review panel of four educators were selected to ensure that the 39 social studies test questions measured the intended content and were correlated to the social studies standards. Each reviewer was required to meet a minimum of the following criteria: hold a master's degree in Elementary Education and with at least five years of classroom teaching experience in middle school. All four educators were highly qualified to teach middle-school social studies. Using an item analysis rating the relevancy of each item on a scale of one to ten, each reviewer had one week to evaluate the instrument and provide feedback. Of the 39 social studies test questions, three questions scored below a seven on the relevancy scale and were removed from the exam. The expert panel suggested rearranging the order of the test questions, according to the subject matter and rewrite one question that was confusing. The expert panel feedback was reviewed, and the items were modified as suggested. Cronbach's alpha coefficient determined the internal reliability. The value for the test was of .895, which exceeded the suggested score for high reliability of .70 (Santos, 1999).

### **The Motivation of Seventh-Grade Social Studies Students**

The Instructional Materials Motivation Survey (IMMS) was used as the pretest (see Appendix B) and post-test (see Appendix E) to measure the second covariate and dependent variable, the motivation of seventh-grade, middle-school students. The IMMS was “designed to measure situation-specific attitudes” and correlate “to the conceptual structure of the ARCS model,” corresponding to the theoretical framework for this study (Keller, 2009, p. 11). The

IMMS had been shown to be a reliable instrument normed and validated for measuring the motivation of middle-school students (Keller, 2009). The IMMS consisted of 39 questions, such as “completing the activities in this unit gave me a satisfying feeling of accomplishment.” Following each item was a five-point Likert-type scale of potential responses: very true (5), mostly true (4), moderately true (3), slightly true (2), and not true (1). Of the 39 items, 10 items were reverse-scored where appropriate, such as “The pages of this unit looked dry and unappealing.” This ensured that the least favorable choice was always assigned a value of one, and the most favorable choice was always assigned a value of five. Therefore, the total possible scores ranged from 39 to 156, with higher scores reflecting a stronger sense of motivation. To determine internal reliability for the present sample, Cronbach’s alpha coefficient was used on the post-test. The value was .924 and exceeded the suggested score for high reliability .70 (Santos, 1999).

This instrument was administered to the control group and the treatment group before and after the instructional unit. The survey measured seventh-grade, middle-school students’ attitude toward the content being studied in the social studies instructional unit. The survey also measured seventh-grade, middle-school students’ motivation to learn the social studies content. Permission to use the survey was granted (see Appendix E) and was administered through Google Forms for seventh-grade, middle-school students at Schools 1 and 2.

### **Procedures**

Prior to the approval of the Institutional Review Board (IRB), I met with the Director of Schools and gained permission to conduct the research study within the selected schools (see Appendix F). I provided the Director of Schools with a letter outlining the purpose,

requirements, and deadlines for the study, and identified the two schools selected to participate in the study. IRB approval was then granted (see Appendix G).

I met with the principal and 7th grade social studies teacher at School 1 to explain the details of the research study. I explained that School 1 was chosen to receive the virtual reality (VR) field trip instruction modification. I also met with the principal and 7th grade social studies teacher at School 2 and explained the details of the study. I explained that the students at School 2 were chosen as the control group for the study.

Prior to leaving for winter break, Teacher A and Teacher B introduced the research study to their students. Teacher A and Teacher B distributed the Parent Consent to Participate letter and Student Assent letter to all students. Teacher A and Teacher B explained each document and stated that each form needed to be signed and returned (see Appendix H and Appendix I). To control for the design contamination threat to validity, the teachers did not mention the use of VR technology. All students participated in the instructional unit, after returning from winter break. Data were collected for the students who returned the Parent Consent to Participate letter and the Student Assent letter.

Prior to beginning the instructional unit, Teacher A received the equipment needed to conduct VR field trips. In a one-hour training session, Teacher A was trained on how to operate the VR equipment (See Appendix J): an ACER Iconia 10 tablet with the Google Expeditions application installed, 12 iBlue Google VR 3-D Glasses, and 12 Zenfone Zoom smartphones with the Google Expeditions application installed. Teacher A and I evaluated the lesson plans for the instructional unit and the integration of the VR field trips. After meeting with Teacher A, I met with Teacher B to review the instructional unit lesson plans and answered questions.



Prior to beginning the instructional unit, Teacher A and Teacher B administered the Instructional Materials Motivation Survey (IMMS) #1 via Google Forms and the pretest via paper to assess the students' knowledge of the instructional content (see Appendix B and Appendix A). For the instructional unit, Teacher A and Teacher B followed the same lesson plan (see Table 4). During the instructional unit, I spoke with each teacher verifying the use of the lesson plans to assess fidelity. I also observed two lessons using VR field trips.

Table 4

*Instructional unit lesson plans outline for Teacher A and Teacher B.*

Lesson	Objective	Duration	Curriculum Standard
1	Identify and locate the geographical features of Europe on a map.	50 min	7.27
2	Describe the role of monasteries in the preservation of knowledge and spread of Catholic Church beyond the Alps	125 min	7.28
3	Explain how Charlemagne shaped and defined medieval Europe including: his impact on feudalism, the creation of the Holy Roman Empire, and the establishment of Christianity as the religion of the Empire.	150 min	7.29
4	Describe how feudalism and manorialism developed and their role in the medieval European economy. Describe how they were influenced by the physical geography.	150 min	7.30
5	Analyze the Battle of Hastings and the long-term historical impact of William the Conqueror on England and Northern France.	100 min	7.31
6	Describe how political relationships both fostered cooperation and led to conflict between the Papacy and European monarchs. Analyze the impact of the Magna Carta.	150 min	7.32 & 7.33

Table 4  
(continued)

Lesson	Objective	Duration	Curriculum Standard
7	Analyze the causes, effects, and key people of the 1st, 2nd, and 3rd Crusades, including Pope Urban II, Saladin, and Richard I. Explain how the Crusades impacted Christian, Muslim and Jewish populations in Europe.	150 min	7.34 & 7.35
8	Describe the economic and social effect of the spread of the Black Death and its impact on the global population. Analyze the importance of the Black Death on the emergence of a modern economy.	130 min	7.36 & 7.37
9	Describe the significance of the Hundred Years War, including Henry V and Joan of Arc.	50 min	7.38
10	Explain the significance of the Reconquista, Inquisition, and the rise of Spanish and Portuguese kingdoms in the Iberian Peninsula.	100 min	7.39
11	Administer social studies test	55 min	

After the 19.25-hour studies instructional unit, the social studies test was given to the control group and the treatment group via pencil and paper (see Appendix A). Testing data were collected on the 76 students who returned the letters of consent. Teacher A and Teacher B replaced student names with an identification number to protect students' identity, when providing me with results of the pretests, post-tests, and motivational studies. At the conclusion of the social studies test, students who returned the letters of consent completed the IMMS Survey #2 (see Appendix D). The students' test results and the survey results were entered into the SPSS program for data analysis.

## Data Analysis

### Research Question One

One-way analysis of covariance (ANCOVA) was used to examine the null hypothesis: While controlling for a pretest, the use of virtual reality field trips integrated into social studies instruction does not significantly influence the social studies academic achievement of seventh-grade, middle-school students, as compared to those who are exposed to traditional instruction. For this question, an ANCOVA was the most appropriate model for data analysis, since it statistically controls for covariates and reduces bias in non-randomized studies, while controlling for a pretest (Porter & Raudenbush, 1987; Rovai, Baker, & Ponton, 2013). The social studies test scores of the control group and the treatment group were the dependent covariant. The independent variable was the type of instruction. The treatment group used the virtual reality (VR) hardware during instruction, and the control group did not use the VR hardware during instruction. The pretest scores on the social studies test for the control group and the treatment group served as the control variable and for comparison of the post-test scores on the social studies test (Salkind, 2010). As is the convention in social science research, a significance level of .05 was used to make a decision of whether or not to reject or fail to reject the null hypothesis (Gall, Gall, & Borg, 2007). Prior to conducting the ANCOVA, assumption testing was conducted to determine if a parametric analysis was appropriate. Cronbach's alpha coefficient was used to determine the reliability of the covariate of the data in the study sample with a score of .895, exceeding the suggested score for high reliability of .70 (Santos, 1999). The assumption of normality was examined by conducting a Shapiro-Wilk normality test for each independent variable. The test of homogeneity of variance was evaluated using Levene's Test for Equality of Variance, with a significance level of less than .05.

## **Research Question Two**

One-way analysis of covariance (ANCOVA) was also used to examine the second null hypothesis: While controlling for a pretest, there is no significant difference in the motivation of seventh-grade, middle-school students exposed to virtual reality field trips, as compared to those who are exposed to traditional instruction. For this question, an ANCOVA was also the most appropriate model for data analysis to reduce bias in non-randomized studies and control for covariates, while controlling for a pretest (Porter & Raudenbush, 1987; Rovai et al., 2013). The type of instruction used during the study was the independent variable. The treatment group used the virtual reality hardware during instruction, and the control group did not use the VR hardware during instruction. The Instructional Materials Motivation Survey (IMMS) pretest scores were the control variable, and the post-test scores served as the dependent variable (Salkind, 2010). The assumption of normality was examined by conducting a Shapiro-Wilk normality test for each independent variable. The test of homogeneity of variance was evaluated using Levene's Test for Equality of Variance, with a significance level of less than .05.

### **Delimitations, Limitations & Ethical Issues**

For this study, there were three primary limitations. The first limitation was the lack of randomization and ethnic diversity of the population sample. Schools 1 and 2 were similar in population demographics and geographic location. Therefore, the data represents one environment. This limited the generalization of the study findings to other middle-school settings. The second limitation was experiment contamination due to the frequent interactions of the participants from Schools 1 and 2. The third limitation was the threat to internal validity, due to the prior knowledge of the topic and was mitigated using a pretest-post-test research design.

For this study, I chose to study seventh-grade, middle-school students, instead of seventh and eighth grade, middle-school students. Although Teachers A and B in this study also instruct eighth grade students, the curriculum standards for eighth grade students were focused specifically on the history of the United States, as opposed to the seventh-grade world history curriculum.

To ensure confidentiality of the school district, individual schools, and teachers associated with this study, a pseudonym was used for identification. Deidentification was used on all student data to ensure confidentiality of student information. The data collected was stored on an external drive and secured in a locked cabinet to ensure the security of the findings.

As a member of the faculty at the treatment school and having relationships with the participants in the study, I limited my interactions with the participants for the duration of the study to control for contamination and bias.

## **CHAPTER FOUR: RESULTS**

### **Introduction**

The data analyses were conducted to address the purpose of this study, which was to examine the efficacy of virtual reality (VR) field trips on seventh-grade, middle-school students' social studies academic achievement and motivation. This study investigated two research questions: (a) While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction compared to traditional instruction, influence the social studies academic achievement of seventh-grade, middle-school students? (b) While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction compared to traditional instruction, influence the motivation of seventh-grade, middle-school students? This chapter discusses the results of the data analysis for the one-way analysis of covariance (ANCOVA) tests conducted.

### **Social Studies Academic Achievement**

An analysis of covariance (ANCOVA) was conducted to determine a statistically significant difference in the academic achievement of seventh-grade, middle-school students who experienced virtual reality field trips, in addition to traditional instruction, and seventh-grade, middle-school students who only received traditional instruction, while controlling for a pretest. The descriptive statistics for the treatment group (virtual reality) and the control group (traditional instruction) are outlined in Table 5.

Table 5

*Means, Adjusted Means, Standard Deviations and Standard Errors for the Social Studies Test: Pretest and Post-test*

Group	Pretest		Post-test	
	<i>M (SD)</i>	<i>SE</i>	<i>M (SD)</i>	<i>M<sub>adj</sub> (SE)</i>
Treatment	38.48 (8.771)	1.293	81.33 (16.785)	85.418 (1.965)
Control	50.23 (16.148)	2.730	76.26 (15.785)	71.219 (2.203)

Prior to conducting the ANCOVA, assumption testing was completed using boxplot analysis, linearity assumption and Levene’s test for equality of variances. An inspection of the boxplot (see Figure 12), indicated that there were no extreme outliers in the data.

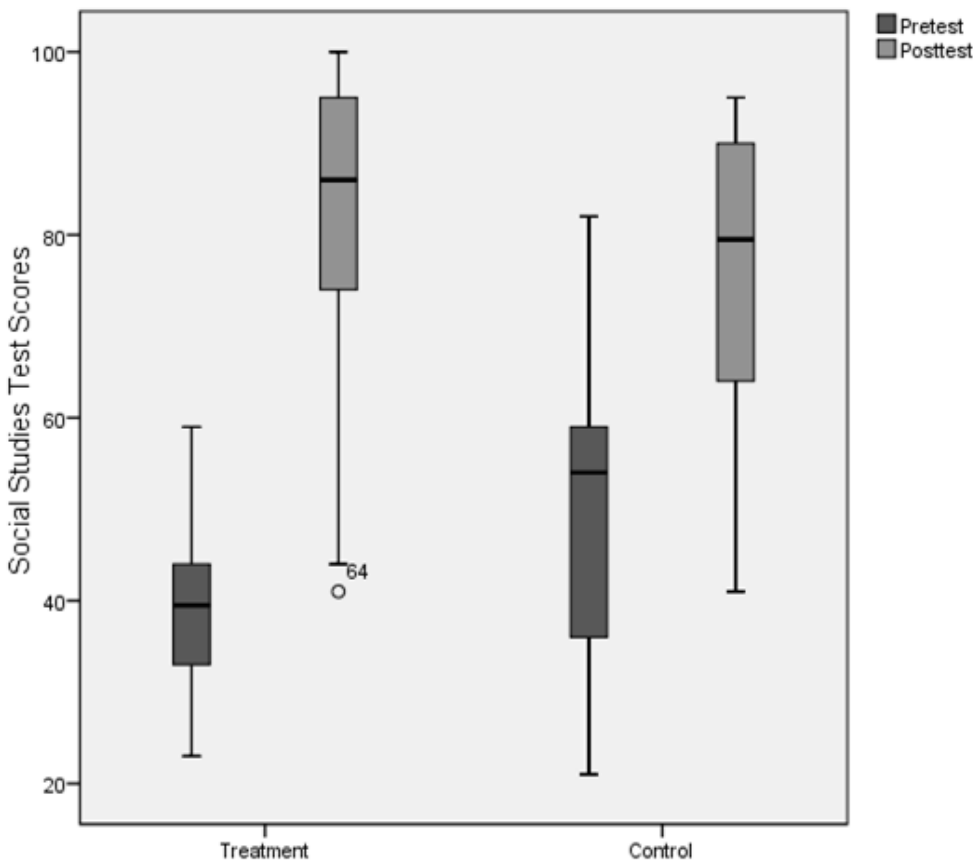


Figure 12. Boxplot of social studies test scores

The results of the Levene's test for equality of variances ( $p = .120$ ) demonstrated that the assumption of homogeneity of variances was not violated. Examining the scatterplot, it was determined that there was a linear relationship between the social studies pretest and the social studies post-test.

However, the dependent variable was not normally distributed for either group as assessed by the Shapiro-Wilk test ( $p < .05$ ). Post-test scores were positively skewed, and the assumption of normality was violated for both groups. However, the ANCOVA remains robust against minor violations in normality. Therefore, the decision was made to continue with the ANCOVA (Warner, 2013).

A significant difference in the pretest scores existed between the two groups,  $F(76)=21.415, p < .001, \eta^2 = .227$ . Thus, the ANCOVA was the most appropriate analysis to analyze, as it controlled for the preexisting differences while examining the difference in the post-test scores (Warner, 2013). After adjustment for pretest scores, there was a statistically significant difference in the post-test scores between the two types of instruction,  $F(76) = 58.653, p < .001, \eta^2=.446$ . Therefore, the null hypothesis was rejected. Inspection of the descriptive statistics indicated that students receiving the virtual reality field trips, in addition to traditional instruction, scored higher on the social studies post-test than the students receiving only traditional instruction. Effect size, based on Cohen (1988), was medium to large,  $\eta^2 = .446$ . The strength of the relationship between the intervention and social studies test scores was moderately strong, with the intervention accounting for 44.6% of the variance of the dependent variable. The power was strong at 1.00, indicating 100% accuracy.



## Motivation

An analysis of covariance (ANCOVA) was also conducted to determine a statistically significant difference in the motivation of seventh-grade, middle-school students who experienced virtual reality field trips, in addition to traditional instruction, and seventh-grade, middle-school students who only received traditional instruction, while controlling for a pretest. The descriptive statistics for the treatment group (virtual reality) and the control group (traditional instruction) are outlined in Table 6.

Table 6

*Means, Adjusted Means, Standard Deviations and Standard Errors for the Instructional Materials Motivation Survey: Pretest and Post-test*

Group	Pretest		Post-test	
	<i>M (SD)</i>	<i>SE</i>	<i>M (SD)</i>	<i>M<sub>adj</sub> (SE)</i>
Treatment	3.34 (.57134)	.089	3.6158 (.62629)	3.569 (.086)
Control	2.91 (.64877)	.104	3.1233 (.50820)	3.192 (.105)

Prior to conducting the ANCOVA, assumption testing was completed using boxplot analysis, linearity assumption, and Levene's test for equality of variances. Through the inspection of a boxplot (see Figure 13), there was one outlier in the data.

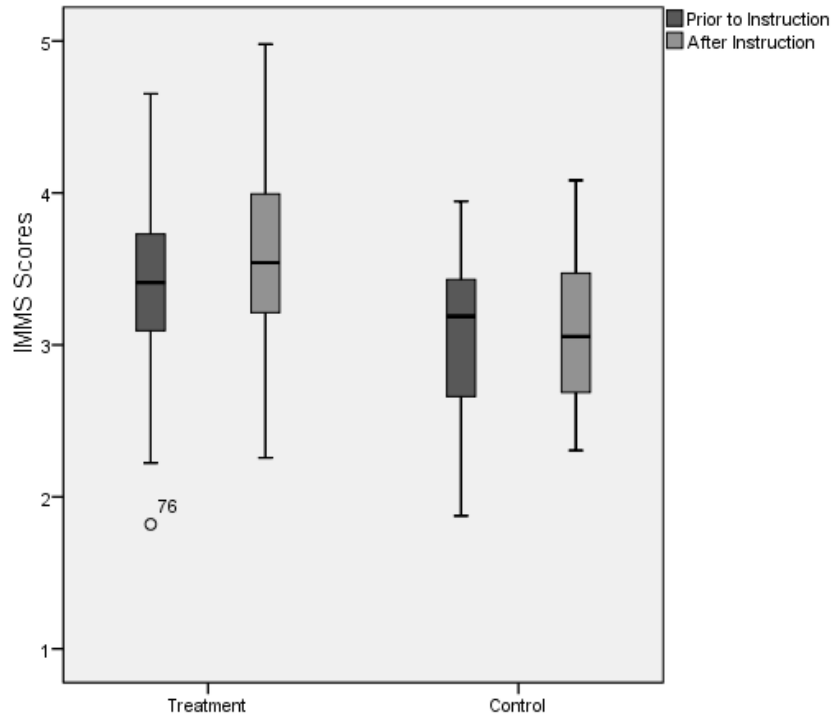


Figure 13. Boxplot of IMMS scores

The results of the Levene's test for equality of variances ( $p = .140$ ) demonstrated that the assumption of homogeneity of variances was not violated. Examining the scatterplot, it was determined that there was a linear relationship between the social studies pretest and the social studies post-test, allowing for parametric statistics (Warner, 2013).

Although post-test scores had a slight positive skew, the assumption of normality was not violated for either group, as assessed by Shapiro Wilks (see Table 7). The ANCOVA remains robust against minor violations in normality. Therefore, the decision was made to continue with the ANCOVA (Warner, 2013).

Table 7

*Shapiro-Wilks Test of Normality for the Instructional Materials Motivation Survey*

Group	Statistic	df	p
Treatment	.976	44	.491
Control	.957	30	.257

A significant difference in the pretest scores existed between the two groups,  $F(76)=7.415, p > .005, \eta^2 = .097$ . Thus, the ANCOVA was the most appropriate analysis to analyze the difference in the post-test scores, since it statistically removes the effect of the covariate influence (Warner, 2013). After adjustment for pretest scores, the results of the ANCOVA demonstrated that there was a statistically significant difference in the post-test scores between the two types of instruction,  $F(76) = 8.633, p < .005, \eta^2=.111$ . Therefore, the null hypothesis was rejected. Inspection of the descriptive statistics indicated that students receiving the virtual reality field trips, in addition to traditional instruction, scored higher on the Instructional Materials Motivation Survey (IMMS) than the students receiving only traditional instruction. Effect size, based on Cohen (1988), was medium to large,  $\eta^2 = .111$ . The strength of the intervention and the IMMS score was moderately strong, with the intervention accounting for 11.1% variance in the dependent variable.

### Summary

The groups were statistically different on both dependent variables, after controlling for the pretest scores. Inspection of the descriptive statistics indicated that students receiving the virtual reality field trips, in addition to traditional instruction, scored higher on the social study achievement test and the Instructional Materials Motivation Survey (IMMS) than the students receiving only traditional instruction. These results provide evidence that virtual reality field

trips are useful in supporting the achievement and motivation of middle-school students. These results are discussed in depth in the next chapter, Chapter Five.

## CHAPTER FIVE: DISCUSSION AND CONCLUSIONS

### Introduction

The purpose of this study was to examine the effect of virtual reality field trips on the academic achievement and motivation of seventh-grade, middle-school students. This chapter provides a summary of the finding for each research question, followed by the implications for practice. The limitations of the study and future recommendations are discussed. Finally, a conclusion is made, based on the research findings of this study.

### Summary of the Findings

#### Research Question One

Research question one stated: While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction compared to traditional instruction influence the social studies academic achievement of seventh-grade, middle-school students? A social studies test was used to measure the academic achievement of seventh-grade, middle-school students after treatment. As discussed in Chapter Three, the social studies test was a 36-question exam which correlated with Tennessee's Seventh Grade Social Studies Standards 7.27 through 7.39 that measure the academic achievement of seventh-grade, middle-school students. A pretest was conducted to serve as a covariate. An analysis of covariance (ANCOVA) was conducted to determine if there was a statistically significant difference in the post-test scores, between the treatment group who used virtual reality and the control group who received traditional instruction.

A significant difference was found between the post-test scores for the treatment group and the control group. The treatment group scored higher on the post-test ( $M_{adj} = 85.418$ ,  $SE = 1.965$ ) than the control group ( $M_{adj} = 71.219$ ,  $SE = 2.203$ ); the practical significance was

moderately high. This indicated that the use of virtual reality field trips to supplement existing social studies curriculum, as opposed to only using existing social studies curriculum, was effective in improving middle-school students' social studies' academic achievement.

### **Research Question Two**

Research question two stated: While controlling for a pretest, does the use of virtual reality field trips integrated into social studies instruction, compared to traditional instruction, influence the motivation of seventh-grade, middle-school students? The Instructional Materials Motivation Survey (IMMS) was used to measure the motivation of seventh-grade, middle-school students before and after the instruction, traditional and virtual reality. As discussed in Chapter Three, the IMMS was a 39-question survey designed to measure situation-specific attitudes and correlate to the conceptual structure of the ARCS model of attention, relevance, confidence, and satisfaction (Keller, 2009). The IMMS taken prior to the instruction, served as the pretest or covariate. An ANCOVA was conducted to determine if there was a statistically significant difference in the post-test scores between the treatment group (virtual reality instruction) and the control group (traditional instruction), while controlling for the pretest. A significant difference was found between the post-test scores between groups. The treatment group scored higher on the post-test ( $M_{adj} = 3.569, SE = 0.86$ ) than the control group ( $M_{adj} = 3.1233, SE = .105$ ). Therefore, the practical significance was moderately high. This indicated a potentially positive correlation between motivation and the use of virtual reality field trips to supplement existing social studies curriculum, as opposed to only using existing social studies curriculum. The significant results were consistent with the hypothesis based on the ARCS theory of motivation.

## Discussion of Findings

The results of this study are consistent and extend the research demonstrating that virtual reality instruction, as compared to traditional instruction, increases student academic achievement and motivation. The following is a discussion of findings as interpreted and supported with relevant literature.

### Academic Achievement

This study's findings suggest that well-structured virtual reality (VR) field trips improve learning, which aligns with the situated learning theory supporting this research (Herrington & Oliver, 1999, 2000; Lave & Wegner, 1991). According to the situated learning theory, learning occurs when students are immersed in an authentic environment to investigate, meditate, and discuss with others who have the same experience (Herrington & Oliver, 1999, 2000; Lave & Wegner, 1991). In this study, the VR, as compared to traditional learning environment, included key factors associated with situational learning theory, which may have contributed to the outcomes. The virtual field trips included three factors of situated learning theory, which are central to improved learning: 1) authentic context and activities, 2) student collaboration, and 3) teacher scaffolding (Herrington & Oliver, 2000).

**Authentic context and activities.** During the virtual fieldtrips in this study, the students were immersed in a virtual environment representing the location and time being studied. That is, they were immersed in an authentic environment. As Bauerle and Park (2012) and Johnston et al., (2017) found, students can form a deep understanding of the content, when provided with the opportunity to interactively explore an authentic environment on a field trip. While interacting with and experiencing an environment, students create meaningful connections to the

content and internalize the concepts, because the content is presented in the ‘real world’ context (Gautam et al., 2018).

While these previous studies focus on traveling to physical locations to have an authentic experience to learn, the findings of this study demonstrate that the beneficial field trip experience does not have to be physical in nature. Students do not need to travel physically to the locations. Rather, virtual experience can provide improved learning experiences.

**Student collaboration.** Students also collaborated during the virtual field trips. Students were paired into groups of two to four and engaged in conversation, expressing thoughts and ideas throughout the virtual experience. In studies focused on the effects of collaboration and virtual reality, Jackson and Fagan (2000) and Burton and Martin (2010), found that student collaboration via text messaging or intercom voice communication within immersive virtual reality environments enhanced learning outcomes. Similarly, this study focused on peer collaboration within the virtual environment and demonstrates that face-to-face collaboration during a virtual field trip is beneficial to the learning experience. Students' communication of findings, shared ideas, and conclusions drawn during a virtual field trip do not have to be digitally embedded into the virtual environment to improve learning outcomes.

**Teacher Scaffolding.** During the virtual field trip, the teacher guided the students' attention to a specific location in the virtual environment by touching the tablet and making an arrow appear in the students' viewfinders, directing focus. As the students explored the location, the teacher provided narration and contextual questions, stimulating students' prior knowledge, while constructing new knowledge. Students could also ask questions in the VR space.

Studies from Behrendt and Franklin (2014) and the National Research Council (2009) found that for learning to occur, the field trip must be well-structured with continual focus on the



instructional objective. Although virtual field trips are informally structured, the finding of this study demonstrates that teacher scaffolding in the Google Expeditions virtual reality system provides the organization of, and emphasis on instructional content necessary for learning to occur. Regardless of the type of virtual reality platform used (i.e. desktop virtual reality, immersive virtual reality, or immersive embodied-view virtual reality), virtual instruction can improve the academic performance of middle-school students (Barbalios et al., 2013; Parmar, 2017; Zantua, 2017).

### **Motivation**

This study's findings suggest that virtual reality field trips improve student motivation, which align with the ARCS theory of motivation supporting this research (Keller, 1987a). According to the ARCS theory of motivation, four needs must be met to motivate an individual: attention, relevance, confidence, and satisfaction (Keller, 1987a). The virtual field trips for this study included key factors associated with ARCS theory of motivation which may have contributed to the outcomes. The following four factors are explored further in this section: 1) attention, 2) relevance, 3) confidence, and 4) satisfaction (Keller, 1987a).

**Attention.** The implementation of virtual reality systems in classroom instruction presents a unique environment that attracts students' attention, engages them in authentic situations, and encourages exploration of the environment. Barbalios, et al. (2013), Lee et al. (2010), and Lindgren, et al. (2016) found that the authentic virtual environment, and the associated tasks within the virtual environment, provide the stimuli to engage students' attention. Although the virtual field trips in this study did not require completion of instructional tasks, the findings demonstrate that the virtual environment attracted and maintained students' attention. Therefore, instructional tasks within the virtual environment are not necessary to sustain

students' attention. Rather, the first-person 360-degree perspective of authentic environments and the teacher's ability to direct students' focus to specific objects within the virtual environment maintain student engagement.

**Relevance.** In this study, the teacher used virtual reality field trips to teach the instruction content to middle-school students. When presenting instructional content using virtual reality as opposed to traditional instructional methods, a distinct learning situation is created that engages students and enhances motivation (Ausburn & Ausburn, 2008; Lee et al., 2010). The findings of this study demonstrate that the use of this unique technology is relevant to middle-school students' technology-infused lifestyle and increases their motivation to learn. The classroom discussion and the scripted narration provided by the teacher also relates to existing knowledge constructs for students, creating relevance and meaning to learned content, thereby increasing motivation.

**Confidence.** During this study, the students gained confidence after completing 14 virtual field trips related to the instructional content. According to Clément, Dörnyei, and Noels (1994), confidence is created through familiarity with the technology, group discussions, peer collaboration, and questioning. Although the students in this study lack familiarity with the Google Expeditions virtual reality system, they are familiar with smartphone technology, making adaptation to the virtual reality system effortless. Consistent with Clément et al. (1994), the findings of this study demonstrate that the repetitive questioning focused on the instructional content and the discussion explaining the significance of each situation improves students' confidence in the material studied. Students' small group discussion of the elements presented in the virtual field trips, also enhanced levels of confidence.

**Satisfaction.** The students' level of satisfaction is also influenced by the virtual reality field trips. Zantua (2017) and Parmar (2017) state that as middle-school students explore authentic virtual environments and perform virtual tasks, their satisfaction with the experience and perception of the instructional content increases. During each field trip in this study, students freely explored the virtual environment with peers. In alignment with previous research findings, this experience likely contributed to the students' enhanced level of satisfaction. The students' successful completion of 14 virtual field trips, also likely heightened their sense of satisfaction and increased their motivation.

### **Implications for Practice**

The results of this study illustrate the potential of VR to increase the academic achievement and motivation of seventh-grade, middle-school students. It, thereby, provides an additional tool for educators to use to create the optimal learning environment. The following five implications of this study are explored in this section: 1) inaccessible environments, 2) constructing background knowledge, 3) differentiate instruction, 4) professional development, and 5) instructional design.

#### **Inaccessible Environments**

Virtual reality introduces learning possibilities for environments that are traditionally hazardous, inaccessible, or improbable (Ali, Ullah, Rabbi, & Alam, 2014; Churchill, 2017; Lin et al., 2017; Zantua, 2017). Implementing VR field trips into the classroom provides students with the opportunity to visit locations that are financially or geographically inaccessible (Zantua, 2017). Regardless of background, socio-economic status, or geographic location, students can experience various cultures, tour historically significant locations, and explore a myriad of careers through virtual field trips. Virtual reality has the potential to provide a safe and cost-

effective alternative in other instructional areas (such as traditional science labs and vocational training in schools). For example, a virtual chemistry lab could provide students with authentic chemical items and equipment allowing for students to safely combine chemicals to test reactions, while eliminating equipment costs (Ali et al., 2014). Implementing virtual technical programs that teach topics, such as welding and electrical engineering, could provide a safe environment for experimental learning, while reducing the cost of materials and eliminating the risk of injury. It would be useful to explore other similar pilot projects in order to evaluate the effectiveness of VR techniques in these areas. Implementing VR field trips will increase social awareness and cultural acceptance in students through the authentic learning experiences, as opposed to relying on videos and textbooks (Lin et al., 2017; Zantua, 2017).

### **Constructing Background Knowledge**

As discussed in Chapter Three, the students in this study come from economically disadvantaged homes and generational poverty. Payne (1998) stated that students from generational poverty define ‘the world’ in local terms and need explicit instruction to build structures and cognitive strategies for learning to occur. The use of Google Expeditions offers students unique authentic experiences with explicit narration concerning the instructional content. Virtual reality systems, such as Google Expeditions, provide field trips encompassing a broad range of topics and locations, allowing educators the opportunity to build background knowledge for students, reinforce difficult or abstract concepts, and aid in knowledge retention (Liou, Yang, Chen, & Tarnng, 2017).

### **Differentiated Instruction**

Virtual reality field trips provide a tool for educators to differentiate instruction for students, according to their learning styles (Lee & Wong, 2014). The continuous teacher

narration throughout the field trip and the informal discussion with peers, during and after the virtual field trip, engages the auditory learner. The visual learner is engaged through the dynamic 360-degree graphics within a virtual reality field trip. The kinesthetic learner is stimulated by the ability to change the perspective of the environment through physical movement. Therefore, the implementation of virtual reality field trips during instruction allows for a deeper learning experience for students with various learning preferences.

### **Professional Development**

Although the low-cost VR systems seem simplistic, professional development focused on the technical aspects of the system should be conducted prior to implementing VR in the classroom (Fowler, 2015). An educational technology coordinator, or educator familiar with the virtual reality system, should be readily available to mitigate any difficulties that arise during classroom implementation. Even though Teacher A, in this study, was familiar with smartphone technology and had an hour of training on the Google Expeditions VR system, she required assistance with questions and technical difficulties during the first few field trips.

### **Instructional Design**

As with all technology, effective implementation of VR in the classroom is necessary for learning to occur (Burton & Martin, 2010). A well-chosen theory such as the situational learning theory used in this study, can guide effective implementation. Drawing from the situated learning theory, the virtual reality content should connect to the learning objective, and this connection must be evident to students. For example, each virtual field trip in this study focuses on topics related to the Tennessee Seventh Grade Social Studies Standards 2018-2019. During the field trip, the teacher linked the traditional instruction and notes from the textbook to the information presented in the field trip that facilitated cohesiveness. Additional elements, as

discussed above, of the situational learning theory (Herrington & Oliver, 1999, 2000; Lave & Wegner, 1991) and the ARCS theory of motivation (Keller, 1987a) should be taken into consideration, when implementing virtual reality into classroom instruction.

### **Limitations and Recommendations**

This quantitative, quasi-experimental, pretest-post-test non-equivalent control group design study made every effort to limit the threats to internal and external validity. Nevertheless, there were still the following limitations that may limit generalization of results and provide the impetus for further study: novelty effect, use of one post-test, (duplicate) one subject area, lack of diversity, convenience sampling, and theory.

#### **Novelty Effect**

The novelty effect may have been a factor in the increased motivation scores of the treatment group (Lee & Wong, 2014). Virtual reality had not been used previously with the treatment group for instructional purposes or enrichment activities. Only a few of the students had ever used VR prior to this experience. During an observation, students made comments such as, “This is so cool” and “I love this,” in addition to an overall presence of excitement during the virtual field trip. Therefore, it is recommended that future research focus on longitudinal studies across a school year to mitigate the novelty effect. A phenomenological or case study may also provide additional insight into students’ experiences with VR, as well as better insight into how it influences learning and motivation.

#### **Use of One Post-test**

Due to time constraints, only one post-test was given at the conclusion of this study. Although the results demonstrate an increase in learning outcomes after virtual reality instruction, the lack of repeated measurements does not exemplify the retention of material

learned via virtual reality, as compared to traditional instruction (Lee et al., 2010, 2014; Zantua, 2017). The retention of knowledge over time needs further study. Therefore, it is recommended that future research focus on multiple post-tests to measure knowledge retention.

### **One Subject Area**

This study focused on a single subject, helping to maximize internal validity, but in turn decreased external validity. The single subject design study has been the emphasis of past virtual reality research (Ali et al., 2014; Beijing Bluefocus E-Commerce Co., Ltd & Beijing iBokan Wisdom Mobile Internet Technology Training Institutions, 2016; Lee et al., 2010; Parmar, 2017). A possible explanation for this, is that previous virtual reality systems, such as desk top VR, were individualized for one instructional area (i.e. Vfrog, MAT 3-D, and Mr. Vetro) (Barbalios et al., 2013; Lindgren et al., 2016; Merchant et al., 2014). Virtual reality systems, such as Google Expeditions, allow for the integration of multiple subject areas during a single lesson, providing opportunities for interdisciplinary studies. Future research should focus on the replication of this study to include multiple subject areas.

### **Lack of Diversity**

The lack of diversity in the sample also limits the generalization of the study results (Rovai et al., 2013). As discussed in Chapter Three, the sample population was located in a rural community, and the ethnicity of the sample was 91% White and 9% African American. Students from culturally and linguistically diverse environments approach the learning situation with different experiences and backgrounds than a homogenous sample, such as in this study (Lee & Buxton, 2008). The cultural and linguistic differences affect how the students acquire knowledge in the learning environment (Lee & Buxton, 2008). Therefore, it is recommended

that future research replicate the study in an urban setting, to mitigate the lack of diversity and cultural and linguistic variances in students' background.

### **Convenience Sample**

For this study, the convenience sample, as well as the setting was unique. The study was conducted in an economically depressed county, where generational poverty existed among the sample population. Furthermore, the selected school district was categorized as 'high needs' but also as an early adopter of technology. Therefore, the school district is considered an anomaly, because it resides in an economically disadvantaged county with a student population categorized as "high-needs," and is an early adopter of technology (Van der Berg, 2008). Schools in economically depressed counties, typically lack educational resources present in this district (Van der Berg, 2008). It is recommended that future research replicate the study within various environments involving a diverse sample population. Research should also be conducted assessing a potential positive relationship between the use of virtual reality field trips and economically disadvantaged students from generational poverty.

### **Theory**

According to Fowler (2015), a challenge to understanding the promise of virtual reality is understanding the 'pedagogical underpinnings' informing the design. Ausburn and Ausburn (2008) suggest that virtual reality research lacks a sound theory to provide explanatory or predictive strength. If a theoretical model is proposed in research, it is based in constructivism (Ali et al., 2014; Fowler, 2015; Lee et al., 2010; Lee & Wong, 2014; Parmar, 2017; Zantua, 2017). Although the situated learning theory and ARCS theory of motivation used in this study were effective, additional theories should be explored with this technology to determine the most effective theory when studying the potential of VR to impact academic achievement, motivation



to learn, and knowledge retention with K-12 students (Ausburn & Ausburn, 2008; Fowler, 2015; Liu et al., 2017). Future research on the use of VR with K-12 students may determine the pedagogical criteria for educators to prepare, apply, assess, and evaluate VR applications, prior to curriculum integration (Johnston et al., 2017).

### **Conclusion**

The purpose of this study was to examine the effect of virtual reality field trips on the academic achievement and motivation of seventh-grade, middle-school students. The results indicated statistically significant differences in academic achievement and motivation levels between seventh-grade, middle-school students who received virtual reality field trips in addition to traditional instruction and seventh-grade, middle-school students who only received traditional instruction. Based on the results, students who participated in virtual reality field trips were found to have higher academic achievement and motivation levels, when compared with students who only received traditional instruction. This research extended the current knowledge base on virtual reality and student motivation and academic achievement. With the rapid advancement in low-cost virtual reality systems, such as Google Expeditions, the positive findings of this study provide an incentive for K-12 schools to consider investing in this technology.

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## Appendix A

### Chapter 10 7th Grade Medieval Europe Pretest & Formative Assessment

*Question 1-4: Circle the correct answer for each question.*

1. What was the name of the church court that tried and punished people who were suspected of heresy?
  - a. Crusades
  - b. grand jury
  - c. Inquisition
  - d. trial jury
  
2. Jews were ordered to convert to Christianity or leave Spain by
  - a. the College of Cardinals
  - b. Parliament
  - c. King Ferdinand & Queen Isabella
  - d. King Henry VII
  
3. Historians believe that the Black Death first spread along which trade route?
  - a. China Road
  - b. Ivory Road
  - c. Silk Road
  - d. Trade Road
  
4. Originating in central Asia, the Black Death was carried by
  - a. ants.
  - b. cattle.
  - c. fleas.
  - d. spiders.

*Questions 5-8: Match each item with the correct statement below. Write the letter in the blank provided.*

- a. plague
  - b. Hundred Years War
  - c. *Reconquista*
  - d. Joan of Arc
  - e. Magna Carta
- 
5. French peasant girl inspired French soldiers in battle. \_\_\_\_\_
  6. fought between France & England 1337-1453 \_\_\_\_\_
  7. disease that spreads quickly and kills many people \_\_\_\_\_
  8. Christian struggle to take back the Iberian Peninsula from Muslims \_\_\_\_\_

*Questions 9-13: Match each item with the correct statement below for questions. Write the letter in the blank provided.*

- a. anti-Semitism
- b. vernacular
- c. heresy
- d. scholasticism
- e. theology

9. way of thinking that used reason to explore questions of faith \_\_\_\_\_
10. hatred of Jews \_\_\_\_\_
11. local language used by people of a region \_\_\_\_\_
12. religious beliefs that conflict with Church teachings \_\_\_\_\_
13. study of religion and God \_\_\_\_\_

*Question 14-18: Circle the correct answer for each question.*

14. Which of the following was one effect of the Crusades on Western Europe?
- a. Feudalism became a stronger institution.
  - b. Christians and Muslims united.
  - c. Wealthy Europeans began to demand eastern goods.
  - d. The economy suffered because trade between western and eastern peoples was no longer possible.
15. In 1095 Pope Urban II called for a crusade, or holy war, against
- a. the Jews.
  - b. the Kievan Rus.
  - c. the Mongols.
  - d. the Muslim Turks.
16. For medieval Christians, the most important holy sacrament was
- a. baptism.
  - b. communion.
  - c. marriage.
  - d. reconciliation.
17. What contributed to the idea that people have rights and that the power of government should be limited?
- a. Common Law
  - b. House of Commons
  - c. House of Parliament
  - d. Magna Carta

18. After the Battle of Hastings in 1066, who was crowned king of England?
- a. Alfred the Great
  - b. Oleg
  - c. Philip II
  - d. William the Conqueror

*Questions 19-20: Match each item with the correct statement below for questions. Write the letter in the blank provided.*

- a. Celts
- b. King John
- c. vassal
- d. Domesday Book
- e. Kievan Rus

19. census taken in England by William the Conqueror \_\_\_\_\_

20. noble who served a lord of a higher rank \_\_\_\_\_

*Questions 21-23: Match each item with the correct statement below for questions. Write the letter in the blank provided.*

- a. fjord
- b. excommunicate
- c. Aachen
- d. concordat
- e. Otto I

21. steep-sided valley that is an inlet of the sea \_\_\_\_\_

22. capital of Charlemagne's empire \_\_\_\_\_

23. agreement between the pope and the ruler of a country \_\_\_\_\_

*Questions 24-26: Match each item with the correct statement below for questions. Write the letter in the blank provided.*

- a. Flanders
- b. serf
- c. knight
- d. fief
- e. Venice

24. warrior in armor who fought on horseback \_\_\_\_\_

25. land granted to a vassal, or knight \_\_\_\_\_

26. person who worked the lord's land \_\_\_\_\_

*Questions 27-36: Match each item with the correct statement below for questions. Write the letter in the blank provided.*

27. Under which system did landowning nobles govern and protect the people in return for services?

- a. feudalism
- b. mercantilism
- c. protectionism
- d. vassalism

28. Charlemagne was the first Frankish ruler to believe in what for all people?

- a. education
- b. equality
- c. freedom
- d. religion

29. Two important farming inventions of the Middle Ages that made turning over soil faster were the horse collar and

- a. the windmill.
- b. crop rotation.
- c. the wheeled plow.
- d. the village mill.

30. Medieval knights followed rules called the code of

- a. chivalry.
- b. the king.
- c. the knight.
- d. servitude.

31. Europe's seas and rivers played an important part in Europe's growth because they provided both protection and opportunities for

- a. invading other lands.
- b. combining kingdoms.
- c. trading with nearby economies.
- d. converting distant groups to Catholicism.

32. Who was at the bottom of the feudal social pyramid?

- a. peasants
- b. king & queen
- c. lords & ladies
- d. Knights

33. Major Rivers in Europe

- a. Rhine

- b. Danube
  - c. Seine
  - d. Po
  - e. All of the Above
34. Which of the following was an effect of the Black Death in Western Europe?
- a. Demand for workers declined and wages fell.
  - b. Food prices increased leading to more starvation.
  - c. Demand for workers increased so much that serfs lost more rights and became enslaved.
  - d. Peasants began to pay rent instead of providing services.
35. Friars spent most of their lives praying and working inside their monasteries.
- a. True
  - b. False
36. Between A.D. 800 and 900, parts of Europe were invaded by Muslims, Magyars, and
- a. Vikings.
  - b. Vandals.
  - c. Finns.
  - d. Gauls.

### **Answer Key**

- 1. c
- 2. c
- 3. c
- 4. c
- 5. d
- 6. b
- 7. a
- 8. c
- 9. d
- 10. a
- 11. b

12. c

13. e

14. c

15. d

16. b

17. d

18. d

19. d

20. c

21. a

22. c

23. d

24. c

25. d

26. b

27. a

28. a

29. c

30. a

31. c

32. a

33. e

34. d

35. False

36. A



## Appendix B

### Instructional Materials Motivation Survey #1

#### Instructional Material Motivation Survey #1

Please read the following questions and choose the answer that best tells how you really feel about this social studies unit you are about to study and not what you would like to be true or what you think others want to hear. The answers that you give will NOT affect your grade.

\* Required

1. Please type the number and letter your teacher assigned to you. Ex: 22B \*

---

2. Which school do you attend? \*

Mark only one oval.



3. I am a \*

Mark only one oval.

Boy

Girl

4. When I look at this unit, I think it will be easy for me. \*

Mark only one oval.

Not True

Slightly True

Moderately True

Mostly True

Very True

5. There is something interesting at the beginning of this unit that get my attention. \*

Mark only one oval.

Not True

Slightly True

Moderately True

Mostly True

Very True

6. **This material will be more difficult to understand than I would like for it to be.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

7. **After the beginning of each lesson, I feel confident that I will know what I am supposed to learn from this unit.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

8. **Completing the activities in this unit will give me a satisfying feeling of accomplishment.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

9. **It is clear to me how the information in this unit will be related to things I already know.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

10. **Many of the pages will have so much information that it will be hard to pick out and remember the important points.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

11. **These materials in this unit will be eye-catching.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

12. **There will be stories, pictures, or examples that show me how this material can be important to some people.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

13. **Completing this unit successfully is important to me.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

14. **The way the chapter is written will help to hold my attention.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

15. **This information in the unit is so abstract that it will be hard to keep my attention on it.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

16. **As I work on this unit, I am confident that I will learn the content.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

17. **I will enjoy this unit so much that I will like to know more about the topic.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

18. **The pages of this unit will look dry and unappealing.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

19. **The content of this unit will be relevant to my interest.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

20. **The way the information is arranged on the pages will help keep my attention.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

21. **There will be explanations or examples of how people use the knowledge in this unit.**

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

22. **The exercises in this unit will be too difficult. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

23. **This unit will have things that stimulate my curiosity. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

24. **I will really enjoy studying this unit. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

25. **The amount of repetition in this unit will cause me to get bored sometimes. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

26. **The content and style of writing in this unit will give the impression that its content is worth knowing. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

27. **I will learn some things that are surprising or unexpected. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

28. **After working on this unit for a while, I will be confident that I will be able to pass a test on it. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

29. **This unit will not be relevant to my needs because I already know most of it. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

30. **The wording of the feedback after the exercises or the other comments in the unit will help me feel rewarded for my effort. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

31. **The variety of reading passages, exercises, illustrations, etc. will help keep my attention on the unit. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

32. **The style of writing will be boring. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

33. **I will be able to relate the content of this unit to things I have seen, done, or thought about in my own life. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

34. **There will be so many words on each page that it will be irritating. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

35. **It will feel good to successfully complete this unit. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

36. The content of this unit will be useful to me. \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

37. I will not really understand a lot of the material in this unit. \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

38. The good organization of the content will help me be confident that I can learn this material. \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

39. It will be a pleasure to work on such a well-designed unit. \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True



## Appendix C

### Tennessee Seventh Grade Social Studies Standards 2018-2019

#### **Middle Ages in Western Europe: 400-1500s CE**

<b>Overview:</b> Students will analyze the geographic, political, economic, and cultural structure of Europe during the Middle Ages.	
7.27	Identify and locate the geographical features of Europe, including: Alps, Atlantic Ocean, English Channel, Mediterranean Sea, Influence of the North Atlantic Drift, North European Plain, Ural Mountains
7.28	Describe the role of monasteries in the preservation of knowledge and spread of Catholic Church beyond the Alps
7.29	Explain how Charlemagne shaped and defined medieval Europe including: his impact on feudalism, the creation of the Holy Roman Empire, and establishment of Christianity as the religion of the Empire.
7.30	Describe the development of feudalism and manorialism, their role in the medieval European economy, and the way they were influenced by the physical geography (i.e., the role of the manor and the growth of towns).
7.31	Analyze the Battle of Hastings and the long-term historical impact of William the Conqueror on England and Northern France.
7.32	Describe how political relationships both fostered cooperation and led to conflict between the Papacy and European monarchs
7.33	Analyze the impact of the Magna Carta, including: limiting the power of the monarch, the rule of law, and the right to trial by jury.
7.34	Analyze the causes, effects, and key people of the 1st, 2nd, and 3rd Crusades, including: Pope Urban II, Saladin, and Richard I.
7.35	Explain how the Crusades impacted Christian, Muslim and Jewish populations in Europe, with emphasis on the increasing contact with culture outside of Europe.
7.36	Describe the economic and social effect of the spread of the Black Death (i.e., Bubonic Plague) from Central Asia to China, the Middle East, an Europe, and its impact on the global population
7.37	Analyze the importance of the Black Death on the emergence of a modern economy, including: agricultural improvements, commerce, growth of banking, a merchant class, technological improvements, towns.
7.38	Describe the significance of the Hundred Years War, including the roles of Henry V in shaping English culture and language and Joan of Arc promoting a peaceful end to the war.
7.39	Explain the significance of the Reconquista, Inquisition, and the rise of Spanish and Portuguese kingdoms in the Iberian Peninsula

## Appendix D

### Instructional Materials Motivation Survey #2

## Instructional Material Motivation Survey #2

Please read the following questions and choose the answer that best tells how you really feel about this social studies unit you are about to study and not what you would like to be true or what you think others want to hear. The answers that you give will NOT affect your grade.

\* Required

1. Please type the number and letter your teacher assigned to you. Ex: 22B \*

---

2. Which school do you attend? \*

Mark only one oval.



3. I am a \*

Mark only one oval.

Boy  
 Girl

4. When I first looked at this unit, I thought it would be easy for me. \*

Mark only one oval.

Not True  
 Slightly True  
 Moderately True  
 Mostly True  
 Very True

5. There was something interesting at the beginning of this unit that got my attention. \*

Mark only one oval.

Not True  
 Slightly True  
 Moderately True  
 Mostly True  
 Very True

6. **This material was more difficult to understand than I would like for it to be. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

7. **After the beginning of each lesson, I felt confident that I knew what I was supposed to learn from this unit. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

8. **Completing the activities in this unit gave me a satisfying feeling of accomplishment. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

9. **It is clear to me how the information in this unit is related to things I already know. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

10. **Many of the pages had so much information that it was hard to pick out and remember the important points. \***

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

11. **These materials used in this unit were eye-catching.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

12. **There were stories, pictures, or examples that showed me how this material could be important to some people.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

13. **Completing this unit successfully was important to me.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

14. **The way the chapter was written helped to hold my attention.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

15. **This information in the unit was so abstract that it was hard to keep my attention on it.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

16. **As I worked on this unit, I was confident that I could learn the content.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

17. **I enjoyed this unit so much that I would like to know more about the topic.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

18. **The pages of this unit looked dry and unappealing.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

19. **The content of this unit was relevant to my interest.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

20. **The way the information was arranged on the pages helped keep my attention.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

21. **There were explanations or examples of how people use the knowledge in this unit.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

22. **The exercises in this unit were too difficult.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

23. **This unit had things that stimulated my curiosity.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

24. **I really enjoyed studying this unit.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

25. **The amount of repetition in this unit caused me to get bored sometimes.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

26. **The content and style of writing in this unit gave the impression that its content is worth knowing.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

27. **I learned some things that were surprising or unexpected.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

28. **After working on this unit for a while, I was confident that I would be able to pass a test on it.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

29. **This unit was not relevant to my needs because I already knew most of it.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

30. **The wording of the feedback after the exercises or the other comments in the unit helped me feel rewarded for my effort.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

31. **The variety of reading passages, exercises, illustrations, etc. helped keep my attention on the unit.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

32. **The style of writing was boring.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

33. **I could relate the content of this unit to things I have seen, done, or thought about in my own life.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

34. **There were so many words on each page that it is irritating.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

35. **It felt good to successfully complete this unit.** \*

*Mark only one oval.*

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True



36. The content of this unit is useful to me. \*

Mark only one oval.

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

37. I could not really understand a lot of the material in this unit. \*

Mark only one oval.

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

38. The good organization of the content helped me be confident that I would learn this material. \*

Mark only one oval.

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

39. It was a pleasure to work on such a well-designed unit. \*

Mark only one oval.

- Not True
- Slightly True
- Moderately True
- Mostly True
- Very True

## Appendix E

### Permission to use the Instructional Materials Motivation Survey



#### Fwd: Permission to use the Instructional Materials Motivation Survey

1 message



Mon, Aug 14, 2017 at 9:32 PM

From: John Keller [redacted]  
Date: Mon, Jul 17, 2017 at 11:17 AM  
Subject: Re: Permission to use the Instructional Materials Motivation Survey  
To: [redacted]

Dear [redacted]

I apologize for the long delay in responding. My internet was out for a full week. It was restored yesterday evening.

You most certainly are welcome to use the IMMS in your research. I am attaching a segment from the chapter in my book that gives information about the IMMS and I am also attaching two shortened versions of it. Unfortunately, I do not have psychometric information about the shorten versions.

You did a very nice job of explaining the terms and conditions under which you will use the instrument, and they are perfectly acceptable. Thank you for being so considerate.

Best wishes for a successful study,  
John

John M. Keller, Ph.D.  
Professor Emeritus  
Educational Psychology and Learning Systems  
Florida State University



Official ARCS Model Website: <http://arcsmodel.com>.

Keller, J.M. (2010), *Motivational Design for Learning and Performance: The ARCS Model Approach*. New York: Springer. Now available in English, Japanese, and Korean.

***"Good judgment comes from experience, and a lot of that comes from bad judgment."***

From "Don't Squat with Your Spurs On:  
A Cowboy's Book of Wisdom."

## Appendix F

### Letter of Permission from the Director of Schools.

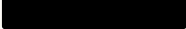


BOARD  
OF  
EDUCATION



August 14, 2017

To Whom It May Concern:

 has received permission to conduct the research related to her study, 3D Immersive Virtual Reality and Middle School Students: A Study of Motivation and Achievement.

The purpose of this study will be to examine the potential impact of the use of 3D immersive virtual reality field trips on student motivation and academic achievement in a seventh grade social studies classroom. The results of the study will contribute to the emerging research on the effectiveness of using 3D-IVR in the K-12 environment.

This permission is granted based on the understanding that the participation of teachers and students will be anonymous and voluntary. Furthermore, information obtained from the teachers and students during the course of research will be confidential and secured on a password-protected computer. No personal names or other individual identifying information will be collected on the student survey.

Sincerely,



## Appendix G

### IRB Approval Letter



---

#### PRO-FY2018-38 - Initial: Approval - Expedited

1 message

From:

To:



Mon, Dec 11, 2017 at 2:04 PM



Institutional Review Board  
Office of Sponsored Programs  
University of Memphis  
315 Admin Bldg  
Memphis, TN 38152-3370

Dec 11, 2017



Submission Type: Initial  
Title: Immersive Virtual Reality & Middle School Students: A Study of Motivation and Achievement  
IRB ID : #PRO-FY2018-38

Expedited Approval: Dec 8, 2017  
Expiration: Dec 8, 2018

Approval of this project is given with the following obligations:

1. This IRB approval has an expiration date, an approved renewal must be in effect to continue the project prior to that date. If approval is not obtained, the human consent form(s) and recruiting material(s) are no longer valid and any research activities involving human subjects must stop.
2. When the project is finished or terminated, a completion form must be submitted.
3. No change may be made in the approved protocol without prior board approval.

Thank you,  
James P. Whelan, Ph.D.  
Institutional Review Board Chair  
The University of Memphis.

## Appendix H

### Parental Permission for Your Child to Participate in a Research Study Student Motivation Survey

Your child is being invited to take part in a research study about what motivates students to learn in a social studies classroom. Your child is being invited to take part in this research study because he/she is a member of Mrs. Andrea Whitten or Mr. Jeremy Blakely's seventh-grade social studies classroom. If your child takes part in this study, your child will be one of about 85 children to do so in McNairy County. This study is being conducted by Mrs. Michelle Bowen of University of Memphis, Department of Instructional Design and Technology. She is being guided in this research by Dr. Amanda Rockinson-Szapkiw. The purpose of this study is to examine the materials used for instruction in the social studies classroom. By doing this study, we hope to learn what materials motivate students and also increase their academic achievement.

If your child attends Ramer Elementary School, the research procedures will be conducted in Mr. Jeremy Blakely's social studies classroom during your child's scheduled class time. If your child attends Michie Elementary School, the research procedures will be conducted in Mrs. Whitten's social studies during your child's scheduled class time. The study will take place for approximately three weeks.

This study will be conducted during the Medieval Europe social studies unit, which is a unit of study required by the state of Tennessee curriculum standards. Your child will be given a survey that asks how interested he/she is to be studying the upcoming unit on Medieval Europe. Then, your child will be given a pretest to assess his/her knowledge over the material before the study begins. For the following three weeks, your child will receive instruction about Medieval Europe from his/her social studies teacher. Your child will receive instruction through the normal methods used by his/her teacher such as: instructional videos, lecture notes, group activities, and/or the use of technological devices. At the conclusion of the three week study, your child will be given a post-test to assess his/her knowledge over the material studied. Your child will also take a survey that asks how interesting he/she found the unit of study.

We will make every effort to prevent anyone who is not on the research team from knowing that your child gave us information, or what that information is. Your child's name will be removed from the surveys, pretest, and post-test results and replaced with a number. After all identifying information is removed from the results, they will be given to the researcher, Michelle Bowen, for analysis. We will make every effort to keep private all research records that identify your child to the extent allowed by law. Your child's information will be combined with information from other children taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. Your child will not be personally identified in these written materials. We may publish the results of this study; however, we will keep your child's name and other identifying information private. All

formative assessments, survey results, consent forms, and assent forms will be secured in a locked file cabinet accessible only by the researcher. After five years, all data will be destroyed by the researcher.

Your child's participation in this study is completely voluntary. There is no cost associated with taking part in this study. Participation or lack of participation **will not affect his/her grade on the instructional unit exam** or his/her class standings. To the best of our knowledge, the things your child will be doing have no more risk of harm than your child would experience in everyday life. There is no guarantee that your child will get any benefit from taking part in this study. Your child's willingness to take part, however, may, in the future, help in the selection of instructional materials that are more effective for learning.

If your child decides to take part in the study, your child still has the right to decide at any time that he/she longer wants to continue. Your child will not be treated differently if he/she decides to stop taking part in the study. Before you decide whether to accept this invitation for your child to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator Michelle Bowen at 662-415-1569 or Dr. Amanda Rockinson-Szapkiw at 901-678-2365. If you have any questions about your child's rights as a volunteer in this research, contact the Institutional Review Board staff at the University of Memphis at 901-678-3074. We will give you a signed copy of this permission form to take with you.

\_\_\_\_\_  
Signature of parent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed name of student

Mrs. Michelle Bowen

Name of [authorized] person obtaining informed consent

\_\_\_\_\_  
Date

## Appendix I

### ASSENT FORM

You are invited to be in a research study being done by Michelle Bowen from the University of Memphis. You are invited because you are enrolled in the seventh-grade social studies class at Michie Elementary School or Ramer Elementary School.

If you agree to be in the study, you will be asked to complete a survey about how well you like the materials your teacher used when teaching Medieval Europe social studies unit. Your scores on the Medieval Europe social studies unit pretest and post-test will be collected by Michelle Bowen as well, but **your name will be removed from the pretest and post-test** before the scores are given to her. A number will be used instead of your name so that no one will know who gave the answers.

You will **not** receive money for being in this study.

Your family will know that you are in the study. If anyone else is given information about you, they will not know your name. A number or initials will be used instead of your name.

If something makes you feel bad while you are in the study, please tell Mrs. Andrea Whitten, Dr. Matthew Alred, Dr. Sondra Kiser, Jeremy Blakely, or Michelle Bowen. If you decide at any time you do not want to finish the study, you may stop whenever you want.

You can ask Mrs. Andrea Whitten, Dr. Matthew Alred, Dr. Sondra Kiser, Jeremy Blakely, or Michelle Bowen questions any time about anything in this study. You can also ask your parent any questions you might have about this study.

Signing this paper means that you have read this or had it read to you, and that you want to be in the study. If you do not want to be in the study, do not sign the paper. Being in the study is up to you, and no one will be mad if you do not sign this paper or even if you change your mind later. Your grade in the social studies class or any other class will not be different if you decide not to be in the study. You agree that you have been told about this study and why it is being done and what to do.

---

Signature of Person Agreeing to be in the Study

---

Date Signed

# Appendix J

## Google Expeditions Training Manual



### Users Guide for Teachers

**What is Google Expeditions?** Google Expeditions is a virtual reality teaching tool that lets you lead immersive virtual trips all over the world. The teacher leads the virtual educational journey from a tablet and the students follow on their devices.

**What equipment do I need to use Google Expeditions in my classroom?** To conduct a teacher-led expedition, you will need access to the Internet or a peer-to-peer network, a wireless router, a tablet with the Expeditions app, compatible smartphones with the Expeditions app, and viewfinders for the smartphones.

To begin a virtual educational journey, complete the following steps.

**Step 1: Locate and open the Expeditions app on the teacher tablet.** (see Figure 1)

Figure 1



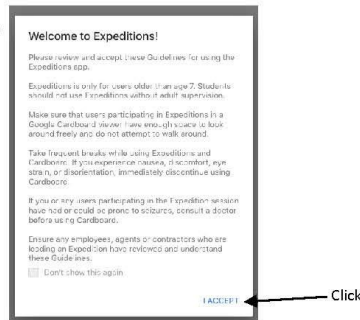
**Step 2: Log in to your Gmail account.** (see Figure 2)

Figure 2



**Step 3: Review the Guidelines for using the Expeditions app then click "I Accept".** (see Figure 3)

Figure 3



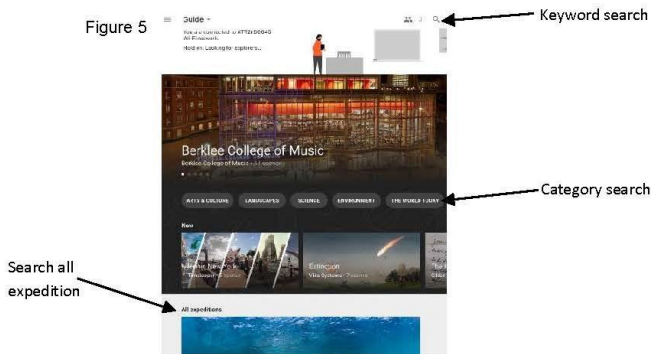




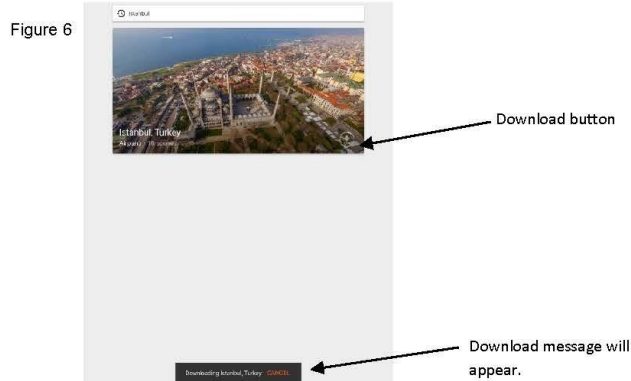
**Step 4:** Select “LEAD” after logging in. (see Figure 4)



**Step 5:** Search for an expedition by category, keywords, or scrolling through all 500+ expeditions. (see Figure 5)



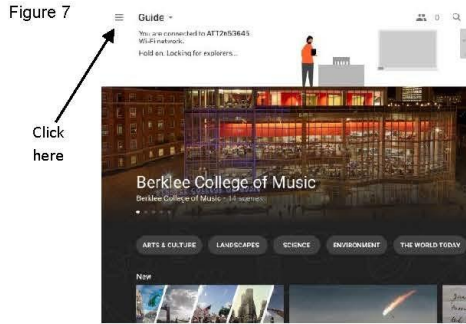
**Step 6:** Select the expedition by tapping the picture and download the expedition to the tablet. (see Figure 6)



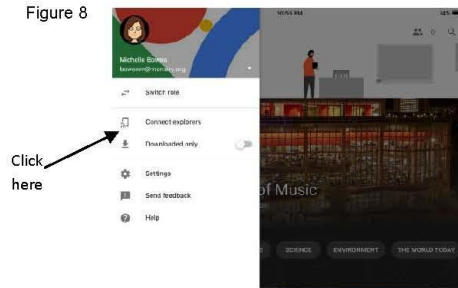
**Step 7:** Power on each of the smartphones and place them in the viewfinders. Give each student a viewfinder.



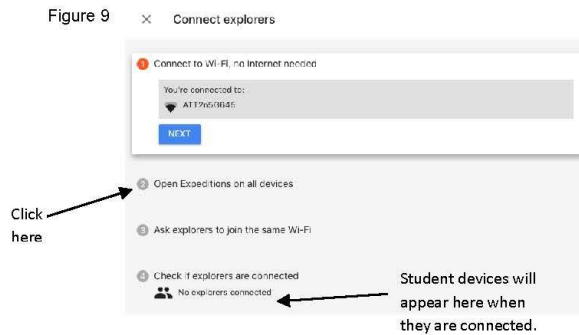
**Step 8:** On the teacher tablet, select the three horizontal lines in the upper left corner that opens the application menu. (see Figure 7)



**Step 9:** In the menu screen, select connect explorers. (see Figure 8)

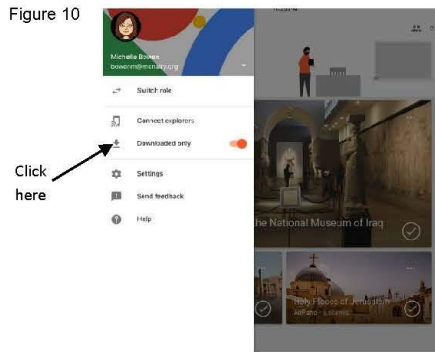


**Step 10:** Select "Open Expeditions on all devices. Monitor #4 to see which 'explorers' (devices) are connected. (see Figure 9)

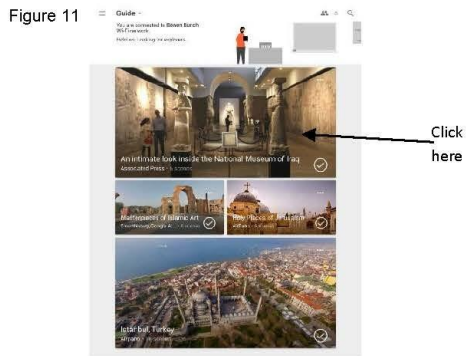




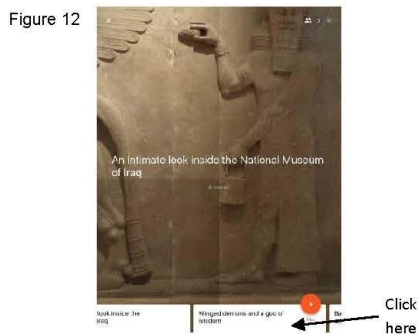
**Step 11:** Return to the menu screen (see step 9) and select “Download content only”. (see Figure 10)



**Step 12:** Select the expedition to begin. (see Figure 11)



**Step 13:** The first location of the expedition will open and the information for the first location will be on a tab at the bottom of the screen. Click the first tab to begin. (see Figure 12)



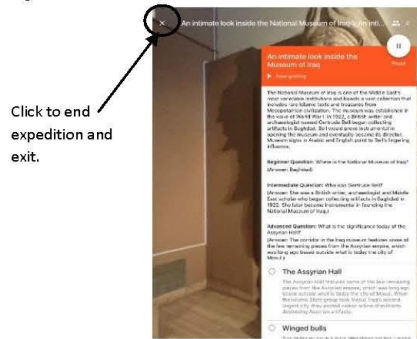


Step 17: After discussing each of the objects of interest, review the questions with the students at the top of the window. (see Figure 14)

Step 17: Continue to the next slide by pausing the expedition and selecting the next tab at the bottom of the screen. (See Figure 12).

Step 18: At the conclusion of the expedition, press the X in the upper left corner of the screen to end the expedition and exit (See Figure 18). This will also close the expedition on the students' devices.

Figure 18



## Appendix K

Permission to use Google Expeditions screenshots from Google Brand Permissions.



**RE: [0-3014000018959] [brandpermissions] Brand Permissions request form submission**



Fri, Sep 8, 2017 at 11:01 AM



Thank you for your interest in Google. We have reviewed your request to use the Google brand for educational purposes. The use of the Google brand is permitted without our formal approval provided it follows the use and attribution guidelines provided [here](#).

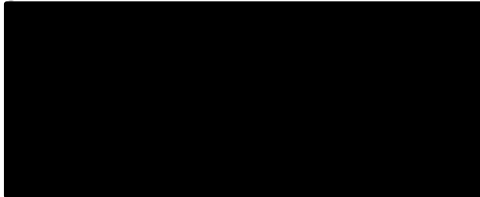
Thanks,

Google Brand Permissions

On 09/04/17 14:21:12 [noreply@google.com](mailto:noreply@google.com) wrote:

You have a new request form submission:

--



Google Product: Other

Other (please specify): Screen shots from Google Expedition tours

Title/URL: The Plague (Black Death)

Request Description: I wish to include screen shots from the Google Expedition The Plague (Black Death) in my dissertation. I have taken three screen shots to illustrate what the students see through their viewfinders.

Distribution geography: Proquest Dissertation database

: on

Attachments: <https://services.google.com/fb/downloadfile/6362308260659200/>

## Appendix L

Permission to use screenshots from *The Plague (Black Death)* expedition.



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**Re: Permission to use a screenshot**

---



Please feel free to use our images. Kindly mention Vida Systems. I would love to read your dissertation or whatever part you want to share before it's ready.  
Best,

Max  
Vida Systems  
CEO

On Fri, Sep 8, 2017 at 5:14 P [redacted]@memphis.edu> wrote:

I am a graduate student at the University of Memphis. My dissertation research is on the effect of immersive 3D virtual reality on student academic achievement. One of the VR field trips use The Plague (Black Death) which you have listed on Google Expeditions. I would like permission to use screen shots of this VR program in my dissertation proposal to illustrate what is displayed on the devices for the teachers and students.

Thank you for considering my request.

