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From chalkboards to virtual reality: Exploring the development and implementation of virtual reality in United States History classrooms

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FROM CHALKBOARDS TO VIRTUAL REALITY: EXPLORING THE DEVELOPMENT AND IMPLEMENTATION OF VIRTUAL REALITY IN UNITED STATES HISTORY CLASSROOMS

by

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Dedication

I would like to dedicate this manuscript to my wife, Christine and daughter, Tesori. Without your support, none of this would have been possible. I would also like to dedicate this manuscript to my grandfather and father; the first published writers in the family.

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I would like to express my appreciation to Professor James Coaxum for his guidance and support throughout this research. Your patience and guidance were instrumental and the skills and knowledge that I have gained are things that I will take with me into my next professional endeavor. I look forward to whatever challenges that come my way knowing that I am prepared to take them on.

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Abstract

Phil A. Brownridge
FROM CHAULKBOARDS TO VIRTUAL REALITY: EXPLORING THE DEVELOPMENT AND IMPLEMENTATION OF VIRTUAL REALITY IN UNITED STATES HISTORY CLASSROOMS
2019-2020
James Coaxum, III, Ph.D.
Doctorate of Educational Leadership

The purpose of this action research dissertation was to explore the development and implementation of virtual reality in United States History Classrooms. Specifically, research focused on how students would respond to virtual reality, the professional development that teachers required to implement virtual reality, health concerns associated with students using virtual reality in school, and how virtual reality would affect pedagogy and assessment strategies. Before implementation of virtual reality, high school students had identified social studies as their least favorite class and results suffered because of their lack of interest. Students being disgruntled about learning history in schools is an issue throughout the country (Milo, 2015).

After successfully infusing virtual reality into the classroom, students' motivation increased, performance improved significantly, and teachers reported drastic changes to their role in the classroom and how they evaluated students. What was surprising was the level of modification that was necessary for questioning technique, how drastically the teachers' roles in the classroom changed, and the number of school subjects that seem to be ripe with possibility for virtual reality (Sholes, 2018). While this technology is just emerging in the field of education, their appears to be ample opportunity for growth and advancement (Reynard, 2017).

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Chapter 1

Introduction

There is wide spread contention that the use of technology can improve student learning in schools (Polly, Mims, Shepherd, & Inan, 2009, p. 1). Tools, such as interactive software, digital imaging, video creation tools, and LCD projectors and computers, allow teachers to make authentic connections with students while allowing students to engage directly with learning. Both educational researchers and educational organizations have committed to supporting student learning through the effective use of technology in schools. Classroom technology can and should be so much more than a student texting under their desk during class. It should be viewed as a significant resource, both in terms of a pedagogical tool and in terms of connecting with younger generations (Polly, Mims, Shepherd, & Inan, 2009). Teachers often quip that they feel like entertainers in front of their classes (the sage on the stage). Technology, used appropriately by skilled teachers, can captivate and engage students and support the creation of active learning environments. Technology already plays a tremendous role in the lives of adolescents and teens as it is estimated that this group look at their phones 150 times a day (Brandon, 2017). If schools can mirror students' existing social interests in the classroom, students may find learning more exciting.

With the inclusion of technology in the classroom, it is fair to ask what impact technology has made on student achievement. Various research has been conducted in the hopes of quantifying results. Kulik (1994) used a research technique called meta-analysis to aggregate the findings from his research on computer-based instruction. Kulik found several positive outcomes including students scoring higher on standardized

tests, retention rates increasing over shorter periods of instructional time compared to students without computers, and students developing a more positive attitude about learning when computers are used as part of the instructional strategies. Sivin-Kachala (1996) reviewed 219 research studies to assess the effect of technology on learning and achievement and concluded that students in technology rich environments experience positive effects on achievement in all major subject areas and at all grade levels. As Apple developed educational technology, they conducted a study to assess the impact of interactive technologies on teaching and learning in five school sites across the nation (Schacter, 1999). Their hope was to encourage instructional innovation and to show that computers could support student initiative, and create cooperative learning environments. The study lasted for five school years and student growth and progress were measured throughout. Apple concluded that students using interactive technology resulted in new learning experiences requiring higher level reasoning and problem solving. Apple noted that no measurable gains were noted in students reading comprehension, vocabulary, and work-study were evident. Combining the results of the aforementioned studies shows positive gains in achievement on researcher constructed tests, standardized tests, and national tests (Kulik, 1994; Sivin-Schacter, 1998; and Apple, 1999). Evidence suggests that students made significant gains in understanding and retention in certain subject areas with the proper instruction.

As teachers have attempted to differentiate instruction, excite students, and create meaningful lessons, technology has always had a place in the classroom (Purdue University, 2018). Throughout the history of education, teachers have relied on new technological advancements to excite students about learning. In 1801, the chalkboard

was an education revelation, introduced in Edinburg, Scotland (Buzbee, 2014). Teachers could model problem solving and direct the entire class's attention to one focal point. Members of Purdue University (2018) believe that the invention of the radio in the 1920's sparked a new wave of learning allowing on-air classes. For example, educational radio programs could supplement learning for individuals unable to attend school consistently by bringing the learning to them in their own homes. This was followed by the overhead projector, a device which allows the educator to face the class while providing instruction and reviewing assignments, allowing students to follow along and take notes. In 1951, a major step forward was taken as students were afforded an opportunity to watch videotapes. The use of video clips, due to their combined visual and auditory features, proved a more efficient way for students to process and recall new information. Teachers had the ability to expose students to history and memorable activities increasing students understanding and familiarity with important events. Shortly after, the photocopier and handheld calculator entered the classroom allowing teachers to mass produce material and students to quickly solve math calculations. Uniform instruction across districts was now possible as math teachers could share worksheets and produce them in mass. Teachers did not have to create every activity from hand, and students were able to solve more complicated problems at a faster rate. Teachers and students could also check their work with the calculator and learn from their mistakes almost instantaneously.

Computers were introduced by IBM in the mid-1980's, but had difficulty gaining a foothold because of their size and expense and the teachers' relative inexperience using them. Likewise, there were few programs available, and the few that were mostly focused

on typing instruction or rote learning. Classrooms were not designed to house such cumbersome equipment and school budgets did not have the flexibility to incorporate such expensive equipment. In 1990, a giant step forward was taken with the introduction of the internet. The internet allowed students to complete research much faster and in greater depth than looking for books in the local library. Students also had the ability to learn from people from around the world as they could create and share content with anyone. Teachers had access to information, maps, and academic material that would have been otherwise out of reach. In 2009, 97% of classrooms had a computer and 93% had internet access which allowed students to do research, find information without the teacher, and explore information like never before possible. (Arefeh, Levin, & Lenhart, 2002). All of these tools have attempted to improve pedagogy and learning outcomes. Each has met with some success and allowed for greater retention of material (Burns, 2013).

In recent years, teachers have been challenged to incorporate social media into curriculum and instruction. For students, engaging with social networking technologies contributes to the development of their identity. Indeed, having access to the almost unlimited context of the Web allows students to form heterogeneous community networks, leading to substantial learning opportunities from a diverse group of peers (Boyd & Ellison, 2007). Sites like MySpace and Facebook, which are mainstream, have found their way into projects for every subject matter and allowed new pathways for communication between students and teachers (Magid, 2010). Educators continue to wrestle and explore with ways to either limit or exploit social media in their classroom and protect or enhance traditional teaching and learning methods (Al-Noor-Deen &

Hendricks, 2013). Teachers question whether social media can facilitate learning by enhancing students' engagement, identity, and enjoyment of a given course, independent of the content to be learned.

As technological innovations occur, there is a ripple effect into the world of education. Corporations who manufacture these devices develop educational applications to entice schools to purchase these devices to appeal to the teenage population (Hendricks, 2014). Teens, who are fascinated with the newest trends, are automatically drawn to cutting-edge and exciting new products. They are mesmerized by these new tools and become almost addicted to them as they rely on them in every facet of their lives (Quora, 2018). Schools who want to stay current and meet the needs of this generation and are challenged by state mandates to improve test results, grasp at any instrument that may lead to improved results.

Problem Statement

Any experienced teacher or administrator can attest that making education for current and future generations of high school students who have grown up in the age of technology relevant, interesting, and meaningful is an exceptionally difficult task. In traditional classrooms, students are expected to retain information through listening, assimilation, and by completing individual work at a desk (Jacobs, 2010). Fostering an environment that is conducive to teenagers learning is a difficult proposition. Teens have a relatively short attention span compared to the typical length of a class period (Johnston, 2016). Johnston believes that teens can only truly focus for about eight seconds on one stimulus before they become distracted by a new topic. It can be argued that today's students have a reduced attention span due to the manner in which

information is shared in the world (Berkowicz & Myers, 2017). Having instantaneous access to news stories, facts, and communication on their cell phones has made students even more impatient. No longer is patience a virtue or even necessary. Processes that used to take hours now can be accomplished in seconds without the need to rely on adults, wait in lines, drive to libraries, or search through countless texts. Since this information is already available to them, at the simple push of a button, students need to learn how to use this information in order to construct learning and engage with the content in ways that can increase and improve their understanding (Wilmarth, 2010). Therefore, the way students are instructed must change from the simplistic learning of facts to the utilization of the technology they have available in order to create and participate in their own meaningful learning experiences.

Briggs (2014) gives teens more credit and estimates that high school students only have the ability to focus on subject matter for approximately ten to twenty minutes if the material is presented in an engaging manner (Briggs, 2014). Further complicating the issue, an estimated 11% of our student population is believed to suffer from Attention-Deficit-Hyperactivity-Disorder (ADHD). Symptoms include daydreaming and a substantially reduced ability to focus on stimuli for a given time (Center for Disease Control, 2017). Students with ADHD often have continuing academic problems resulting in below average marks, more failed grades, and more discipline problems (U.S. Department of Education, 2009). Teachers must find ways to refocus students and excite them about learning. Capturing student attention with traditional lessons and unimaginative resources for extended periods of time is exceptionally difficult (Ferlazzo, 2011).

Schools on a traditional schedule have periods that last for approximately forty-five minutes while schools utilizing a block schedule can have classes that can last for eighty minutes or longer. Engaging the typical twenty to thirty teenagers enrolled in lengthy classes is complex and challenges even the best teachers (Berkowicz & Myers, 2017). Traditional teaching strategies are no longer enough and dynamic lessons need to replace antiquated methods (Lynch, 2018). The challenge is deciphering what teens will respond to and what resources will have the greatest impact. Research suggests that teachers will realize the best results if instruction is relevant and relatable to students' lives (Ferlazzo, 2011).

Students who do not feel personally attached to the information being disseminated do not internalize the material leading to memory loss after a short period of time (Sawyer, 2014). Sawyer (2014) believes this reduced learning leads students to perform poorly on summative assessments and a lack of conceptual learning. The more invested students are in the material and the more senses that are used to learn new material, the more likely students are to retain it for a longer period of time (Pino-James, 2014). Teachers must invest in new pedagogy and resources to create an active partnership in learning with students so that personalization may occur. Students are involved with the learning environment and treated as equals in the learning process are more likely to retain information and act as a motivated learner (Sawyer, 2008). This educational philosophy is not as situativity.

Constructing knowledge, critical thinking, and the learning of new information are situated in experience, or situativity. Situativity means that "knowledge is not just a static mental structure inside the learner's head; instead, knowing is a process that

involves the person, the tools and other people in the environment, and activities in which the knowledge is being applied" (Sawyer, 2014, p. 5). Once knowledge has been gained, it becomes a usable part of a student's memory. This retention and personalization usually manifest itself in better test scores. When children actively participate in constructing their own knowledge, they gain a deeper and more generalizable understanding and greater motivation. Resnick and Klopfer (2010) call for instruction that is "high in cognitive demand and that focuses on conceptual learning (p.183)." They argue that lecturing on facts without demands for reasoning produce "fragile knowledge" which is likely to disappear. The art of teaching requires simulations of real-life that provides reflective periods where students must apply learning and not simply regurgitate facts memorized at a superficial level. Finding new resources and technology that can create real-life simulations and expose students to as authentic learning opportunities as possible is critical.

Tools, such as virtual reality, can offer these real-life simulations, providing an engaging learning experience in which students interact with the content through multiple sensory perceptions at the same time. Virtual reality harnesses technology spawning opportunities for active learning (Reynard, 2017). Virtual reality is the term used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person. In the virtual reality environment, a user experiences immersion, or the feeling of being inside and a part of that world. He is also able to interact with his environment in meaningful ways. The combination of a sense of immersion and interactivity is called telepresence.

By assimilating virtual reality into traditional high school classrooms, schools afford students an opportunity for innovative and meaningful experiences that would otherwise be impossible (Babich, 2018). As students submerge into active learning environments, their motivation to learn and ability to retain information improves exponentially allowing for greater performance on assessments. Furthermore, by providing an academic forum based in technology, schools can provide a colloquium for learning natural to this generation serving to motivate twenty-first century high school students. Technology already infiltrates the methods in which students communicate, work, study, and participate in society (Roland, 2017). As teachers acknowledge their role is no longer to disseminate facts; instead, focusing on the creation of lifelong learners who need to create and explore. Virtual reality steps to the forefront as a critical educational resource because of its ability to simulate the real world, immerse students into their learning, and captivate their attention.

The next logical technological inclusion for academia is virtual reality. With the recent advancements in virtual reality, it can now be used in classrooms to enhance student learning and engagement like never before. Virtual reality can transform the way educational content is delivered because it works on the premise of creating a virtual world which necessitates that the user interacts with it (Babich, 2018). This is important as many students want to have experiences greater than reading about a topic. With virtual reality, students are not limited to word descriptions or book illustrations; they can explore the topic and see how things are put together.

Experts believe that virtual reality offers benefits that previous technologies could not afford students. Castenda, Cechony, and Bautista (2010) point to the positive results

that many elementary school teachers have had using virtual reality with younger students. Virtual Reality poses benefits in learning because it allows for manipulation of objects and participation in events that are physically out of reach and it increases the learner's participation and enthusiasm while broadening the array of multiple learning styles supported (Castaneda & Pacampara, 2018). They argue that the deeper learning experiences and immersive learning environment are positive steps in pedagogy. Thompson (2018) believes that even reluctant, early learners may be enticed to participate in activities that allow them to explore independently and move at their own pace. Steinbach (2018) illustrates the uses of virtual reality from elementary school to college and quips that virtual reality is on its way to becoming the new norm in instructional strategies. Steinbach points to the growing ability to visualize ideas and plans and to see ideas come to life. Heick (2017) concurs suggesting that virtual offers an opportunity for human interaction that creates experiences not otherwise possible. She discusses the ability to travel and explore places all over the world, the opportunity for students to develop empathy for communities in crisis, and the chance for students to explore within the human body.

As schools continue to look to technology to support learning, virtual reality can no longer be ignored and will become an integral part of the constructivist learning platform which focuses on each student developing knowledge for him/herself and giving it meaning as it applies to the individual (Hein, 1991). Contemporary educational philosophy asserts that students are better able to master, retain, and generalize new knowledge when they are actively involved in constructing it through an active learning partnership (Krajcik and Shin, 2014). This is the philosophy of pedagogy described by

Guba and Lincoln (1994) where they define constructivism as "knowledge accumulating only in a relative sense through the formation of ever more informed and sophisticated constructions caused by immersion and interaction (207)." Virtual reality can serve as an amazing academic tool that allows for complex immersion and interaction.

Not only is there the potential that virtual reality will significantly impact learning, it may also transform teaching and assessment. Teaching practices can transform from a more lecture-focused classroom environment to one that is more student-centered and focuses on active and project-based learning. Krajcik and Shin (as cited in Sawyer, 2014) discuss situated-learning which promotes the concept that the most effective teaching occurs when the learning is situated in an authentic, real-world context. By experiencing events with multiple senses, the expectation is that students will remember more information and understand it at a far superior level. Krajcik and Soon (as cited in Sawyer, 2014) argue that for students to truly understand a lesson, they must not only hear the lecture, but be involved with a learning process that involves problem-solving, decision-making, and explaining real-world phenomena. This will lead to elaborative rehearsal memory and comprehension rather than superficial short-term memories which will disappear quickly (Kassin, 2001). By fully immersing students into an experience and environment, virtual reality creates the learning environment and active learning that constructivist learning theories and Krajcik and Soon implore teachers to provide.

With the change in teaching strategies, assessments must be developed to mirror the instructional practices. In the past, assessments were often used to see if students were paying attention, completing assignments, and retaining information (Gronlund &

Waugh, 2009). These tests were often multiple choice and true/false with an occasional short answer. With advancements, it will no longer be acceptable for students to simply regurgitate information or select multiple-choice answers. With the use of virtual reality teachers have the ability to create assessments which allow students to be reflective by asking for analyses of situations and explanations as to why events occurred that students have witnessed. Students will be able to elaborate on complex concepts, express emotion, mood, and the causation for historical events. This type of assessment is more authentic and requires higher-order, complex thought, and understanding.

Technology is generating opportunities for communication and collaboration. Depending on a school's location and the available resources, students may have limited opportunities to explore cultures, museums, and landmarks. With the advent of technology, students can follow expeditions, interact with experts, and videoconference with students from around the world ("Purdue University," 2019). The potential impact of technology may be understated and misunderstood (Lynch, 2019; Schacter, 1999; Purdue University, 1999). They point specifically to the active engagement that computers offer students, the use of real-world issues, opportunities for simulation and modeling, students use of discussion and debate boards, opportunities for group work and collaboration, coaching by both teachers and professionals from around the world, and assessments based in critical thinking and problem solving.

The same study found that it was not just the opportunities for students that changed. Teachers roles changed as well. Due to the access of information through other sources, teachers are no longer counted on to be experts on every topic in the classroom. Teachers are now able to guide the procurement of knowledge as students are given

independence and additional responsibility. Teachers can also create interactive instructional resources that encourage collaboration and experimentation. Teachers must be cognizant that their role has not been trivialized, only altered as students are given more ownership of their own learning.

Perhaps, more importantly, is the impact that technology has had and how it can continue to decrease the achievement gap which exists between higher and lower socio-economic classes. Schools serving underserved students that have added technology to curriculum and instruction have seen marked growth ("Gap," 2019). Poor and minority students have shown growth in time on task, improved attitudes towards learning, increases in knowledge, more face-to-face time with their teachers, better curriculum and instruction, and a classroom that has the potential to meet the needs of every child regardless of their individualized education plan (IEP) and poverty" ("Gap," 2019, p. 2). These advancements become increasingly impressive as access to adequate teaching, field trips, and other tools may be limited. Closing the achievement gap has been a focus of professional educators and politicians for decades (Lynch, 2019). Students and schools in poorer districts lack the access to the same educational opportunities and technologies afforded to their more affluent counterparts. Computers and technological innovations that are added, must be done so with a student-centric ideology. Computers cannot simply be added to reinforce current teaching strategies, they must revolutionize the classroom experience (United States Department of Education, 2019). When given access to appropriate technology used in thoughtful ways, all students, regardless of their respective backgrounds, can make substantial gains in technological readiness, STEM

classes, and college and career readiness skills (Darling-Hammond, as cited in The Communications Staff, 2018).

Impetus of the Study

The Harmony School District is perfect for the examination of virtual reality's promise and impact on instruction, particularly in the area of United States History. The diversity of socio-economic background, race, gender, and overall academic ability, provide the perfect backdrop for the results of this action research dissertation to serve as a blueprint to most districts in the United States. Too often, high school students are passively receiving their education. The idea of learning as an active endeavor often takes a backseat to the need to get through the curriculum and prepare for standardized testing. What is chiefly missing from education, for many students, is the sense that they are actually being primed for their future and they are going to interact with the world at large.

Students are not often provided the opportunity to solve practical problems or to explore the relevance of their learning; instead, school is about completing assignments and earning abstract grades. Some of the content, like English and Mathematics have obvious applications beyond school. Students needs to know how to read, write, communicate, and complete basic operations for everyday living. Even science plays a significant role in life outside the classroom. However, unless one plans on teaching, entering the Military, or working in a museum, learning Social Studies (i.e. History) typically has little relevance in the life of a teenager.

Due to my years of experience as an administrator, it is easy to understand why social studies is seen as a second-class subject. First, social studies content knowledge is

not a tested subject in any state mandated assessment or policy. Second, there is the lack of a clear direction towards a high paying career. High school students cannot point at someone, other than their social studies teacher, who is making money directly from earning a degree in social studies. Students sometimes lack the foresight to understand that political careers, newscasters, and others have earned their positions through a thorough social studies background. Third, and most importantly, many students feel that the current methodology utilized to teach social studies is boring and does not appeal to the 21st century learner (Davis, 2017). The topics discussed in social studies classrooms are covered at such a pace that they are not interesting and fail to capture the imagination, nor is there time for students to make in-depth connections with the world we live in today (Milo, 2015). Where other subjects allow for creativity, physical activity, and experiments; social studies relies on textbooks, globes, and maps (Davis, 2017).

Harmony High School social studies elective classes have lost enrollment consistently over the last several years while other subjects have seen an increase. Students are taking the three required courses and leaving the department before experiencing any of the outstanding electives. While in class, Harmony High School students complain of boredom, fail to complete assignments, and pine for their senior year when they will not be forced to take a social studies course. Harmony's ten social studies teachers have failed to incorporate any new manipulatives or incorporate new technology into the curriculum that would draw the interest of students. Observations conducted by myself and my assistant principals often note that class time is dominated by textbooks, lectures, and Power Points. Department conversations around student-centered learning often end with few innovations and some blaming students for being

apathetic. While the Harmony teachers are a strong, well-meaning group, they have been perplexed about how to change the culture of the department and the perspective of students.

Complicating the matter is the graduation requirement from the New Jersey Department of Education which requires high school students, regardless of interest and college and career pathway, to take two years of United States History and one year of World History. During the three years of enrollment, teachers feel pressure to cover comprehensive standards that ask for a great deal in a relatively short amount of time. Without worthwhile resources social studies teachers attempt to cram every important event that has happened in the United States over the last 600 years, plus thousands of years of world history into three years (Alber, 2014; Whitson 2004). This expectation does not create opportunities for in depth analysis or project-based learning. The time for constructivist learning is simply not built into the curriculum unless the teacher wishes to cut out a few hundred years of history. With the previous resources failing to provide students with dynamic tools, Harmony High School teachers are challenged to make social studies classrooms more relevant and tangible, by infusing new technology that allows students to interact with prominent events and places and captivates their imagination (Milo, 2018; Luck 2015). Students who are active, engaged learners are willing learners who will retain more and possibly find new enthusiasm for the social studies curriculum (Ferlazzo, 2011).

If the overall data relevant to student attention spans in schools is not reason enough to find new and meaningful ways to interest students in learning, the level of boredom that students are experiencing in the traditional social studies classroom makes

the lack of meaningful learning exponentially worse (Milo, 2015; Luck, 2018). It is not unusual to hear Harmony High School students quip about how learning history "will not help them with their lives" and "why should they care about a bunch of dead people." Memorizing dates and names is not something that excites the common adolescent, and teachers struggle to make history come alive (Luck, 2018). Even when the newest textbooks can be purchased, they do little to captivate students who would rather engage and interact on their electronic devices (Ferlazzo, 2016). Blackburn (2018) agrees suggesting that publishers who try to meet "everyone's needs end up missing the mark and offering irrelevant information to students that is impractical for teachers to infuse in any meaningful manner" (p.2). More recent and hands-on tools like Google Earth and Wikipedia are interesting, but not truly geared towards the classroom and can serve as a tremendous source of misinformation (Davis, 2017). Anyone with a computer and an opinion has the ability to post "facts" to Wikipedia. Students conducting research come across this information and believe it is researched data instead of a fallacy that has been irresponsibly posted.

Purpose of the Study

The purpose of this study was to assess to what degree virtual reality could serve as a dynamic learning tool that could create engaging learning environments and transform the learning experience for high school students. Particularly, I was looking at the impact that virtual reality could have on student performance in United States History I classes. This dissertation addresses the logistics of creating virtual reality learning environments, the potential impact virtual reality has on student learning outcomes,

teaching strategies, changes to assessments, and the potential for expansion into other subjects.

By embedding virtual reality into regular social studies instruction, students should be more excited about learning and feel more connected to the material. This is imperative because students who are interested and actively engaged are more likely to retain information (Sawyer, 2014). Mathan and Koedinger (2005) state that the key to designing deep learning environments is to develop student interest, motivation, and engagement. Krajcik and Shin (2014) believe that "to form usable understanding, knowing and doing cannot be separated, but must be learned in a combined fashion that allows for problem-solving, decision-making, and real-world phenomena (p. 275)." Finding new and exhilarating ways to create active learners is imperative. There are an estimated 3.6 million high school students in the United States and 47 million elementary students (US DOE FACTS, 2017, p. 1). Exploring opportunities in virtual reality could change the methods of teaching and learning for all of them. It is likely that virtual reality could be a useful tool in every high school subject curriculum in a myriad amount of ways, but for this dissertation, I will only focus on United States History I.

Action research provided the most poignant manner for me to conduct this study. When blended with mixed methods, action research generated more systematically sound and more versatile results by combining "qualitative stakeholder engagement methods with quantitative outcome-based oriented approaches" (Ivankova & Wingo, 2018). Instead of focusing on theory, mixed methods action research establishes first-hand learning from concrete practice. This methodology allowed for the development of a plan to improve teaching practices that are already occurring, to actually implement the

plan with the support of the teachers and superintendent, to observe the impact of the modifications, and to reflect on these changes as a basis for further planning, expansion, and development of strategies through a succession of cycles (Kemmis, 1983). Real students, in existing classrooms experienced social studies in a manner never before possible.

Research Questions

Research on the applications and implications of virtual reality led me to ask questions concerning different aspects of instruction. One pathway led me to developing essential questions relevant to the logistics of adding virtual reality to the school district. The main research question associated with this action research dissertation focused on the logistical, curriculum, and professional development issues that the school encountered. The second pathway concerned whether or not student growth and achievement improved with the addition of virtual reality into the teaching practices. The specific research associated with this area evaluated students' assessment scores. Some of the research questions had to be refined or omitted and new question became necessary as the data collection process begins. Conducting this study as an action research model allowed me to focus closely on my specific research questions. In addition, the following supporting questions were explored:

1. What could virtual reality add to the United States History curriculum?
2. What professional development and support did teachers need to successfully implement virtual reality into their United States History curriculum?

3. How did virtual reality impact instructional pedagogy of United States History teachers as they moved from traditional teaching strategies to more technology-based strategies?
4. How was student performance and achievement impacted by virtual reality?

Significance

The goals of this study were many and evolved as both qualitative and quantitative data were unpacked. First, there was the hope that new insights would be garnered about the practical applications and implications of virtual reality in schools. Little was known about how teachers could successfully implement this budding technology and no data existed to determine how students would respond to it. By creating two virtual reality labs, this dissertation could play a prominent role in blazing a pathway for other schools interested in improving student learning outcomes through virtual reality. These results were based upon the achievement of action-oriented outcomes (Herr & Anderson, 2005). After analyzing the quantitative and qualitative data, not only will I be more cognizant of whether or not virtual reality is a passing fad or holds great potential, but hopefully students will be more informed citizens, teachers will have a powerful new tool, and fellow administrators will have a resource to develop their own virtual reality labs. Professional development specific to high school teachers had to be created and was shared throughout this dissertation process. Finally, by illustrating the logistical aspects of creating successful labs and identifying pitfalls for other school districts to avoid, there is hope that this dissertation will serve as a virtual reality map for districts interested in creating similar experiences.

Drawing inferences from a mixed method action research analysis helped me answer the research questions that I had set forth. Potential changes to the curriculum were examined for significance and necessity, and any professional development that is either created or already exists was evaluated for effectiveness. The effectiveness of professional development was measured by conducting interviews with the participating teachers, through clinical observations, new assessment strategies and questioning techniques, and overall student performance. The final area of measurement included any health/ethical concerns that arose from the use of virtual reality. A concern exists that prolonged exposure to this new technology could cause various medical issues such as nausea, motion sickness, seizures, or damage to eye muscles. Notes were taken every period documenting how many students complained of any pain and to what extent. Students complaining of prolonged issues were sent to the nurse for care. Significant professional development and support from the school nurse was relied on to make sure that virtual reality did not cause an unsafe teaching practice. Student health was of the utmost importance and was not be jeopardized for this action research project.

For the purpose of this research, Google Expedition (GE) will be the virtual reality hardware that is referred to throughout the dissertation. After careful research into various options, GE was the best option for the school district for a number of reasons. The first consideration was that students do not have to place their individual phones into the headset. Requiring students to use their own phones would have created a logistical nightmare as not every student has a phone and those that do, may not have the same type of phone. Second, the cost was appropriate for a school, as each set of 30 goggles cost approximately $10,000. Third, there are a number of virtual "field trips" offered. United

States social studies teachers were able to identify seventy that they would consider using throughout the course of the year.

Virtual field trips ranged from museums discussed, access to Angel and Ellis Island, to battlefields and historical monuments. At the beginning of this dissertation, over 600 virtual field trips existed covering topics taught in every subject at every grade level. Not all of them are appropriate for schools and most do not relate to social studies, but there is a significant library from which to choose and that is important. Due to the nature of the virtual reality offered, there is a significantly reduced risk of students having health concerns and that factor was also very important. There is no ability for students to socialize or engage with citizens unrelated to the school environment which would cause situations that teachers would have to monitor closely. The software, due to the manner of display does not cause overheating quickly and will be easy for teachers and students to master. The technology is not overwhelming, there is limited ability for students to interact with the virtual environments or each other, and substantial room for improvement is evident, but some roadblocks are unavoidable and pale in comparison to the potential benefits.

Conclusion

As discussed, there is a definite need to update the teaching pedagogy associated with the curriculum for United States I History. The tools associated with the course were outdated and not motivating to students. New resources had to be infused to reinvigorate students and create an enthusiasm around a course that should prepare students for college, career, and to be informed citizens. This research was critical to explore the impact that virtual reality can have on teaching and learning. What pedagogy

would change and how students would respond to the changes were unknown. Whether or not students would be able to better retain information and become better students because of virtual reality has not been sufficiently documented in a quantitative or qualitative manner. The modicum of research that is currently available rarely speaks to a high school in the United States and even less often focuses on a social studies classroom. Several researchers (Bell, Black, Davis, etc.) hypothesize that virtual reality can have a significantly positive impact, but few are in a position to implement it and chart the data. That is what made this opportunity so exciting. How to support teachers through this endeavor was a virtually untapped field that will have to be enhanced to create a sustainable practice that teachers successfully implement. This study should lead to the creation of professional development tools and resources that are generalizable to any district looking to infuse virtual reality.

Google Expedition has only been available to schools for a couple of years. Few schools have implemented the costly hardware. It is estimated that just over two million students from around the world have used Google Expedition in a school and over half of them are students in England ("GE use," 2017). No professional development was currently offered for teachers who wish to use virtual reality. Even Google, the manufacturer, did not offer specialized, professional development for schools. Very little data existed to support the benefit of using any format of virtual reality in the classrooms and concerns about medical issues can lead to schools second-guessing whether or not virtual reality is worth the risks.

Whether or not the use of virtual reality succeeds in the classrooms will depend on utilizing best practices for creating the right environment for change and developing

policy that speaks to the updated pedagogy. Creating a change environment that welcomes virtual reality will depend on the change leader creating an atmosphere conducive to this transformation in pedagogy. Weick and Quinn (1999) refer to this as an episodic change because it follows an unfreeze-transition-freeze pattern. This form of change is labeled episodic because it "tends to occur in distinct periods during which shifts are precipitated by external events such as technology change or internal events such as change in key personnel. Episodic change tends to be dramatic change" (p.8). To create a fluid transition Rogers & Renard (1999) illustrate some poignant strategies that include involving teachers in the decision-making process, evaluating the innovation's role in the current structure, and then trying it out to see if it is an effective tool. In addition to exploring the meaningful changes to instruction and learning, this research has the potential to serve as a logistical map for facilitating change supported by the development of an evolving, 21st century policy.

Chapter 2

Literature Review

There was a dearth of literature available about how to infuse virtual reality into traditional high school classrooms. Delving into a still developing topic created challenges and opportunities. Much of what was encountered through the action research methodology was novel although it was possible to make connections with learning theories. Specific information had to be reviewed from Google Expedition about the virtual field trips that are offered, their recommendations for using it, and logistical issues that schools may encounter. Understanding assessment strategies common in social studies classrooms will be the next topic to be defined and reviewed. Preston (2018) identifies over forty different potential assessment strategies that can be used to evaluate student retention for various social studies curriculum units. How students are performing on the assessments and skills specific to the social studies classroom with and without virtual reality were analyzed.

The literature discussed delves into the various cycles of this mixed methods action research study. Specifically, literature focused on the history of technology in education, pedagogical impacts of adding technology, student motivation, and health concerns. An examination of the impact that technology has had on education followed by a specific review of virtual reality and Google Expedition will follow. Next, I will delve into the discernable problems with social studies instruction including pedagogy, student motivation, and assessment. Tied closely to this is supporting teachers through PLC's and other professional development. Finally, a review of any literature on the health and ethical concerns will conclude the literature review and lead to a thorough

discussion on mixed methods action research. Combining these topics illustrated the potential applications and implications of virtual reality in the classroom. A literature review is necessary for defining various components and analyzing the technological journey from chalkboards to virtual reality. Virtual reality was not the first technological development to be introduced to social studies classrooms. With the field of education consistently turning to technology to increase student learning and to improve teaching pedagogy, a focus on the past successes and failures of technology in the classroom is necessary (Schwartz, 2015). There is a scarcity of documentation and data on the use of virtual reality in high school social studies classrooms, especially concerning action research initiatives, but there was some research which was similar. This research, mostly in the fields of business and military was generalized for reference and guidance. It was possible to find other levels and types of schools and institutions that are using virtual reality in comparable initiatives. While there were many differences, correlations were possible in the areas of pedagogy, assessment strategies, student performance, and professional development needed by the teaching staff.

Technology in Education

Various technologies have made their way into American classrooms over the last couple of centuries meeting with different levels of success. None are given credit for revolutionizing education more than the chalkboard which made its first appearance in the early 19th century (Gershon, 2017). In 1841, one educator declared that the blackboard's unknown inventor "deserves to be ranked among the best contributors to learning and science, if not among the greatest benefactors of mankind." Around the same time, another writer praised blackboards for "reflecting the workings, character and

quality of the individual mind" (Gershon, 2017 p.1). While the chalkboard remained the focal point of classrooms for almost 200 years, it eventually became a victim of technology as it was replaced by whiteboards and smartboards. Today, with the advent of chrome books, laptops, cell phones, and emerging technologies, schools need to evaluate which technologies will have the greatest impact on both learning and pedagogy. All of these resources support active learning environments and are easy for teachers to implement allowing for a significant impact on learning.

Schools face an uphill battle as limited budgets make it next to impossible for districts to stay current with technological advancements (Kreuger, 2006; Press, 2009). District administrators can ill-afford to buy new technology and invest in professional development, only to see the technology be pushed into the corner or worse: be an ineffective device that wastes time and leads to little educational improvement. While principals acknowledge that change must occur; what the change platform resembles and how to act as an effective change leader becomes the challenge (Fullan, 2010; Weick & Quinn, 1999). Virtual reality appears to offer the necessary risk versus reward and allow for schools to buy-in at a reasonable price and create exciting learning environments for students (Catapano, 2017).

Today's teenagers spend an inordinate amount of time in front of a screen (New York Times, 2019). The New York Times argues that this reliance on technology has changed the way students learn and process information. They state that "there is mounting evidence that constant use of technology can affect behavior, particularly developing brains, because of heavy stimulation and rapid shifts in attention" (p.2). This shifting of attention may have caused a variance in how students process information.

Christensen and Knezek (2008) created instruments to evaluate the effectiveness implementation of technology in education. They identified seven validated tools spanning the areas of attitude, beliefs, skills competencies, and integration proficiencies. What they found was that the effectiveness of technology in the classroom was reliant upon professional development for the teaching staff and how well the initiatives were supported by administration. With supported sustained focus on educational technology, Christensen and Knezek (2008) documented substantial growth in student learning and an improved attitude towards school. They define educational technology as a field of study that investigates the process of analyzing, designing, developing, implementing, and evaluating the instructional environment and learning materials in order to improve teaching and learning. Schacter (1996) and (Cox, 2019) came to the same conclusion in their own research as they looked at notable studies to determine what impact technology had on student achievement. Each study asserted that technology, in varying degrees, had improved the learning environment for teens.

Other studies found that students who had used computers regularly in class scored fourteen percent higher than comparable classes where no computers were available (Schacter, 1996; Salsich, 2018; Catapano, 2017). Kulik (1991) noted that students learn more in less time when they receive computer-based instruction. Kulik (1991) and Sivin-Kachala,(1996) suggest that students have more favorable opinions and develop a more positive attitude about their classes when computers are a regular part of instruction. Lynch (2017) concurs and believes that students' improved outlook about school is directly related to the more active engagement with the material that students enjoy due to the interactive nature of technology. Researchers at Purdue University

(2019) noted that another beneficial aspect regarding the implementation of technology was the increased communication and collaboration skills that students displayed because of the availability of technology in the classroom. They specifically noted that technology allowed for group work, peer collaboration after school hours, and direct contact with scientists, experts in the field, and other students from around the world.

Baker, Gearhart, and Herman (1994) focused on the gains made by the teachers in their pedagogy when using technology in the classrooms. They discovered through empirical studies that using computers forced teachers to update teaching practices toward a more cooperative approach and reduced teacher lecture by almost half. Both studies focused on the increased creativity of lessons when teachers infused technology. They believe that the entire concept of learning can go from passive to active when technology is successfully infused. Baker, Gearhart, and Herman, (1990); Champagne, (2013) also argue that instruction is more likely to be authentic and based upon real-world problems when students are subjected to the material using technology. Finally, Solomon (1991) determined that the effective implementation of technology was more effective than cutting class size, adding instructional time, or providing tutoring programs.

Conversely, many researchers have pointed to the many disadvantages of focusing too heavily on implementing technology in the classroom. Most schools do not have the ability to keep up with the advancements in technology (Heick, 2016; Lynch, 2018). They cite the continuous costs and professional development that would be necessary. Kulik (1991) found that computer-based instruction was not beneficial for every subject and not every teacher is properly prepared to introduce technology into the

regular curriculum. Baker, Gearhart, and Herman (1990) and Lynch (2018) note that students, especially lower economic students, did not perform any better on standardized tests that focused on vocabulary, reading comprehension, mathematics concepts, and work-study because of the use of technology, while Wenglinsky (2002) found that students using technology only performed three to five weeks ahead of their counterparts making the investment in computers ineffective. Technology also poses issues with social skills and can serve as a major distraction (Heick, 2016; SREB, 2018; Gates, 2002). Students who are engaged in an animated version of the world will spend less time engaging with their peers and teachers may lack the basic ability to monitor students' activities when technology is relied on too heavily.

Interestingly, how the technology is infused seems to make a tremendous difference in the success rates. Stone (1991) argues that if computers are used as a resource to improve instruction, greater success is realized than if the focus is on using technology and the education/instruction comes later. Teachers realize that adding a tool will not, in itself, make the instruction better. Kurzweil Blog Team (2018) found that 75% of teachers found positive gains if they were given professional development on how technology can assist them in reinforcing or expanding content; Herold (2018) refers to this as blended learning. Research suggests that technology is more effective when it is used for personalized learning as opposed to group instruction (Herold 2018; Ron 2018). They believe that technology gives teachers an opportunity to tailor education to individual academic strengths, interests, motivations, and pace. It seems that technology offers great opportunity, but is not a magic bullet for instruction (Wainwright, 2014). Poor instruction remains ineffective even with the newest computers. Strong instruction

may get even better when technology is embedded in already strong teaching practices. The key is for professional development to support motivated teachers as they infuse new tools into their existing pedagogy (Ron, 2018; Wainwright, 2014).

If teachers are provided with the appropriate technology and professional development to implement it, students can realize tremendous academic gains (Christensen and Knezek, 2008; Schacter, 1996). A 2016 meta-analysis of 15 years' worth of research studies, for example, found that "1-to-1 laptop programs had, on average, a statistically significant positive impact on student test scores in English/language arts, writing, math, and science" (Herold, 2016, p. 1). New findings suggest an important three-way intersection between computers and digital technologies, getting students to work together, and employing extra learning supports and tools (Herold, 2016; Tamim & Borokhovski, 2011). Learners with computer-supported collaborative learning achieved significantly greater knowledge gains, exhibited better skills, and had more positive perceptions than their counterparts in computer-supported individual learning" (Chen & Wang, 2018).

If traditional, two-dimensional computers can impact learning, collaboration, and pedagogy so significantly, then virtual reality's potential is overwhelming. While studies on students using virtual reality are rare, one study found that when comparing the impacts of the Internet Virtual Physics Laboratory with a traditional laboratory on collaborative problem solving among four classes of 150 Taiwanese 10th graders, students who used the virtual laboratory to observe physics phenomena, measure variables, and analyze data were found to have "significantly better science process and problem-solving skills" (Herold, 2016, p. 3). These results are promising, but a thorough

review of best practices with virtual reality in a classroom, assessment strategies, and medical concerns is limited as virtual reality hardware is just coming to the forefront of the educational discussion.

Learning Theory

Learning is defined as an increase, through experience, of problem-solving ability, an increase, through experience, of ability to gain goals in spite of obstacles (Washburne, 1937). Learning is further defined as the memories which aid in imaginal extension of experience toward the goal. How students learn is a complicated topic that has evolved over time. Gardner (1983) believes that people learn in very different ways. He developed his theory on multiple intelligences. The multiple intelligences theory refers to a theory describing the different ways students learn and acquire information. These multiple intelligences range from the use of words, numbers, pictures and music, to the importance of social interactions, introspection, physical movement and being in tune with nature. Trying to find the best instructional pedagogy for so many different learning styles is critical, but also elusive. Students have different learning styles and will gravitate towards varying teaching strategies. Research conducted on the topic show that teachers and students rarely agree on the best methodology for learning (Schwartz, 2018). While it may be difficult for teachers to rely on one learning theory, there are a few that seem to be the most effective. The main focus of this research will rest on constructivist learning and situation learning because of the focus being placed on creating active learners who are immersed in the material due to the use of virtual reality. Salsich (2018) identifies constructivist learning as one of the most effective methodologies for the

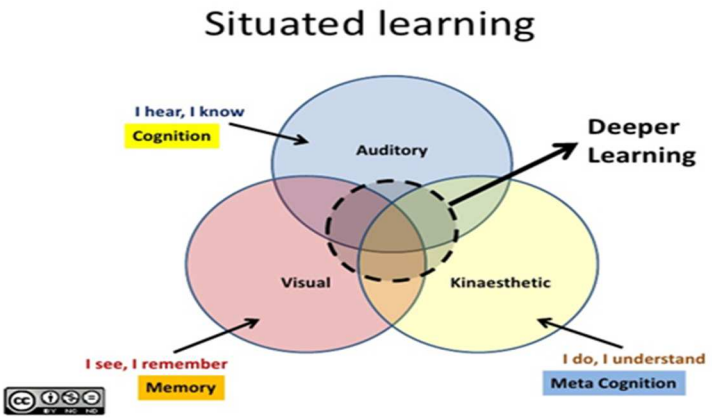
majority of student learners. Through virtual reality, the creation of a constructivist learning environment is possible like never before.

Constructivist learning. Constructivism as a paradigm or worldview posits that learning is an active, constructive process. The learner is an information constructor (Vygotsky, 1980). The term refers to the idea that learners construct knowledge for themselves---each learner individually constructs meaning as he or she learns (Hein, 1991). People actively construct or create their own subjective representations of objective reality. New information is linked to prior knowledge, thus mental representations are subjective (Vygotsky, 1980). Vygotsky's theory promotes learning contexts in which students play an active role in learning. Roles of the teacher and student are therefore shifted, as a teacher should collaborate with his or her students in order to help facilitate meaning construction in students. Learning therefore becomes a reciprocal experience for the students and teacher.

Active learning is student-driven, teaches students how to learn in collaboration with their peers, and asks teachers to give some portion of the authority that has traditionally been theirs over to students (Salsich, 2018). Students, on the other hand, take increased ownership for the direction and progress of their learning. Vander Ark (2019) believes this teaching strategy is imperative considering the challenges faced by students entering the workforce. Teaching student's ownership of their learning and encouraging them to use information in a creative way is paramount to success in this century (Vander Ark, 2019). Creating active construction learning environments focuses on students collaborating and creating instead of listening and memorizing. This theory contradicts the practice that students act as buckets waiting for teachers to fill them with knowledge.

Instead, learning is seen as an active process in which the learner uses sensory input and constructs meaning out of it (Hein, 1991). The more traditional formulation of this idea involves the terminology of the active learner stressing that the learner needs to do something; that learning is not the passive acceptance of knowledge which exists, but that learning involves the learners engaging with the world (Vygotsky, 1980; Hein, 1991).

Situated learning. Situated learning is a by-product of constructivist learning theory. Both theories emphasize the importance of students learning in the most realistic environments possible. Situated learning environments place students in authentic learning situations where they are actively immersed in an activity while using problem-solving skills. This includes field trips where students actively participate in an unfamiliar environment, cooperative education and internship experiences in which students are immersed and physically active in an actual work environment, music and sports practice which replicate actual setting of these events, and laboratories and child-care centers used as classrooms in which students are involved in activities which replicate actual work settings ("Situated Learning," 2010). These opportunities should involve a social community which replicates real world situations. In the end, the situated learning experience should encourage students to tap their prior knowledge and to challenge others in their community (Stein, 1998).



(Wheeler 2012)

Figure 1. Situated Learning.

One of the most common assessment strategies for situated learning is project-based-learning (PBL) (Blogger, 2016). PBL is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of authentic problems (Blumenfeld et al., 2011). Project-based learning (PBL) is a model that organizes learning around projects. According to the definitions found in PBL handbooks for teachers, projects are complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision-making, or investigative activities; gives students the opportunity to work relatively autonomously over extended periods of time; and culminates in realistic products or presentations (Jones, Rasmussen, & Moffitt, 1997; Thomas, Mergendoller, & Michaelson, 1997). Other defining features found in the literature include authentic content, authentic assessment, teacher facilitation but not direction, explicit educational goals, cooperative learning, reflection, and incorporation of adult skills (Diehl, Grobe, Lopez, & Cabral, 1999). PBL projects are focused on questions or problems that drive students to encounter and struggle with the central concepts and principles of a discipline (Thomas,

2000). Creating PBL assessments for students allows for creative answers to difficult problems. Students become investigators, seeking out information and solutions as the teacher facilitates learning and guides student inquiry. This authentic assessment strategy is strengthened when teachers connect learning to partnership and technology.

Technology's Impact on Motivation

While technology has been added to the classroom in multiple ways for generations, determining what impact it has had on students is imperative. Does technology motivate students to learn and help to create a more positive climate for learning? Motivation refers to what a person will attempt, yet ability is defined as what a person can do (Pintrich & Schunk, 1996). Pintrich and Schunk (1996) believe the purpose of motivation theory is to explain student behavior and influence future behavior. Recent theories of motivation can be categorized as variations of expectancy-value model of motivation. This model focuses on three areas: value (students' beliefs about the importance or value of a task), expectancy (students' beliefs about their ability or skill to perform the task), and affective (emotional reactions to the task and self-worth evaluation (Pintrich and Schunk, 1996). If students believe that a task is worth doing, that they can be successful in accomplishing it, and the students are emotionally attached to it, they are more likely to be motivated to put a great deal of effort into it.

One of the keys to improving student motivation is to appeal to what interests them (U.K. Learners, 2019). If you want students to be engaged and motivated to learn, then you must find which resources students will have an emotional reaction to and what will inspire them. Studies show that students thrive and are more likely to stay engaged in what they do when they are utilizing technology (Heafner, 2019; Kurzweil Blog,

2019). Studies reported positive effects of using technology on student motivation (Cox, 2019; Lynch, 2019). In Cox's study, students report that learning is more fun though technology and it makes them feel smarter. Students also report being motivated by lessons that illustrate real-world problems (Lynch, 2019). By using the internet, students can research real issues happening at that moment that are related to the classroom curriculum. This helps students understand that the lesson being taught refers to real problems and real people (Lynch, 2019). By creating empathetic students who can relate to current issues being faced by people around the world, students are more likely to engage in the topics and be invested in the outcomes (Heafner, 2019).

Using technology is especially important in social studies classrooms in which students perceive social studies as boring (Schug, Todd, & Berry, 1984; Shaughnessy & Haladyana, 1985). Antiquated maps and globes do not provide an engaging realistic perspective and students quickly lose interest (Luck, 2018; Heick, 2016). If students perceive the task as boring or too difficult, they will avoid the task. Students will approach tasks they believe are fun, require a moderate amount of effort, and are reasonably challenging. Thus, the nature of the task and student perception of the importance of the task become key factors influencing student motivation for approaching or avoiding the task (Blumenfeld, Mergendoller, & Swarthout, 1987; Eccles et al., 1983). A study by Godzicki, Godzicki, Krofel, & Michaels (2013) focuses on the element of motivation among middle school students. They implemented a technology supported learning environment and targeted behaviors. The authors found that students were more likely to engage in an activity simply because technology was being used. It

appears that the more inclusive and interesting the technology is, the longer it will hold students' attention and serve as a strong motivator.

Technology can also motivate students because it can modify the pace of instruction to meet students at their ability levels. In a traditional classroom, students who were struggling to learn new concepts would quickly fall behind their peers. With online assignments, however, students can advance at their own pace. "Those who need more time or extra help can practice outside of class with guided exercises or additional coursework. So, too, can learners who want more of a challenge" (Himmelsbach, 2019; U.K. Learners, 2019, p.2).

Finally, technology can motivate students by praising accomplishments and correct answers or by illustrating mistakes and immediately allowing for remediation (Kurzweil, 2019). Technology is interactive, and students learn by doing, researching, and receiving feedback. The more immediate the feedback, the more likely students are to remember the correct answer (Lynch, 2018). Traditionally, students had to wait until a teacher graded papers and hopefully returned them. Now, most computer programs, immediately tell students which problems are incorrect and sometime even offer a tutorially explaining the proper steps.

Technology's Impact on Pedagogy

In general, as people reflect on their time in school memories probably consist of a teacher and a textbook at the center of instruction. This outdated pedagogy places an emphasis on two sources of learning and eliminates opportunities for students to be active in the process. With the infusion of educational technology, students can also supplement their learning by connecting with online groups and virtual communities in

real time, or by collaborating on group projects with tools such as wikis and cloud-based apps (Himmelsbach, 2019). In addition, instructors can provide access to course material by setting up portals through learning management systems or providing access to course-specific software for each learner.

As technology has advanced, so have the expectations of the teacher in the classroom. It is no longer acceptable to lecture for the duration of the period and expect students to remain attentive. For teachers, the possibilities are endless: from using simulation tools to demonstrate how a hurricane develops, to using virtual reality to practice medical procedures (Himmelsbach, 2019). As a growing number of medical schools bring virtual reality into the classroom, students are finding it an effective way to learn complex subject matter, such as anatomy, that's often easier to understand with hands-on practice.

Furthermore, the introduction of technology into the classroom has decreased classroom management issues for many teachers, especially in situations where classrooms are overcrowded. For example, a blended classroom model combines an online component with traditional direct instruction (Sholes, 2018). Sholes suggests that with this model, teachers can break their classroom into groups and it allows them greater freedom to facilitate learning. It also allows for students to work both collaboratively and independently with the technology creating opportunities for both kinds of work.

While teachers may want to incorporate technology into daily instruction, they may lack the fundamental knowledge of how to incorporate it without losing the value of current lessons. "The problem of integrating technology into teaching and learning process has become a perennial one. Common excuses for the limited use of technology

to support instruction include shortage of computers, lack of computer skill and computer intimidation" (Virginia Tech, 2019, p. 1). While these issues could affect the success of technology integration, it should be acknowledged that the degree of success teachers have when using technology for instruction could depend in part on their ability to explore the relationship between pedagogy and technology. Providing ample support and creating a system that is conducive for teacher exploration and partnership, perhaps through a PLC can affect change and sustain growth as technology and instruction dovetail.

According to research findings, the use of technology changes the role of the teacher from a traditional knowledge provider rather into a facilitator guiding the students' learning processes and engaging in joint problem-solving with the students ("Finland," 2015). Teachers must show a willingness to share control of the classroom with students and technology and become comfortable in their role as a facilitator of learning. It is imperative that teachers remember that it is not their role to fill students with facts as if students are empty buckets waiting passively to be filled. Bruner eloquently states:

> To instruct someone ... is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as a historian does, to take part in the process of knowledge-getting. Knowing is a process not a product. (as cited in Virginia Tech, 2019, p. 2)

If one alters their perspective of the role of a teacher in a classroom from knowledge keeper to learning facilitator, it becomes easier to imagine the important partnership that should exist between teacher and technology. Technology can help shift the focus of education away from learning discrete facts to engaging in a way that develops rich and productive knowledge (Gerard & Matuk, 2016).

History of Virtual Reality

The history of virtual reality is not a long one. Various aspects of the software and hardware have only been experimented with since the 1920's. Virtual reality truly gained its foothold as a military training tool. Virtual reality provides the user with an accurate simulation of real events in a safe, controlled environment. Specialized military training can be very expensive, particularly for vehicle pilots. Some training procedures have an element of danger when using real situations. Advancements in virtual reality allowed for advanced training that was most cost effective and less dangerous. Starting with a flight simulator in 1929, Ed Link attempted to offer training for pilots (Virtual Reality Society, 2017). Around 1930, the Links Corporation designed the first flight simulators, which saw considerable development in the following years. Research in this field was essentially for military purposes and centered on the training of fighter pilots (Virtual Reality Society, 2017). Other industrial applications were soon found such as training ship pilots, combat missions, and to study battlefield positions and complicated maneuvers. While this provided a great resource, images were of low quality and the equipment was heavy and unreliable.

A giant leap forward took place in the 1950's with the advancement of Morton Heilig's *Sensorama*. This technology looked like a standard arcade game, but it had the

capability of stimulating the user's five senses to fully immerse the viewer into the movie (Virtual Reality Society, 2017). It was not until 1987 that the technology was given the name "virtual reality" by Jaron Lanier and the first pair of virtual reality goggles went on sale for $9,400. These goggles exposed the user to a pixilated backdrop and created a passion for what would be possible. In 1991, advancements in video game design made it affordable and fun for the public. A few arcade style games were released and a promising introduction to the public was made. In 2014, Google and Samsung created new headsets and software that allow virtual reality to be a prominent resource that can motivate students and change the educational environment for school districts. How virtual reality is defined is complicated and evolving. Depending on which manufacturer is being referenced, the premise, uses, and processes can be slightly different. The term "virtual reality" associated with this research will be defined by the previous definition given to us by Franks, Bell, and Trueman (2016).

Most three-dimensional virtual worlds are simulated environments, usually downloaded via an app or through the use of the internet and facilitated by network computers, which users can "inhabit" and interact through their graphical self-representations known as an "avatar" (Minocha & Hardy, as cited in Gregory et al., 2016). This definition holds true for Google Expedition except that it does not make use of avatars. Avatars would allow for socialization and require greater memory and downloads causing potential issues for schools. Virtual reality offers two different ways in which the participant can view the experiences. The first is known as a simulation. Simulation is defined as the imitation of a situation or process (Baek, 2010). Programs that rely on simulations respond to the user's movements, location, and track their eyes to

see where they are looking. The purpose is to create immersive and engaging learning experiences. Allowing users to be surrounded by a novel environment permits the user to be captivated, potentially forming empathy and understanding of situations to a greater extent. The principles of virtual reality learning are to impart, practice, and check a student's knowledge using interactive real-life scenarios and traditional environments to reflect situations the user may encounter. Students also have the capability to visualize abstract concepts, visit places hundreds or even thousands of miles away, engage students in other parts of the world, visit the past, present, or future, and partake in activities that may otherwise prove to be unsafe like visiting an active volcano, standing on a battlefield, or conducting risky chemistry experiments.

The second option for students to experience virtual reality is through pictures that offer 360-degree visual displays. The process includes the use of multiple cameras taking pictures and then connecting those exposures into a seamless experience (Black, 2017). For example, when observing these pictures through a phone, the application responds to head movement and ocular focus to change the perspective of the object in front of the user. This methodology allows for multiple angles and pictures of the image, but limited interaction. This is how Google Expedition is currently manufactured and provided to schools. While virtual reality engineers may be able to make outstanding programs, they are limited by the quality of images possible on cell phones. As the phone is placed within inches of the eye, users are often able to see the pixels of the images which can lead to a distortion or a lack of clarity. This phenomenon is known as the "screen door effect" because the image is akin to looking outside through a screen door (Kavanagh, Luxton-Reilly, Wuensche, & Plimmer, 2017). This virtual reality

option can be better for schools due to the fact that the simulations tend to overheat phones and drain batteries quickly because of the amount of information that is necessary to download to make the programs work. Teachers who want to use virtual reality for multiple classes need devices that will last for several hours. This method is also safer for students because it is less likely to cause motion sickness. The majority of current apps for virtual reality involve students entering into a different environment or domain and experiencing divergent cultures, worlds, or learning lessons through experiences with more heightened senses then would normally be possible. Occasionally, such as in popular apps such as Second Life, students are required to add to the environment and assist in the creation of the virtual world.

Virtual Reality in Education

Over the last several years, virtual reality has expanded from the worlds of aviation and military into the world of education. Much of this early foray has centered on the hard sciences such as biology and anatomy (Reede & Bailiff, 2016). Many companies now offer the option of virtual reality meeting rooms, allowing employees to participate in meetings from various locations around the world in one inclusive setting. Other programs have been developed to assist workers who have dangerous jobs such as police officers and welders. Simulations are relied upon to expose people to the dangers they will experience and allow them to gain valuable experience in a safe environment. In the entertainment industry, some theaters and arenas have installed virtual reality cameras allowing anyone with the proper device to watch live events from the comfort of their own homes.

Today, most virtual reality applications have been created to be implemented in a specific curriculum. Teachers believe that virtual reality is best suited to teach science, history, social studies, art, English, and engineering with the majority of the applications targeting younger students (Pantelidis, 1993; Bell, 2016). Bradley (2006) and Cooper (2005) provide a compelling argument about how important virtual reality can be in the medical sciences field. By allowing medical students and doctors to simulate surgeries and practice their craft in a safe manner, complex procedures become exponentially safer for the patient (Bradley, 2006; Cooper, 2005).

The possibilities are endless and virtual reality offers far more excitement to the classroom than traditional tools. In the past, when teachers exposed students to something new, they were limited to options like a documentary, a textbook, or photographs. While these resources can occasionally be engaging, they do not offer comparable opportunities for students to be active learners. In a traditional setting, students sit at their desks and look passively at the images. Virtual reality offers a more interactive, immersive experience. With the use of virtual reality students are encouraged to stand up, turn their heads and move their eyes to view multiple angles of a multitude of images (Catapano, 2017). Instead of participating in a semi-conscious, zombie-like daze, staring blankly on the walls of the typical classroom environment, they are immersed in a thrilling, heart-pumping, 360° setting. These experiences are far more likely to captivate students, create lifelong learners, and make an indelible impression.

Studies are beginning to emerge measuring the impact that virtual reality can have on student learning. One recent study lauded virtual reality's potential to "reduce costs, allow students to interact with unobservable phenomena, increase perceived learning

outcomes, and increase student engagement" (Madathil et al., 2017, p. 8). Further, use of these tools also has the ability to increase equality of access to education. The study went on to claim that the student perceived improvement in learning outcomes is significant and demonstrates the importance of integrating technology-based instruction into instructional models. Further, perception that students were more engaged in their learning and found the systems overall to be more usable when virtual reality was incorporated is also significant and suggests that virtual reality positively enhances the entire student learning experience. Another study by Durbin (2016) found that

> compared with traditional education, virtual reality-based education displayed obvious advantages in theoretical knowledge teaching as well as practical skills training. In theoretical knowledge teaching, it boasts the ability to make abstract problems concrete, and theoretical thinking well-supported. In practical skills training, it helps sharpen students' operational skills, provides an immersive learning experience, and enhances students' sense of involvement in class, making learning more fun, more secure, and more active (p. 1).

The thesis of this study is that virtual reality can simulate great learning scenarios and facilitate the communication, expression and application of knowledge; thus effectively creating a favorable learning environment where students are inspired to learn. Both studies (Madathil et al., 2017, p. 8; Durbin, 2016) demonstrated that teachers and researchers are just beginning to understand the possible impact of virtual reality in the classroom. With greater development of educational programs and teacher professional development, students will be afforded greater learning opportunities and substantial gains in learning are possible (Madathil et al., 2017; Durbin, 2016).

Professional Development for Teachers Using Virtual Reality

Preparing teachers to be successful is a pivotal step in creating a successful change environment (Burke, 2014; Ellsworth, 2000). Teachers do not like to look incompetent or encounter self-doubt in front of a classroom full of students. Breaden (2008) and Mojgan, Kamariah Abu, Wong Su, Bahaman Abu, & Foo Say (2009) believe that most teachers teaching in public schools today have little to no experience with virtual reality and similar technologies, but it is important that competencies are developed or teaching professionals will be left behind. Breaden (2008) continues by suggesting that "If teachers around the world do not take part in more professional-development training in information and communication technologies, or ICT, they will continue to lack the skills necessary to integrate technology into the classroom and improve student learning" (p.1). Most educators trained prior to the digital information revolution rely on traditional teaching practices Breaden (2008; Mojgan, Kamariah Abu, Wong Su, Bahaman Abu, & Foo Say, 2009). Teacher training followed an academic process that relied on traditional practices of how peer review and archives use controlled the contents of their lectures. This is not a constructivist epistemology, but rather a top down release of archived material that learners are expected to accept and memorize" Franks, Bell, & Truemann, 2016 p. 9). In essence, students were to be passive buckets waiting to be filled with knowledge by the teacher who fulfills the role of "sage on the stage".

Teaching is an evolving art that requires teachers to change as the tools change (Franks, Bell, & Truemann, 2016). Sawyer (2014) discusses the elemental view of developing learning environments which focuses on engaging the learner while

integrating learning strategies across informational sources. De Leon (2010) continues by reminding educators that becoming a "three-dimensional teacher requires a self-transformation, epistemological change that further predisposes the individual to learn new tools with steep learning curves, to spend more time preparing instruction, and to push pedagogical paradigms to meet the technological needs of our new modern society" (p.16). This belief forces teachers to continue professional development even if the tools are foreign or scary because they allow students to become enveloped in the material and passionate about learning. By incorporating Google Expedition, teachers will transform from traditional methods and like a phoenix, will experiencing a teaching rebirth as they shift the focus of the classroom from themselves to the events being studied. This altered sense of what it is to teach will create a "shift in pedagogy moving from established transmissive theories of learning such as behaviorism and cognitivism (Minocha & Hardy, p.4) to participator ones such as social constructivism in virtual worlds" (Minocha & Hardy 2016).

Offering the appropriate professional development in a timely manner was the key to supporting teachers and allowing for a positive learning environment. Burke (2014) portends to tell school administrators that the key to successful change and growth is coaching, counseling, and developing followers. Ostermann and Kottkamp (1993) believe the goal of reflective practice is not just the acquisition of knowledge but the changes in behavior because of it. Social studies teachers must accept that some of the pedagogy has not been as effective as they would have wished and changes must occur. Replacing dated maps, globes, and textbooks with an innovative technological solution benefited students and reinvigorated an otherwise uninspired subject matter. Russell

(2010) urges teachers to no longer practice teaching strategies that only allow students to be passive learners. Teachers occasionally have to reinvent themselves as they reflect on the successes and failures of their teaching strategies.

Tasking a small group with the implementation of new technology like Google Expedition may best be supported through a professional learning community (PLC). Hord (2007) describes PLCs as supportive and shared leadership, shared values and vision, collective learning and application, shared personal practice, and supportive conditions. Dufour and Eaker (1998) suggest that the benefits of PLC's include a shared mission, vision, and values, including public reflection, shared meaning, joint planning, coordinated action, collaborative teams, and are results oriented. Instead of forcing teachers to continue with the traditional faculty meeting time and topics, allowing for time to meet and discuss concerns, challenges, and opportunities directly related to specific instructional strategies has proven to be a far more effective strategy. Research conducted by Hirsch (2018) and Snow-Gerano (2005) found that by engaging educators in shared learning, planning, and reflection, educational leaders make it possible for quality instruction to spread from classroom to classroom. Strong increases and advancements were found in cycles of students' learning, curriculum, and assessments.

A recent study conducted by the American Institutes for Research and MDRC examined the impact of a professional development program on knowledge and teaching skills (Mizell, 2011). The results found that to impact student achievement, professional development must be intensive enough to significantly increase teachers' knowledge and skills. A cardinal principle of effective professional development is that it is focused, intensive, and sustained enough to impact what teachers know and can do in their

classrooms (Mizell, 2011; Snow-Gerano, 2005). Mizell's study concludes: "Because we do see a correlation between the teacher knowledge total score and student achievement, these findings suggest that programs positively affecting teacher knowledge have the potential to increase student performance" (p. 1). When institutions aspire to create learning spaces, there are few studies or guidelines to inform them (Minocha & Hardy, 2016).

Student Perspective Concerning Social Studies

As exciting as it may be to add virtual reality to the United States History curriculum, it is more important to understand why a school district would consider adding it and what the reasonable accomplishments would be for the students. If no improvements are needed by social studies students, teachers, or curriculum writers and students are performing as well as can be expected in these classes, adding virtual reality will have little impact and will be a waste of money. Many initiatives in the educational world come and go leaving teachers frustrated about what to do with them and how they are supposed to help. Almost every seasoned teacher can recollect a time when they had a dynamic lesson planned for students only to see technological malfunctions destroy their hard work (Murray, 2018). Murray quips that "the reliability of technology is directly proportional to your needs." Many technological missteps end up costing schools money and collecting dust on a shelf. There is a joke in the computer science field that ties in directly with this philosophy by stating "this design provides a great solution, we just have to find the problem for which it is an answer" (Corrigan, Ng-A-Fook, Levesque, & Smith, 2013, p. 55).

Defining the need is a pivotal step in this process. A survey conducted in the Midwest revealed that students in grades 6-12 had overall negative attitudes about social studies classes they had taken in school (Milo, 2015; Luck, 2018; Schug, 1982). The Science Education Data book (1982) has found that only thirteen percent of high school students surveyed, listed social studies as their favorite subject. Moreover, the majority of students identified social studies as one of the least important classes they will study (Shug, 1982; Milo, 2015). English, reading, science, physical education, and math were seen as far more important in regards to college and workplace readiness. Shug (1982) and Strauss (2017) assert that the reasons include the need for math in almost every job students could identify, the importance of being able to communicate effectively, the number of science, technology, engineering, and math (STEM) careers available, and the salaries associated with these careers, and the importance of being physically fit and healthy regardless of which profession students choose after college. A research study by Scheurman and Newmann (1998) came to the conclusion that students spend too much time absorbing and reproducing trivial information conveyed by textbooks or teachers—and not enough time interpreting documents, evaluating perspectives, and thinking for themselves.

Another factor impacting students' perspective on social studies classes is that the majority of students found the material to be boring, unrelatable, and inconsequential to their lives (Milo, 2015; Hakim, 2018). Students surveyed were unable to recall any significant learning experiences like a field trip, game, debate, controversial discussion, or active learning experience that held their attention (Salsich, 2018; Schrug, 1982; Hakim, 2018). Overwhelmingly, students reported feeling bored when they were

required to memorize dates, names, and geography. Other common complaints include that history is just studying dead people, all the teacher does is lecture and make students read the textbook, and that the lessons are not relevant to anything in the current students' lifetimes (Luck, 2018; Milo, 2015). Overall, it appears that the majority of instructional practices were passive and left students yearning for a more hands-on experience.

Science, technology, engineering, and math (STEM) are the current zeitgeist of the time. Schools throughout the country are creating curriculum and introducing new classes related to these fields (Moon & Rundell-Singer, 2012). Most are infusing computer programming in a number of ways. Some schools have pushed STEM to STEAM including the arts as an important addition (Robelen, 2011). What both STEM and STEAM conspicuously omit is social studies. Furthermore, United States high school students are inundated with standardized tests. These tests include the Standard Aptitude Test (SAT), Armed Service Vocational Aptitude Battery (ASVAB), American College Testing (ACT), and the New Jersey Student Learning Assessment (NJSLA) just to name the most common. The aforementioned tests all consist of sections of various math and English skills and standards. There is not a single test grounded in social studies content or curriculum standards.

Social Studies has become a second-class subject that has failed to capture the imagination of teenagers. Students lack of interest and success in social studies becomes exacerbated when research focuses on lower income students, females, and minority students (Mahnken, 2018; Ayres, 2016; Chapin, 2010). Chapin notes in her study that African-American students show significant academic gaps in social studies starting in kindergarten and continues to widen as students progress through school. Chapin (2010)

believes that the gap that exists can be directly related to the level of teaching that the students receive. Mahnken (2018) and Chapin (2010) both believe that remediation of teaching strategies is imperative to close the gap and to inspire all students to study civics courses.

Pedagogical Issues Concerning Social Studies

A subject matter that still relies on textbooks and maps as its main resources is not a concentration that engages 21st century learners (Davis, 2017). The few textbook companies that are still in existence are not interested in creating an exciting product that will create a passion in social studies students (Porter, 2019; Ansary, 2004). Porter (2019) and Ansary (2004) argue that publishing companies choose the safe route and work energetically to shut down the kind of dissent and debate that makes for an engaging learning environment. As publishing companies try to offer lessons and concepts that are generalizable enough to meet the curriculum standards for all fifty states without offending the core beliefs of different regions of the United States, any content that could cause dissension is removed. What is left is a watered-down, politically-correct version of history.

Even the technology that has been infused in the classroom is not specific to the subject. Educators report that there are fewer social studies specific digital curriculum offerings available than for STEM subjects (Davis, 2017). Without the implementation of subject specific technology, making the curriculum come to life, and creating a passion for historical issues, social studies faces the possibility of becoming relegated to a second-class subject (Luck, 2018; Milo, 2015; Bailidon & Damico, 2010). This would be

an unfortunate occurrence as we need socially-conscious and politically motivated students to advance equity and equality (Torres, 2018) and (Burns, 2018).

It is difficult to believe that students hate social studies and the important topics discussed. To the contrary, evidence exists that suggests that students love the topics associated with social studies. One has to look no further than Hollywood. A list of some of the most popular recent movies includes Lincoln, National Treasure, Darkest Hour, Dunkirk, The Post, Hacksaw Ridge, Schindler's List, Hidden Figures, Thirteen Hours, and Twelve Years a Slave. All of these movies are based on concepts inherent in social studies curriculum. Together, these movies have grossed close to one billion dollars and all of this money was willingly spent by people who were excited to view an aspect of history in a new and compelling manner (IMDB, 2018). Because the story was told in an exciting way, the audience was captivated. Some of these people even purchased a copy of the movie to watch it at home when they had the time. This is a far cry from the student who anxiously awaits a reprieve from the bell's signifying that the class is over, freeing them from their social studies induced coma.

Kids do not innately despise the lessons learned through history. Not when the methods to teach it are well-done, with relevancy, choices, small groups, engaging problems, interesting documents, outside experts, and technology used to create a constructivist learning environment (Bailidon & Damico, 2010; Wiebe, 2013). Social studies instruction should challenge students to think about the events that have made our world the way it is; the lessons should be so engaging and interactive that no child could ever find it boring (McCullough, 2019). Teachers need to include students as active learners instead of seeing them as buckets that need to be filled (Stanford Teaching

Commons, 2018). In order to promote student engagement with historical events and people, it is necessary to generate a true sense of immersion. Immersion has been defined as the "subjective impression that one is participating in a comprehensive, realistic experience" (Dede, Gregory et al., 2016, p. 141) and is seen as a necessary condition for "presence in the psychological sense of actually being located in the virtual environment" (Franceschi, Lee & Hinds, 2008). Incorporating tools that allow for immersion will increase comprehension, enthusiasm, and engagement with the material (Gregory et al., 2016; Aukstakalnis, 2017). This can include more traditional tools such as flip books, ABC Books, experiential exercises, shadow boxes, and the newest and most interactive resource to date, virtual reality (McCullough, 2019).

Measuring Student Performance and Engagement

How do teachers know if learning has taken place? This is a complex topic that does not have a clear answer. Student learning can be difficult to measure or observe. The creation of appropriate assessments that are both valid and reliable is critical if we are going to use the data to determine best practices in instruction (Schacter, 2001; Gewertz, 2015). Traditional assessments often focus on the regurgitation of information that students had been tasked to memorize (Montgomery, 2010; November, 2017). These tests usually take the shape of multiple choice, true/false, and fill-in-the-blank. While these methods assess whether or not a student can retain data, they do little to determine understanding and a student's ability to apply the information in any meaningful manner (Pellegrino, Chudowsky, & Glaser, 2001; Hartman, 2019).

Using virtual reality will not automatically engage students in the higher-order thinking that is desired by transformational educators. A change in assessment

epistemology is necessary (Gewertz, 2015; Erstad, as cited in Voogt & Knezek, 2008). For research purposes, summative assessments will remain the same for this year allowing for a comparison to be made from the previous year's cohort, but formative assessments will drastically change. This is in part, due to the variation in teaching and partially because of the three questions that each virtual field trip comes with. Two of the most significant issues highlighted within educational research are the need to internally align the learning outcomes, assessment, and activities, and to adequately guide and support learners throughout the entire process (Pellegrino, Chudowsky, & Glaser, 2001). In order to accomplish this, teachers need to carefully consider the mix of tasks, questions, and challenges within the virtual world activity to encourage learners to respond using higher-order thinking (Gregory et al., 2016). The teachers associated with this research and myself spent significant time focusing on the theoretical implications of our work as well as the practical application. Gregory et al. (2016) provides a compelling argument for lessons to carefully align the learning objectives, activities, and assessment. When teaching strategies change, assessments strategies must be regenerated as well.

It is apparent that there are many compelling reasons for implementing virtual reality. Possibilities include teaching advanced concepts that focus on using working memory, making interactions with technology more immersive, adding more lifelike and natural "cues" to the environment that combine to trigger recollection later, and easing and enhancing a student's ability for application of course material using higher order skills such as comparison and contrast (Erstad, 2013; Wilkes, 2011). Providing high school students with appealing environments will cull students' attention spans and focus it on learning content rather than the interface (Mayer & Moreno, 2002). With a renewed

focus, student's retention rates should improve allowing students to thrive as long as an assessment has been created that allows for expression of the active learning that has taken place.

Health and Ethical Issues Using Virtual Reality with Students

School administrators have a multitude of responsibilities, but none is greater than to ensure the safety of every student (Weaver, 2007). When parents entrust a school with their child, they rightfully expect that the people in charge have the best interest of the children in mind with every decision they make. Making educational decisions which could place a child at risk is unacceptable and every possible method to protect a child must be enacted (Lynch, 2015; Weaver, 2007). The ethics of care delineated by Shapiro and Stefkovich (2005) speak to the importance of creating a culture that is focused upon valuing virtues such as compassion and trust. If students do not believe that teachers and administrators have their best interest and safety in mind, they will be unable to make a concerted effort to focus on educational initiatives. The Interstate School Leaders Licensure Consortium (ISLLC, 2018) and the NASSP (2009) clearly define the standards of care that school leaders must employ when considering instructional strategies that will impact students. Specifically, standard three, states that a school administrator "must promote the success of all students by ensuring management of the organization, operations, and resources for a safe, efficient, and effective learning environment (p. 2). Standard five addresses the ethics and integrity of school leaders and emphasizes that all decisions must be made in the best interest of the student (ISLLC, 2018).

The focus of administrator ethics is an important one when considering the addition of a complex technological innovation that students will wear on their head,

inches from their eyes. This is no small change to the manner in which students learn, and there are both ethical and health concerns associated with this new technology (Mattison, 2018). While there is great promise to leave an indelible impression, transformational leaders must make sure that the emotional and education impact is a positive one that does not cause harm or a negative mental or physical reaction (Burns, 1978). Doctors and scientists worry about the impact that virtual environment can have on agency and behavior (Darvasi, 2016). There have been no long-term studies to determine how our bodies, sight, and mind will respond to long-term exposure to virtual environments (Costello, 1997; Nicholas & Patel, 2002).

Students may gain great insight by being submerged into various countries and times in history, but not all of these events are appropriate for every age group and many students may be left traumatized if exposed to genocides, wars, and countless other tragedies (Lindquist, 2010). For example, whether students be exposed to the horrors of Auschwitz, the bombing of Pearl Harbor, presidential assassinations, the tragedies suffered by African Americans during the period of slavery in this country, or the more recent terrorist acts that have occurred in Europe is a sensitive topic. While these are important times in history and learning may occur, the damage to the student psyche may outweigh any educational value. Even the Holocaust Memorial Museum, which has been established to teach all members of our society about the atrocities that occurred, warns against exposing children to the graphic material associated with the time and states that any simulations about the occurrences is a practice that is pedagogically unsound because of the potentially harmful impact on children ("Holocaust," 2018; Lindquist, 2010). While environments can be created to garner empathy or other emotions, technology

could be used to push religious, political, or anti-social agendas (Berkowicz & Myers, 2017; Darvasi, 2016).

Recently, a growing concern has emerged about the impact that violent video games and movies have on the mental health of children (Anderson & Bushman, 2001; Ferguson, 2007). Specifically, society worries that students are becoming desensitized to violence as they are exposed to it through movies, music, video games, social media, and television programming (Mrug, Madan, & Windle, 2016). Often, violence is glorified or even rewarded in these social platforms. As we struggle with an exponential growth in the number of school shootings in our country, schools have been challenged to create trauma sensitive cultures, so exposure or overexposure to violent, virtual field trips may be counterproductive. While there is limited data connecting the violence in virtual reality specifically, it is fair to assume that with its much more intensive medium than other experiences, virtual reality could impact students in the same manner (Anderson & Bushman, 2001; Ferguson, 2007). The virtual field trips selected by the teachers and administrators, which students will be exposed to, must be previewed and selected with great care. Field trips cannot be selected that trivialize the events, are biased in their very nature, diminish the importance of the historical event, or could lead to emotional trauma for any of the students. Creating culturally sensitive learning opportunities that prepare students for the events they are about to witness will be a crucial step (Montgomery, 2001; Fitchett, Starker, & Salyers, 2012).

In a best-case scenario, virtual reality could serve to instill compassion into students as they are exposed to the events and people throughout history with a personal perspective (Berkowicz & Myers, 2017; Darvasi, 2016). This inclusion could create

empathy for the struggles of other cultures and civilizations and create an alliance that is otherwise impossible. By giving students that opportunity to sympathize with the struggles of people from around the world, it is possible that a greater environment of tolerance and acceptance will reign supreme, and that boundaries created by ignorance and distance will be greatly diminished.

Perhaps, most importantly, when discussing the ethics of using virtual reality in high school classrooms are any health concerns that may be caused by strapping Google Expedition Goggles to the heads of students. Administrators have an ethic of care that usurps anything else (Shapiro & Stefkovich, 2005). Shapiro & Stefkovich, (2005) emphasizes the point by reiterating that the first responsibility a school has is to care for the children. Both the Oculus Rift and Samsung's Gera VR suggest that people under the age of 13 should not use virtual reality (McKie, 2017; Gent, 2016). The reason for the age requirement is ambiguous at best. There appears to be little research to date suggesting that a particular age is more appropriate than another.

Gotsis (as cited in Gent, 2016; McKie, 2017) suggests that some of the health concerns revolve around the neuroplasticity of children's brains and how they will respond. Gent goes on to discuss a study that was conducted on rats which showed that their brains behaved completely different when confronted with the unique spatial relations that exist in virtual reality. This caused more than half of the normally functioning neurons to shut down while using virtual reality. The long-term impact or potential issues for humans is still unknown. While this study may not be generalizable to people, there is a high level of uncertainty that could cause caution amongst parents, teachers, and administrators.

Besides, the impact on the brain, there is a significant risk of prolonged vision and balance issues, especially in children (Gent, 2016; McKie, 2017; Costello, 1997). They believe the strain that viewing a three-dimensional environment on a two-dimensional screen sitting uncomfortably close to the eyes places a significant strain on the human visual system. In adults, visual strain can lead to headaches and sore eyes. In children, the long-term implications are unknown. In an exceptionally small study, conducted by a team of Leeds's scientists, a few students suffered briefly from issues with stereo-acuity and one had balancing issues (McKie, 2017). There is significant concern that failure to acknowledge and address the physical impacts of virtual reality could lead to significant physiological damage (Gent, 2016; McKie, 2017; Costello, 1997). They also worry about the vergence accommodation conflict, especially as it relates to the vision of children. When using virtual reality, each eye is exposed to a slightly different image on a two-dimensional screen (Slater, 2009). This results in each eye remaining focused on a consistent point regardless of how far away an object appears. This is probably what results in the symptoms of cybersickness (McKie, 2017; Stein, 2016).

Cybersickness has similar side-effects to motion sickness (McKie, 2017; Stein, 2016). While the effects are different depending on the length of use and variations of the user's age and health, cybersickness is a real and important topic when deciding whether or not to subject high school students to virtual reality. Cybersickness is the unintended psychophysiological side effects that results from sensory and perceptual mismatches between visual and vestibular systems (McKie, 2017; Stein, 2016). Nausea seems to be the most likely side-effect (Lewis, 2015). Howarth (1999) argues there is evidence to suggest that only people who have vision issues are impacted by

cybersickness and suggests that virtual reality may actually help diagnose these visual impairments and be indicators that the child needs to see the eye doctor. Other users of virtual reality have reported feeling a great deal of anxiety, stress, and sometimes depression after prolonged exposure (Diemer, 2012; Magyari, 2016). There is also the very real risk that people who are strapped into virtual reality goggles cannot see the real world around them.

While the potential negative impact on eye sight and cybersickness remain a very real issue, there are other medical issues that may make the use of virtual reality an insufficient tool. For example, students who have recently suffered from a concussion are counselled to avoid computer and television screens (McGrath, 2010). It is estimated that around 20% of high school students will suffer from a concussion making this a large subgroup (Nationwide Children's Hospital, 2017). Placing virtual reality goggles one inch from the eyes could be exceptionally detrimental to the concussed student leading to nausea, headaches, and blurred vision. Students who have visual impairments may have difficulty processing the images and may not be able to use virtual reality (McGrath, 2010). Students with seizure disorders will have to determine if virtual reality will cause a greater likelihood of seizures. Finally, some students with learning disabilities or special needs may find that this is not a worthwhile tool for them. Teachers will have to accommodate these students and make modifications to instructional strategies. This could include placing a limit to the number of minutes students can use virtual reality or returning to the traditional tools such as textbooks and overhead projectors.

Conclusion

There is significant literature that speaks to the impact that technology has had on learning. Studies indicate that strong growth in learning can be realized by the effective implementation of technology in the classroom. There is also a great deal of evidence on the importance of meeting students' needs and interests to create a constructivist learning environment (Stringer, 2014). As learning tools evolve and meet the needs of students with varying learning styles, schools will be challenged to assimilate them into policies and curriculum (Office of Educational Technology, 2017). Teachers will be compelled to update pedagogy and assessments to envelop new opportunities and challenges associated with the addition of technology into the classroom. Transformational leaders will be challenged to stay current on technological initiatives, provide professional development for teachers, and evaluate the impact on instruction and education (Dantley & Tillman, 2010). Through a mixed method action research format (Ivankova, 2015), both qualitative and quantitative data was collected and evaluated to determine the impact of virtual reality on student performance in United States History I. Currently, social studies is a subject matter that is not appealing to students and lacks creativity and enthusiasm (Luck, 2018). Through a supportive partnership between teachers in a PLC format and administration, meaningful changes are probable (Argyris, 1990). This action research study will serve to provide data and a comprehensive analysis as to the impact of virtual reality on both teaching and learning and the logistics that are involved with pioneering such a technologically innovative alteration to the current pedagogy.

Chapter 3

Research Design

High school students in the United States rank in the middle of the world based upon their performance behind many of the advanced, industrial nations on the international math and science assessments (Desilver, 2017). One of the biggest international tests is the Programme for International Student Assessment (PISA). This assessment is given every three years and measures reading ability, math and science literacy and other key skills in fifteen-year-olds. The most recent results rank United States students thirty-eighth in math and twenty-fourth in science (Desilver, 2017). One possible explanation is the drastic decrease in funding for public schools. Over the last 10 years, government funding provided to public schools has fallen by five percent (Bendix, 2018). Bendix (2018) believes this decline in funding is directly related to the economy and the growing deficit. Although the nation still spends more per student than most of its peers, including Turkey, China, and Brazil, many countries that saw a rapid improvement in their rankings have instituted significant policy reforms in the last 30 years. These include providing equal funding for schools in different locations and tailoring curricula to students' abilities (Bendix, 2018). This lack of funding in the United States has led to an inequity in teacher abilities and money for field trips and curriculum, especially with America's poorest students (Bendix, 2018). Finding resources that can provide student-focused learning activities, introduce students to parts of the world they may never see, and excite apathetic students is pivotal if educators hope to impact and engage all students.

The purpose of this study was to analyze the impact that virtual reality, particularly, Google Expedition could have on the United States History I (U.S. I) curricula. Furthermore, it was necessary to explore and develop teacher professional development associated with virtual reality, and determine if virtual reality impacts student performance. It was perceivable that any gains realized may provide a blueprint for other subject areas, specifically other social studies, English, and science curricula. The virtual field trips offered through Google Expedition are most applicable to these three subject areas (Bell, 2016). By creating the professional development seminars for high school teachers, charting student growth in both a quantitative and qualitative manner, and monitoring the health and ethical concerns, this study has the potential to serve as the foundation for high schools across the country. The goals of this chapter include discussing the basic tenets of action research, evaluating the context of the study, outlining the overall design, assessing participant recruitment, and reviewing data collection and analysis. The research questions associated with this mixed methods action research study are:

1. What did virtual reality add to the United States History curriculum?
2. What professional development and support did teachers need to successfully implement virtual reality into their United States History curriculum?
3. How did virtual reality impact instructional pedagogy of United States History teachers as they moved from traditional teaching strategies to more technology-based strategies?

4. How was student performance and achievement impacted by virtual reality?

The answers to these questions will determine the impact that virtual reality has had on both teaching and learning and allow districts to perform a cost versus reward analysis.

Methodology

The goal of this dissertation was to improve the learning environment for high school students where I serve as a school administrator, to test the potential impact that virtual reality can have for students in my school, and to create professional development to prepare teachers to use virtual reality in the classroom. In order to meet these needs, an action research strategy was selected. Bolman and Deal (2013) and Argyris (1990) suggest that conducting action research is an efficient and supportive manner to study the impact that changing pedagogy can have on student performance. Action research is a detailed process of systematic inquiry that will be used to foster improvement in the academic opportunities of students (Hine, 2013). Lewin, considered by many to be the "father" of action research, viewed the methodology as "cyclical, dynamic, and collaborative by nature" (Hine, 2013, page 151). Herr and Anderson (2005) agree with the cyclical nature of action research as they outline a pattern of planning, acting, observing, and reflecting. Once reflecting is complete, the process can begin again based upon the new-found knowledge.

Stringer (2014) reduced this complex process with his more simplistic model of: look, act, and think. These three phases focus on the gathering of information, reflecting on and analyzing the data and then planning, implementing, and evaluating student learning. All research involves procedures that require people to move past their

understandings to engage in more precise and rigorous forms of description, observation, and explanation. Stringer (2014) believes that action research is a collaborative approach to inquiry or investigation that provides people with the means to take systematic action to resolve specific problems. Continuing research cycles enables evaluation, reformulation, and redevelopment of actions, leading to increasingly effective solutions to the problem at the heart of the research project. Lewin (2014) and Stringer (2014) concur that any research needs to begin with meticulous observation including listening as well as looking. Much of the research conducted during this study involved sitting in classrooms and observing both the teachers' and students' interactions with Google Expedition. Anecdotal evidence about complexity of use, student enthusiasm, and curiosity although hard to quantify, was observable.

Action research allows educational researchers to develop a systematic, inquiry approach toward their own practices (Frabutt, Holter, & Nuzzi, 2008). Finding new ways to teach traditional material fits perfectly into this complex definition. By incorporating virtual reality into the traditional United States History curriculum, new methods were explored which allowed reflective practice by teachers looking to transition from the current teaching pedagogy, which lends itself to whole group instruction and the teacher as the focus of the classroom. Pursuing action research methodology enabled the school community to move forward with a new practice of teaching in the pursuit of growth and improvement. McNiff and Whitehead (2011) emphasize action research's reliance on episodes of practice which illustrate a teacher's educational influence upon the learning of others. With the evaluation of student performance, both qualitative and quantitative,

evidence of growth will be quantifiable, reliable, and valid (McNiff & Whitehead, 2011). There were several variables and aspects to consider when pursuing action research.

Herr and Anderson's (2005) list of potential goals of action research includes the generation of new knowledge, the achievement of action-oriented outcomes, the education of both participant and researcher, and the conducting of research using reliable and valid methodology. The goals involve the determination of whether or not virtual reality is a worthwhile tool for schools to add to the social studies curriculum, if there is measurable growth, what professional development is necessary, and how the educational field may grow from this new resource. This research could have a far-reaching impact on the way high school history classes are taught.

Another attractive aspect of action research is that it is collaborative by nature as it allows all parties of a school community to work together to create something more powerful and exciting. With cooperation comes the prospect of improvement for everyone. Thinking that every teacher is comfortable with change and will embrace initiatives would be naive. A transformational leader must complete an organizational diagnosis that includes understanding relationships, purpose, and strategies (Coghlan & Brannick, 2010). Antheil and Spinelli (2011) argue that by establishing a culture of change and building a culture for sustainable change, teachers show a commitment to growth and continued professional learning. Action research pertaining to Google Expedition created a brand-new challenge for everyone involved and coaxed teachers out of their previous pedagogy. While every teacher involved may not look forward to using new technology or stepping out of their comfort zone, there are strategies that can be implemented to garner support and foster acceptance. Argyris (1990, p. 13) suggests

"collecting data, formulating and implementing strategy, reflecting on both processes, examining and implementation cases, continued iterative learning, implementing their strategies, and follow up to minimize teacher apprehension." Argyris outlines an outstanding guide to creating a successful change initiative.

As discussed in a previous section, students find the study of United States History boring and unappealing (Milo, 2015). In order to find a solution, action research offers the most attractive methodology for potential solutions (Antheil & Spinelli, 2011). The organization being used is a high school with students under the age of eighteen. It is imperative that students are cared for and that their needs come first. Students in a collaborative learning environment are fulfilling a participatory role and are believed to be competent in their ability to successfully fulfill their role in this action research study (Ampartzaki, Kypriotaki, Voreadou, Dardioti, & Stathi, 2012). All that will be asked of the students is to study a subject that they would have otherwise studied, but now with the addition of Google Expedition. Herr and Anderson (2005) stress that action research is something that is done in partnership with the learning community, not on them. As such, they are an integral part of the process as they will be using the Google Expedition goggles, reporting out on their experience, and being evaluated for growth, motivation, and medical concerns. Action research relies on the participants, with an emphasis on the social relationship between the individuals and the organization than it is an abstract study on theoretical concepts (Kemmis & McTaggart, as cited in Herr & Anderson, 2005).

Mixed Methods Action Research

In order to develop an informed theory at the end of this action research dissertation, a large quantity of quantitative and qualitative data was collected. This created a mixed method opportunity for evaluation of the impact that virtual reality had on student learning and whether or not it was a useful educational tool. Mixed methods research consists of a mixing of the two forms of data either concurrently or sequentially through multiple phases of a study (Creswell & Plano Clark, 2011). In mixed methods, the researcher, collects and analyzes persuasively and rigorously both qual and quantitative data, mixes the two forms of data concurrently by combining them sequentially by having one build on the other, uses these procedures in a single study or in multiple phases of a program of study, frames these procedures within philosophical worldviews and theoretical lenses, and combines the procedures into specific research designs that direct the plan for conducting the study (Creswell & Plano Clark, 2011).

This research study qualifies as a mixed methods action research (MMAR) study as I collected both quantitative and qualitative data. Johnson and Onwuegbuzie (2004) defined mixed methods action research as the class of research in which the researcher merges "quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" (p. 17). Mixed methods research involves collecting and analyzing both quantitative and qualitative data. "The quantitative data includes closed-end information that undergoes statistical analysis and results in a numerical representation. Qualitative data, on the other hand, is more subjective and open-ended. It allows for the "voice" of the participants to be heard and interpretation of observations" (Mahmood, 2017, p. 1). This particular data collection process qualifies as a convergent

parallel strategy due to my concurrent collection of both the qualitative and quantitative data during the same phase of the research process. Data was analyzed separately and then mixed for interpretation (Creswell & Plano Clark, 2011).

Green (2001) and Ivankova (2015) believe this to be the best method of research as it allows for dovetailing of information for multiple ways of seeing. Klette (2012) argues that there is no benefit in separating numbers from every other type of data. Only through the key aspects of a mixed methods study, the action researcher is required to collect and analyze persuasive and rigorous data that frames procedures within philosophical worldviews and theoretical lenses. The strategy of inquiry was a convergent parallel model which allows the researcher to use concurrent timing to implement the quantitative and qualitative strands during the same phase of the research process (Creswell & Plano Clark, 2011). There are several benefits to a mixed methods approach. By combining the two models, there is an offset of any weakness that one may have, there is more evidence for triangulation, and the researcher can answer questions that would be impossible using only one model (Ivankova, 2015).

Specifically, in this study, quantitative data collection included a look at assessment and overall scores, the number of discipline issues incurred by students in this class, and the amount of time students spent out of the classroom as compared to time spent out of other classes. Qualitative data collection included surveys, field notes, and interviews conducted during the last week of the course. Surveys are information collection methods used to describe, compare, or explain individual and societal knowledge, feelings, values, preferences, and behaviors (Fink, 2017). In accordance with Fink's (2017) assertions, these surveys were designed to assess whether or not virtual

reality met the curriculum standards and needs of the U.S. I teachers and students, to allow research on the impact that virtual reality had on teaching and learning, and was combined with information from the other sources (see APPENDIX A). The questions were designed to be closed-ended with ordered choices allowing students to select their favorite to least favorite classes, excitement of topics, engagement of the resources, and importance of social studies to the students' future endeavors. Fortunately, because surveys were filled out in class, the response rate was approximately 92%.

Context

This study was conducted in a suburban, public high school in New Jersey. Annually, the school has between 1,200-1,300 students enrolled in grades 9-12. Of the student enrollment 50% were female and 50% are male, 20% were economically disadvantaged and eligible for free or reduced lunch, 18% were listed as special education students, 1% were English language learners (ELL), and 1% were homeless. The racial makeup is diverse which lent itself nicely to this study. According to the school report card, 45% of students were White, 35% were Black or African American, 10% were Asian, 8% were Hispanic, and 2% were two or more races. Scores on standardized tests such as the Partnership for Assessment of Readiness for College and Careers (PARCC) and the Standard Aptitude Test (SAT) fell slightly below the state average in both Math and English. A large percentage of students attend the local two-year college after graduation. There were approximately 100 teachers employed in the high school although only four were involved with this study. Teacher ranged in experience from being first year teachers to having forty-two years of experience. The majority of the teachers were white, middle-aged females. Teachers held varied

certifications and many were dual certificated in special education. The teachers that had been hired over the last eight years have been offered employment based upon their ability to form relationships with students and create a culture of mutual respect.

The research took place in two classrooms. The classrooms were rather traditional other than the availability of a Google Chromebook lab and a Google Expedition set in each. There were fourteen sections of the United States History I course offered with approximately twenty-five students enrolled in each. In total, there were slightly over 300 students in the student group last year that did not get to use the virtual reality labs and 300 students in the freshman class this year that had the opportunity to use virtual reality as a part of regular instruction. While the focus was on how students in this cohort performed, this information gave me an excellent comparative population for studying both the quantitative and qualitative impact of virtual reality.

United States History I was chosen for this study for many reasons. The fact that every student had to take this class as a graduation requirement meant that students of every ability level were included in the study. Second, the number of Google Expeditions that support the standards for this curriculum made it easy for teachers to have a myriad of options. Third, with the cost of Google Expedition limiting me to only being able to purchase two labs, the fact that this course could be taught in only two rooms made it perfect logistically. Most subject areas are taught by multiple teachers in several rooms which would have necessitated purchasing more Google Expedition labs. Fourth, the four teachers associated with the curriculum and this study were technologically savvy and interested in being a part of the study. Having an excited staff that had offered to be a part of the study made professional development and

implementation much easier. Finally, as the supervisor of the social studies department, I had the ability to change curriculum, create the schedules for the social studies teachers, spend a great deal of time in the classrooms observing teaching and assessment strategies, and offer professional development to the teachers as needed. Overall, the United States History courses were perfect to determine the impact of virtual reality in United States History I.

Participants

Data collection was preceded by letters of consent mailed to parents garnering their support for the study. Informed consent requires the researcher to provide enough information that the participants understand possible risks, benefits, confidentiality, and the ability to withdraw from the study at any time (Fink, 2017). Furthermore, students were asked to consent to taking part in the study and were allowed to opt out at any time. When given the option, every student volunteered to participate. The goal was to provide parents and students with enough information about the study, so that they would provide informed consent. Through the collection of both quantitative and qualitative data, we could begin to assess the impact of introducing virtual reality into the social studies classroom.

Before the school year began, a letter was sent home to the parents of every incoming freshman explaining that virtual reality will be a new resource used in every United States I class. A general explanation of what Google Expedition was and why students would be using it was offered. A cautionary description of any possible health concerns was offered as well as an option for parents to opt their child out of using virtual reality. An additional letter was sent home seeking consent from every parent to allow

their child to participate and to notify them that data from this study will be published. Students also were provided with documentation explaining their use of virtual reality, asked to fill out surveys, participate in interviews, and explaining their right not to participate. These were important steps for transparency and, although the opt out form was offered, it was not anticipated that many parents would choose to exclude their child.

When the school year commenced, just over 300 incoming freshmen began their high school career at Harmony High School. They all had United States History I included as a part of their courses as it is a required freshman course. Due to their enrollment in this course, they used virtual reality to learn and participate in the research. Additionally, there were four sophomores included in the rosters as they did not successfully complete the course during their first year. This sophomore subgroup was broken out to determine how much this cohort grew and how these students felt about the class with and without the virtual reality. Unfortunately, by the end of the course, one of the sophomores had transferred to another district, still leaving three students in the cohort. In the freshman class, approximately 50% are male and 50% are female, 45% are classified as a minority, 18% are special education students who have an individualized education plan, and 28% receive a free or reduced lunch due to their socio-economic standing. The 45% of minority students are mostly African-American, but represent several countries mostly in Asia and Africa. Students reported seventeen different languages being spoken at home. The special education population included multiply-disabled students, autistic students, and students with specific learning disabilities. There were also students with hearing and visual impairments. Every freshmen student was asked to complete a survey at the beginning of the course asking for their perceptions on

social studies classes. They then completed the same survey at the end of the course to see if their feelings about studying social studies had changed. In addition, twenty-five students were asked to participate in an interview at the end of the course. These students were selected randomly by the teachers, but represented most of the subgroups of the class including minority students, special education students, and both high and low achieving students.

Only four of the teachers in the high school were involved with this study. Three of the teachers were certificated social studies teachers while the fourth was a special education teacher that worked as an in-class resource teacher for the special education students in the class. Two of the social studies teachers happened to be nontenured, while the special education teacher had 11 years of experience. Teachers taught on a 4 X 4 block scheduling. This means that they had students for 76 minutes a day for 90 days. Teachers then welcomed a new group of students for the last 90 days.

Teachers were made aware of the regulations that they will be required to ensure that students are treated in-line with the human subjects' regulations outlined by the United States Department of Education (USDOE). The USDOE defines research as "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge. It included activities which meet this definition, whether or not conducted under a program considered "research" for other purposes." The research that was defined by this action research dissertation was exempted from the USDOE regulations because it is "conducted in established or commonly accepted educational settings, involving normal educational practices, such as (a) research on regular and special education instructional strategies, or

(b) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods" (USDOE, 2018).

Google Expedition Virtual Reality

Google Expedition (GE) was not listed as one of the top five virtual reality headsets available although two other Google products were named. At the time, the HTC Vive, Oculus Rift, Playstation VR, Google Daydream, and Samsung Gear are ranked as offering higher quality to the individual ("Best headsets," 2018). This was because of the picture quality, ability to interact with the material, and games and applications available. While these features were enticing, they were not the most important driving factors when schools decide to invest. While not one of the most popular yet, GE offers desirable features to schools that no other companies offered, making it the most widely used virtual reality in classrooms across the United States (Lynch, 2018; Barack, 2018). What made it a school favorite was easy to quantify. First, many of the other virtual reality systems required students to connect their personal phones to the virtual reality device. This necessitated that every student in the classroom have the same phone so that it was compatible, which is wholly unlikely. GE came with a built-in computer that took the place of a phone. In classrooms where every student may not have their own phone, this was a wonderful solution. Additionally, while many of the other options had far more interactive programming, this increase in downloaded data could cause the virtual reality devices to overheat and malfunction at a significantly faster rate. Google Expedition had a solid battery life which allowed teachers to get through a class period before students' virtual reality equipment died.

Google offered unique features that made implementing it into curriculum very easy for the teacher. Lynch (2018) points to the fact that there was a script for the teacher to use as a guide, so students were not left to wander randomly and haphazardly make discoveries. This made it easier to correlate the Expedition with instructional objectives. Each field trip also came with a script for the teachers to read to the class and three questions ranging in difficulty from beginner, intermediate, and advanced. Virtual field trips were not intended to take the place of the teacher or the lesson, but added a ten to fifteen-minute activity to enhance the learning that was taking place.

When classes, especially those on a block schedule, need virtual reality devices to be available to students for several hours, overheating issues can lead to uncertainty about reliability for teachers that they cannot afford. Hicks (2014) asserts that many teachers have experienced technology crashes due to overheating or files being too large to download. Due to the nature of the virtual field trips associated with Google, overheating concerns were almost non-existent and files usually download within thirty seconds.

Google Expeditions offered innovative opportunities that had been developed to provide educational virtual reality experiences in classrooms around the world (Bell, 2016). The myriad of field trips offered made it possible for teachers to guide students on virtual expeditions to countries around the world, museums, underwater, or to different eras in history. The expeditions were collections of linked virtual reality (VR) content and supporting materials that could be used alongside existing curriculum. They include 360° panoramas and 3D images annotated with details, points of interest, and questions that made them easy to integrate into curriculum (Bell, 2016). The teacher controlled what the students saw and experienced with a tablet provided by Google. At the time,

there were over 700 virtual expeditions offered through the expedition program, but this number will undoubtedly grow as more are added all the time (Mennuti, 2018). As stated above, the social studies teachers associated with this action research study had identified between thirty and forty-five that may be appropriate for inclusion in the United States I curriculum.

Data Collection

Quantitative data. This study qualified as a concurrent parallel design. Both quantitative and qualitative data were collected throughout the semester as it became available. With a concurrent parallel design, qualitative and quantitative strands are implemented independently throughout data collection and analysis (Jang, McDougall, Pollon, Herbert, & Russell, 2008). Consistency among teachers was pivotal as the same data had to be collected from each of the classrooms in the same manner. Quantitative data collection included course grades from Power School, time spent out of the classroom as logged by EPass, and discipline issues incurred in the classroom which were also documented in Power School.

Power School and EPass. Power School was a tremendous resource that allows administrators to enter data about discipline issues that students have throughout their entire academic career. It also served as a grade book for all of the teachers and gave twenty-four-hour access to parents who were interested in their child's academic progress ("About PowerSchool," 2018). EPass was a web-based software that tracked students' movements throughout the day. If a student asked to leave the room, the teacher checked them out electronically and notified teachers and administrators where the student was going. EPass timed the students to see how long they were out of class and sent alerts if

the students spent more than the allocated time out of the room ("How Student EPass Works," 2011). At the end of the year, reports were run and analyzed to assess students' grades, discipline infractions that occurred in U.S. I class, and the amount of time that students spent out of the room on virtual reality days.

Google Classroom summative scores. Teachers determined which Google explorations to infuse into the curriculum, but all teachers involved with this study were required to use the same virtual field trips. Formative assessments were grounded in the information garnered from the virtual field trip. This created a significant difference in epistemology. Each field trip was explored and then students were asked essential questions that came with the devices as well as questions generated by teachers. Students answered these questions in Google Classroom or on teacher created worksheets. Student scores on summative assessments including assignments that were part of their digital portfolio were reported on a spreadsheet and compared to scores earned by students who took the same class and assessments without the benefit of virtual reality during the previous two semesters.

Qualitative data. A great deal of qualitative data was collected from three different sources. Fink (2017) discusses the best ways to create qualitative surveys which will be used to compare or explain feelings and preferences. This made it a perfect tool for an analysis of virtual reality in social studies. Additional qualitative data was collected through observation and field notes. Rossman and Rallis (2017) believe that this is an excellent, humanistic way to collect qualitative data. Field notes and observations allowed for information to be captured as students were engaged in the classroom. Field notes are widely recommended in qualitative research as a means of documenting needed

contextual information. With growing use of data sharing, secondary analysis, and metasynthesis, field notes ensure rich context persists (Phillippi & Lauderdale, 2017, p. 32). Finally, interviews took place with all four teachers as well as a small group of students that were selected by the teachers. Interviews are a well-established methodology for collecting qualitative data. The qualitative research interview seeks to describe the meanings of central themes in the life world of the subjects. The main task in interviewing is to understand the meaning of what the interviewees say (Kvale,1996).

Interviews are particularly useful for getting the story behind a participant's experiences. The qualitative research interview seeks to describe the meanings of central themes in the life world of the subjects. The main task in interviewing is to understand the meaning of what the interviewees say (Kvale,1996). The interviewer can pursue in-depth information around the topic. Interviews may be useful tools if used as follow-ups to certain respondents to further investigate their responses (McNamara,1999).

Baseline surveys. Qualitative data was also collected through the use of a short survey (Appendix B) provided to the students through Google Surveys and given during the first and last day of the semester in the social studies classroom. The survey was disseminated by the teachers to the students assigned to their classes using Google Survey. Questions that asked students about their interest level in the topics discussed, how engaging the resources were associated with the curriculum, how important they believed social studies will be to their college and career readiness, and where social studies ranks in regards to their favorite classes were included on a survey. Students were given five choices for the first two questions that range from poor, fair, satisfactory, and excellent. The third question offered answers that range from not important,

somewhat important, neutral, important, and very important. The final question allowed students to rank social studies from favorite to least favorite class.

Interviews. Finally, interviews took place with all four teachers as well as a small group of students that were selected by the teachers. Interviews are an excellent way to garner the qualitative data that a researcher needs. Patton (1990) categorizes interviews into three types: informal conversational interviews which occur while you are hanging around a setting, the interview guide approach which is a typical method in qualitative studies, and standardized open-ended interviews which are tightly prefigured, having fixed questions that are asked in a particular order for all participants. The key elements of effective questioning technique include going into great detail, asking questions that allow for in-depth analysis, obtaining a realistic picture that comes to life, focusing on the nuances of the answers, and providing a forum for numerous themes to be explored in richness (Rubin and Rubin, as cited in Rossman and Rallis, 2017).

Interviews are a well-established methodology for collecting qualitative data. Questions were posed in my office making this an interview guide approach which according to Rossman and Rallis (2017) is a typical method in qualitative studies. The purpose is to elicit the participant's worldview. Twenty-five students were interviewed either in the conference room or my office. Students were asked six questions about their use of virtual reality, what other subjects would be appropriate for virtual reality, negative experiences with virtual reality, their motivation, grades, and if they would want to use virtual reality to learn in the future. Teachers were interviewed about their experiences with implementation of virtual reality into the curriculum, difficulties they encountered, student reactions, the importance of the professional development they

received, student responses, and if they want to use virtual reality in the future. These interviews took place in my office. Interviews of the students and teachers will be included as well as any emails sent by parents, students, or teachers to me.

Field notes. Field notes were collected throughout the year as students and teachers were observed using virtual reality in the classroom. As an administrator for the school, I had unlimited access to the classrooms and could observe several occurrences of implementation. It is important to note that as an authority figure for the teachers and students involved, I was inherently aware of how my status may impact classroom procedures or student and teacher reactions. Furthermore, as this is my research, an attempt was made to remove any inherent biases that may have existed.

Equal amounts of qualitative and quantitative data were collected. Teachers collected grades and entering them in Power School for every student. Students' data was analyzed first in totality and then subsets were broken out. These subsets included gender, race, socioeconomic status, and special-education. A comparison of the test results was made to determine if a change is apparent in students' ability to retain information using Google Expedition. The statistical tests included a comparison of the median, mean, and standard deviation for each test and subset. Any differences between the scores should have been attributable to Google Expedition as everything else should have been constant. With only one variable, the expectation was that the research was both valid and reliable. At the conclusion, the data was represented as bar graphs since there was a direct comparison between two groups. A bar graph is a graph showing the difference in frequencies or percentages among the categories of a nominal or an ordinal variable. The categories are displayed as rectangles of equal width with their height

proportional to the frequency or percentage of the category (Frankfort-Nachmias & Leon-Guerrero, 2015).

In addition, Harmony High School used programs called EPASS and Power School. EPASS allows for students' time out of classes to be monitored. It allowed for a comparison to be drawn between students' time out of social studies class when virtual reality was being used versus days when traditional pedagogy was being implemented. I was also able to track discipline in a similar manner through a program called Power School. I believed students who are active learners through virtual reality would spend less time out of the classroom and would be less likely to engage in poor behavior. At the conclusion, a recommendation as to whether or not schools should invest in virtual reality was made based upon a statistically significant change in student performance being present.

Creating the Need for Change

Working with teachers to create a culture of change can be extremely difficult. Many educators are steadfast in their ways and disinterested in exploring new techniques. The old adage "if it's not broken, don't fix it" applies to many veteran teachers. Kotter (1996) discusses the eight-stage process for leading change which includes: establishing a sense of urgency, creating the guiding coalition, developing a vision and strategy, communicating the change vision, empowering employees for broad-based action, generating short-term wins, consolidating gains and producing more change, and anchoring new approaches in the culture.

It was critical that a building-based administrator heed each of these steps and cajole teachers to stay focused throughout the process. Failure to continue garnering

student investment led to an even the greatest initiative failing to produce results. A sense of urgency had to be created for this dissertation by exposing teachers to the results of a survey of students both enrolled in the school and nationally that illustrated how poorly social studies is received by students. Students consistently rank social studies poorly and changes will have to occur if social studies teachers want to improve their lot in the high school course listings.

A coalition proved easy to form as a PLC naturally developed between the four teachers tasked with implementing virtual reality. DuFour and Eaker (1998) argue that educational reforms often fail because teachers do not understand the nuances and complexity of the tasks and a lack of clarity as to what the intended results are for the change initiative. They believe that a PLC can help with these issues as there is a chance for collective inquiry, reflection, joint planning, and collaboration. In addition, I worked closely with both teachers and students to promote the success of Google Expedition in the classrooms.

Burke (2014) believes that creating an understanding for the need to change can be accomplished by a transformational leader focusing on modifications in the external environment that necessitate an organizational adjustment. By passionately expressing the need to change, organizational members will willingly embrace innovation, and a change leader can create a sense of urgency and provide a vision for the future. The author also discusses the challenges that will be faced including the realization that there will be unintended consequences and there will be resistance. In this particular action research study, teachers were made aware of the need for change, and an understanding of the importance of technology in students' lives served as a compass for leading the

initiative. Any change leader must be patient, supportive, transparent, and open-minded. Creswell and Plano-Clark (2011) pushes the group to prioritize which actions take priority; summing up this process as: Look, Think, Act.

This framework of action involves three phases: planning, implementing activities that help participants accomplish their tasks, and reviewing. Planning with all of the teachers took place in many ways. Professional development was scheduled with the nurse and the information technology department. Teachers were also been given time to role play the activities with other members of the department. Implementation began in earnest when students returned to school in September. As the year progressed, regular walkthroughs and observations took place to ensure the researcher was aware of both the successes and failures encountered by the teachers. Monthly department time was set aside to allow for the PLC to collaborate, identify new virtual field trips, and explore best practices in instructional strategies, assessments, and to resolve logistics issues.

Action Research Cycles

To achieve change and development, mixed methods action research is a responsive methodology (Dick, Passfield, & Wildman, 2000). It has the ability to respond to the emerging needs of the situation, be flexible in a way that some research methods cannot be, and emergent. The process takes place gradually and its cyclic nature helps responsiveness. The early cycles are used to help decide how to conduct the later cycles. In the later cycles, the interpretations developed in the early cycles can be tested, challenged, and refined. Tashakkori (2009) suggested that mixed methods action research designs have a cyclical nature. Researchers can move from the early strand of quantitative or qualitative data collection and analysis to subsequent quantitative or

qualitative strands, seeking more reliable answers to the research questions. In mixed methods action research, the cycles of activities form a research spiral and increase the researcher's understanding of the original questions or problems. The action research process for this study consisted of three cycles: an evaluation of the problem; the implementation of virtual reality; and the evaluation of data.

Cycle I. The purpose of cycle one was to create a platform to establish a need for change, support the change process, and develop a process that led to success for both teachers and students. Burke (2014) and Ellsworth (1991) discuss the importance of communicating the need for change and the support necessary to allow for a change culture to persist. In this cycle, parents were notified about the use of virtual reality, so that they could understand the experiences that their children would have and the technology they would be exposed to. Teachers, administrators, and the nurse developed professional development plans and created a collaborative working relationship that allowed for growth and exploration without judgment or feel of failure. With strong communication, a team approach to creating a change-culture was fostered.

The first cycle of my action research study included an evaluation of the problem faced by social studies teachers, which was the students' negative attitude and general apathy towards History courses. Next, in identifying the solution, I determined that the way to enhance history instruction and bring it to life would be to utilize virtual reality technology. As this was a new endeavor for all teachers in the high school, I decided that establishing a PLC would be necessary in supporting the teachers involved in this study. Finally, planning for approval and implementation of virtual reality meant that I had to first get permission from the superintendent and the board of education to conduct this

study, permission from parents to involve their students, and then I had to determine the best implementation strategies. Stringer (2014) refers to this as "building a picture," meaning the researcher must provide a context to rouse the stakeholders' interests, so they are willing to devote their time and energy to the study. Meticulous planning enables each participant, including the researcher, to both understand the setting and to become a part of the context. This cycle was highlighted by a great deal of communication with all of the stakeholders. With the teachers selected, a PLC was formed so they had a system of collaboration and support as they faced this new initiative. Cox (2004) and Argyris (1990) site the need for creating a learning community to support student learning initiatives. Often, teachers do not have the communication nor support to make meaningful gains in their own practices. Baker (1999) states that teachers often feel lonely and isolated from each other and administrators. Therefore, in forming the PLC, the teachers and I agreed on goals, how they would collaborate and work with one another, how and when implementation would occur, and the support needed from me, as an administrator and researcher (DuFour & Eaker, 1998).

I presented my action research plan as well as information about virtual reality to board members, the superintendent and assistant superintendent in order to have my action research approved and to garner the financial support required to purchase the virtual reality equipment. Additionally, the parents of freshmen students received a letter in the mail over the summer prior to the beginning of the 2018-2019 school year; likewise, I discussed the action research project and the details about the Virtual Reality being used at the freshman orientation in September, 2018. The IT department provided professional development on the use of the virtual reality equipment. The nurse provided

professional development about the safety risks of virtual reality and any precautions needed to avoid them. Finally, Google professional development was created, logistics were resolved, and the teachers, curriculum, and classroom were prepared for the implementation of virtual reality. Watkins and Marsick (1993) refer to this as "framing" and "reframing." They insist that a reliance on data instead of assumptions is the key to effective planning. Tuckman and Jessman (1996) agree and refer to this process as "form" and "storm."

Cycle II. The second cycle was comprised of the actions associated with implementation of virtual reality: setting up the virtual reality classroom labs; incorporating virtual reality in classroom teaching practices; observing student performance with virtual reality; teacher collaboration and modification of pedagogy; and analysis of formative and summative assessments. This cycle was primarily dedicated to the logistics of implementation of virtual reality into the classroom, student performance, and teacher strategies and assessments. The Information Technology (I.T.) department ran the ethernet cables and explained how the virtual reality equipment worked. During classroom instruction, goggles were put into use so students could view the chosen virtual field trips and began learning United States history in an exciting, new way. Daily instructional practice, including questioning techniques and the inclusion of station-based learning, were updated by teachers during PLC meetings. Regular observations, meetings with teachers and students, and analysis of the process highlighted the process. Collecting valid and reliable data through qualitative methods such as field notes, observations, and interviews as well as quantitative methods such as test scores, discipline issues, and time out of the classroom, was paramount if any theories were to be

developed at the culmination of the study. McNiff and Whitehead (2011) offer field notes, record sheets, observation, written accounts, personal logs, text messages, emails, questionnaires, surveys, and interviews as possible strategies to collect information. Combined with student test scores, a myriad amount of information was available to complete the mixed methods action research analysis.

Cycle III. The final cycle was an evaluation of the data associated with virtual reality and its impact on student performance. This process led to an analysis of the aforementioned quantitative and qualitative data. Generating sufficient evidence to make a claim was an arduous proposition. McNiff and Whitehead (2011) believe that generating evidence involves establishing criteria and standards of judgment and selecting data to assess the situation. Appropriate selection of data allowed for establishing triangulation. This process required demonstrating the authenticity of the data, negotiating the authenticity of the data, and demonstrating the validity of the data (McNiff & Whitehead, 2011). Stringer (2014) calls this the reflection and analysis period. The focus is on unpacking the data, asking the appropriate questions about why change occurred, and reflecting on concepts of "how" and "why." Combined, these three steps led to a thorough evaluation of the impact that virtual reality had on the performance and attitude of high school freshmen in social studies. Specific assertions about pedagogy, learning and motivational strategies, and the feasibility of adding virtual reality to social studies classrooms was explored.

Data Analysis

Due to the nature of the study, both quantitative and qualitative data had to be collected to paint the total picture. To only look at half the picture would tell an uneven

story and fail to provide the necessary information to draw some inferences as to whether or not virtual reality was a successful endeavor. As the two sets of data were dovetailed, a mixed methods application was evident. Ivankova (2015) defines mixed methods as "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry" (p.5). Her description was poignant for this study because of the phases of action research that she identifies. Ivankova (2015) elaborates on six phases including "diagnosing an issue, reconnaissance and fact finding, planning and acting, evaluating the next course of action, and monitoring and revising the plan" (p.90).

Rallis (2017) states that qualitative research begins with questions; its ultimate purpose is learning. To inform the questions, the researcher collects data. When data are grouped into patterns, they become information. When information is interpreted and put to use or applied, it becomes knowledge. This learning can become a community practice that will allow a group of teachers to engage in a shared enterprise. Rallis (2017) goes on to say that qualitative research has two unique features; "the researcher is the means through which the study is conducted and the purpose is to learn about some facets of the social world" (p.4).

Qualitative methods are interactive and humanistic. The primary technique of interviewing, observing, gathering documents, and examining material culture. For this study, students completed a survey at the beginning and end of the course to see if their feelings about social studies had changed after using virtual reality to learn the material. All four teachers and some of the students were interviewed to garner their insight into

how effective the use of virtual reality is as a teaching tool. Patton (1994) labels this technique as standardized open-ended interviews because they are tightly prefigured, having fixed questions that are asked in a particular order for all participants. Field notes and observations took place regularly by the researcher. In analyzing the qualitative data sets (interviews, field notes), I was looking for themes that supported the benefits of virtual reality in U.S. History classrooms. Rallis (2017) describes this type of information as descriptive interpretivism because it holds improvement assumptions about the social world and interpretivist assumptions about epistemology.

Quantitative data was collected simultaneously to allow for a more far-reaching understanding of what the issues were and how effective the solution was. Quantitative research is a structured way of collecting and analyzing data obtained from different sources. “Quantitative research involves the use of computational, statistical, and mathematical tools to derive results. It is conclusive in its purpose as it tries to quantify the problem and understand how prevalent it is by looking for projectable results to a larger population” ("Quantitative Research," 2018, p. 1). The ultimate purpose of quantitative data is to recommend a final course of action.

Fortunately, as the researcher and administrator in the district, there are a number of sources where quantitative data was collected. The first source, was the students’ report card grades indicating their performances for each of the marking periods and the final exam. Due to the block schedule, each student earned a grade for two marking periods and on a final exam. The final exam was not a traditional final exam, but a digital portfolio that measured students’ ability to retain information, apply it, and write in a comprehensive manner. Scores were analyzed and compared to see if using virtual

reality had impacted student memory. The second source was a program called EPass, which charted students' time out of the classroom. This data allowed for a comparison to be made between how much time students spent out of the room when using Google Expedition and when they were engaged in other, less interactive learning activities such as lectures and book work. The third source, PowerSchool, allowed me to review discipline issues from the United States History I classes in the same manner.

Rigor

As the researcher, my perspective played a critical role in the development of the research and the purpose of implementation. Researchers strive for "understanding" that deep structure of knowledge that comes from visiting personally with participants, spending extensive time in the field, and probing to obtain detailed meetings (Creswell & Plano Clark, 2011). To establish the trustworthiness of a study, Lincoln and Guba (1985, p. 243) use unique terms, such as "credibility, authenticity, transferability, dependability, and confirmability as equivalents for internal validation, external validation, reliability, and objectivity".

Trustworthiness

Internal validity speaks to the trustworthiness of the inferences drawn from the data and external validity refers to how well these inferences generalize to a larger body of students (Herr and Anderson, 2005). Taking precautions to ensure validity and reliability are paramount. As I had a vested interest in the outcomes of this study, it could have been tempting to alter data if it does not garner the results that I want. Making sure data was reported accurately for both internal and external validity was important if I wanted this study to serve as a model for other districts.

Role of the Researcher

Few things are more important to me professionally than creating an exciting learning environment for my students. Seeing students happily attend classes, discuss their experiences in the halls with their friends, and develop their skills and knowledge so that they may have successful lives is rewarding. Improving instructional tools and pedagogy that leads to student advancement is my passion. This drive, along with my position as the social studies supervisor, created the enthusiasm for this study. Virtual reality appeared to offer the greatest opportunity to significantly advance the department and foster a level of enthusiasm in both teachers and students like never before.

As an administrator in the district, the role of the researcher was considered. Playing an integral "insider role" in the academic environment was important to acknowledge, and it was important to ensure that my influence does not alter the results (Herr & Anderson, 2005). Reason (1994) calls this "critical subjectivity." Critical subjectivity refers to the fact that we tend to view events through our own experiences and perspectives, and researchers may tend to report data in a biased manner because of this. As one of the teachers that worked with me closely on this project was non-tenured, I had to be careful not to put undue pressure or stress on her as she was still fine tuning their craft. I had to be certain not to take advantage of the situation, but instead treat teachers as partners in a learning opportunity. Therefore, my role in the PLC was as a facilitator. My function was to guide the conversations by asking reflective questions rather than simply giving answers or telling teachers what I wanted them to do. Since the teachers were the ones actively implementing the virtual reality, I had to ensure that their experiences in the classrooms with students interacting with virtual reality, was

paramount in determining how to move forward and what modifications to pedagogy were needed.

Theoretical Framework

This action research study was completed in an attempt to improve students' performance in social studies and to see what impact virtual reality could have on students' learning. Students are currently underwhelmed with the classroom resources available to them and become disaffected about the topic in totality (Alber, 2014; Aldoobie, 2015; Minocha & Hardy; Weibe 2016). These researchers believe that the methodology is the cause of the disinterest and not the subject matter. Luck (2018) agrees and points to people's fascination with historical topics. Milo (2015) adds that the lack of engaging resources seems to diminish student interest. The problem is to determine what can be done to interest high school students.

Finding the appropriate methodology and pedagogy was at the epicenter of this issue. If the right teaching practices and resources are put in place, social studies can become a student favorite. The constructivist learning theory promotes the ideology that students must be engaged in learning. It states that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. When we encounter something new, we have to reconcile it with our previous ideas and experience, maybe changing what we believe, or maybe discarding the new information as irrelevant (Hein, 1991). In any case, we are active creators of our own knowledge. To do this, we must ask questions, explore, and assess what we know.

Incorporating virtual reality into the classroom allowed me to provide the most immersive technology available at this time. No other resource allowed for replication of

the sorts of pedagogical activities used in classrooms and lecture theaters in the real world. Virtual reality also provided an environment in which to explore emerging pedagogies, or allow the investigation of issues that might be too arduous, dangerous, or expensive in real-life (Gregory et al., 2016). By creating novel learning opportunities students are empowered to create their own learning. Students need control (flexibility of design), discovery (immersion), and relevance (Driskill, 2016).

Learning Theories

Understanding the learning process and how to maximize students' ability to retain information is critical for a school administrator. Various learning theories have been developed in an attempt to explain the way learners process information and transform it into memory. These theories include: constructivist learning, the exploratory approach, metacognition, and situational learning. Each theory represents a way in which students can take more ownership over their own learning, including understanding how they learn best. Incorporating technology into the learning sphere can have a profound impact on the way students interact with information and develop their understanding.

Constructivist Learning

From a constructivist perspective, my belief was that learning is an active, contextualized process of constructing knowledge. researchers strive for "understanding" that deep structure of knowledge that comes from visiting personally with participants, spending extensive time in the field, and probing to obtain detailed meetings. Students should not be treated as passive in the process, but need to be an involved partner in the learning process. Teachers must develop opportunities through technology, project-based

learning, Socratic Circles, and other twenty-first century best practices in an attempt to create active learning communities.

Constructivist learning strategies usually mean encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure she understands the students' preexisting conceptions, and guides the activity to address them and then build on them (Whitson, 2004; Torres, 2018). Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally become expert learners (Dewey, as cited in Sawyer 2014). If making instruction, more captivating and hands-on is the key, adding technology that invigorates students seemed to be a worthwhile solution.

Sawyer (2014) and Aldoobie (2015) agree that a constructivist learning environment is an ideal structure for meaningful learning to occur. They focus on the learner's role in building the information inside their minds based on their experiences and prior knowledge. As virtual reality allows for more genuine experiences than traditional methods of teaching, Google Expedition supports this model perfectly. Dewey (1916) adds to this concept by developing his child-centered pedagogy where creating interest for a child drives the learning environment. A child centered pedagogy requires teachers to respects each individual child and their perspectives, social environment, needs, ideas, learning styles. Dewey's (1916) theories emphasized the importance of inquiry that children learn best when they interact with the world much as

a scientist or philosopher does. It becomes apparent to anyone watching teenagers that using technology drives their interest and serves as a strong motivator.

Exploratory Approach

Winne and Hadwin (2008) agree with Dewey and believe in an exploratory approach to learning that focuses on learners actively engaging and inquiring in the pursuit of knowledge. Virtual field trips were the most effective method of integrating students into the learning environment and creating life-like experiences. These virtual field trips are partnered with each unit's content as a means to provide students with a more in-depth understanding of the subject matter by presenting it in an interactive and engaging way.

Learning does not take place in isolation nor is it categorized with one theoretical approach. The teacher's role in supporting learning cannot be minimalized. Teachers must prepare students for success and develop questions that drive important information home. Resnick (2010) refers to this as a "nested learning system." Resnick highlights interpreting presentations as well as engaging in discussion and arguments as pivotal to the learning process.

Metacognition

Exploratory Learning theory aligns with Winne and Hadwin (2008) who elaborate on the metacognitive forms of thinking. Metacognition, in this theory, focuses on students to shape and adapt their thinking and generate awareness of how they think. By creating thoughtful, essential questions, and focusing on Bloom's Taxonomy, teachers can take the experiences of virtual reality and make the experiences meaningful through thoughtful formative and summative assessment questioning strategies.

Situational Learning

One component that most learning theories seem to agree on is the need for the learner to be an active participant in the learning process. Teachers are encouraged to create meaningful learning experiences that drive home real-world concepts. The situational learning theory posits that learning is situated within authentic learning activities, context, and culture (Lave, 2017). Unfortunately for schools, field trips have become cost prohibitive and opportunities for hands-on learning are minimal. Shell and Black raise the concern that learners often cannot adequately apply their acquired theoretical knowledge when solving complex problems in their everyday lives (Schell & Black, 1997). Their research led them to believe that situated learning has the "potential advantage of (a) placing learners in realistic settings where socially acquired ways of knowing are often valued, (b) increasing the likelihood of application within similar contexts, and (c) strategically applying the learner's prior knowledge on a given subject" (p.6).

Anderson, Reder, and Simon (1996) believe this is the key to learning and retention. They argue that learning is "grounded in the concrete situation in which it occurs; knowledge does not transfer between tasks; training by abstraction is of little use; and instruction must be done in complex, social environments" (p. 1). Virtual reality is a technology that allowed for the simulation of authentic experiences and endeavors that placed the learner within the genuine culture. By recreating the social situation, students could practice the learned behaviors and apply new information in a simulated real-life situation. This developed educational platform provides a forum for complex practice and skill acquisition in a realistic, yet safe environment.

Limitations

Issues with conducting an action research study are inherent. By spending over $20,000 of a school's budget, I had a great deal invested in the success of this pilot program and the resources utilized. Explaining to a superintendent, students, parents, and a community why equipment that failed to produce meaningful growth was purchased can create mistrust and anger. If the motivation seems to be my own self-interest, it will be hard to regain the trust of the school community. Another serious detriment to conducting action research in a school where I currently serve as the principal is that my role in this study could significantly impact the results. As I visited the classrooms involved with the study on a regular basis, my presence may have caused teachers to improve teaching strategies, students may have remained on task more regularly, and disruptions were probably be marginalized. Student behavior and academic performance could have shown improvement simply because I was in the room on a more consistent basis. Finally, there may have been epistemological issues associated with my action researcher bias as there are undoubtedly some biases that I brought into the study. Accounting for these factors and ensuring the validity and reliability of the study were important if I wished for the study to have far reaching implications.

Being able to document a need for changes in how the subject is taught was very important. If there is no need for change, the premise of this dissertation would be off-track and there would be no need for new endeavors. Exploring varying change initiatives created a dovetailing of several important facets that created a strong case for the addition of virtual reality into classrooms across America in some capacity. Coghlan & Brannick, (2010) suggest that an action researcher needs to draw on knowledge of how

change and learning take place and what would cause failure. For meaningful, lasting, change to occur, the need for change must be expressed through purpose, relationships, and with a well-developed strategy.

Conclusion

Conducting this study using mixed methods action research was crucial to be able to make educated decisions and evaluations concerning the true merit and values of virtual reality in a high school classroom (Antheil & Spinelli, 2011). Assessing first-hand successes and failures by both teachers and students allowed for an evaluation of what professional development teachers required; how pedagogy changed; and the reactions of students, socially, academically, physically, and emotionally. Dovetailing information garnered from both a quantitative and a qualitative perspective created a more thorough opportunity for understanding the true impact of virtual reality (Ivankova, 2015).

While participants were representative of students who typically would be enrolled in a U.S. History I course, results may not have been generalizable to other grade levels or subject matter (Bailidon & Damico, 2010). This study focused very specifically on one subject and one grade level. Logically though, many of the logistics, professional development, policy changes, and student reactions should translate to other high school students. Moreover, this student population is diverse enough, that data will be collected on multiple populations including minorities and students with physical and learning disabilities. Examining these subsections provided an interesting perspective as to what accommodations need to take place.

The hope was that success in this district will provide a roadmap for other districts to follow. It is important for any transformational leader to pay close attention to creating a culture of change and to support teachers throughout the process (Argyris, 1990). Even the best intentions will be unsuccessful if teachers do not buy-in to the plan (Burke, 2014). Savvy administrators will engage teachers in the exploratory process, explain the need, and develop a cohesion in vision and desired outcome. Working together and establishing a professional platform that gets its structure from a singular focus on student outcomes can lead to great gains.

Chapter 4

Planning, Preparing, and PLC's

Cycle I: Awareness and Interest

As one of the first high schools to implement Google Expedition into the United States History I curriculum, there was no blueprint to follow. Deciding on how to implement the technology, train teachers, and prepare students was a difficult proposition. Furthermore, predicting what challenges would occur along the way and what the results would be was an imperfect science. The key to success would be establishing a plan that would allow for collaboration, growth, and exploration throughout the first school year.

Creating a coherent plan that encompasses all of the important details and allows for collaboration is a pivotal first step in establishing the two virtual reality labs in the U.S. History I classrooms. Rogers (as cited in Kezar, 2001, pg. 13) asserts that "diffusion of change includes awareness, interest, evaluation, trial, and possibly adoption as its phases." Rogers argues for slow, incremental advancement so that an organization can learn from a trial period. After the trial period comes to a conclusion, an organization can make an educated decision pertaining to the adoption of the change in a full-scale design. Adding Google Expedition to the classroom would constitute a "first-order change" because it involves only minor adjustments and improvements to instructional pedagogy. First order change is characterized by an evolutionary change as new technology is now available and requires "single-loop learning" by the educators (Levy and Merry, as cited in Kezar, 1986, p. 16). As teachers use other technologies in the classroom and will still adhere to state curriculum standards, adding Google Expedition will result in an

adjustment to already existing practices. Teachers will be challenged to learn how to implement a new technology and will have to assess their current pedagogy to ensure a cohesive fit between resources and outcome. Where this transformational process begins is critical. Failure to include all vested parties through the process of change can lead to resentment and resistance (Burke, 2014). The first stakeholders that needed to buy-in to using virtual reality in the classroom were the four United States History teachers who would be entrusted to use it in their classrooms. Without their investment, making any changes to instruction would be impossible.

Obtaining teacher buy-in. Selection of the teachers involved with virtual reality was critical for a number of reasons. First, with only two labs, I needed teachers who could collaborate, share classrooms, and work closely together. Second, I needed teachers who were open to change and not afraid of technology. The four teachers that were selected for this venture were young, dynamic, willing to work together, and taught all of the sections of U.S. History I. Alice was the lone special education teacher in the group. She supported U.S.I classrooms as an ICR teacher and also teaches the POR classes. Dan was a tenured teacher who also coaches within the building. Alan and Anna were both nontenured teachers who show a great deal of promise and have quickly become two of the more popular teachers in the building. All four teachers were adept with technology and were willing to modify their pedagogy in the best interest of their students.

Approaching the teachers was not a difficult or complex task. As the supervisor of the Social Studies Department for the last eight years, I have a strong, working relationship with the teachers, know their personalities, and can anticipate challenges and

concerns. I first discussed this during a department meeting on March 28, 2018 in one of the teacher's classrooms. During the meeting, I specifically addressed the four United States History teachers who would be involved in the infusion of the Virtual Reality, and found they truly needed little convincing as to its potential merits. I felt it was important to give each teacher an individual platform to express themselves and to be heard. We discussed the academic and behavioral challenges that the social studies curriculum and classrooms face, specifically with motivating students and creating excitement. We highlighted the potential areas of improvement such as students being more excited for the material, student engagement, and being at the forefront of the newest technological innovation. Finally, we focused on the opportunities that virtual reality could inspire students to continue studying social studies in both high school and college. I promised professional development, leniency with observations as this was sure to be a difficult learning curve, and the opportunity to grow and develop as professionals. Anna, who recently graduated from college, talked about her exposure to educational technology in college and believed this was the natural progression for education. Alan concurred and volunteered to do some research on his own on the virtual field trips that could be added to the curriculum. Alice offered that she was concerned about some of the unique challenges her special education students may face, but she believed the potential growth far exceeded any potential shortcomings. Without teacher buy-in, pursuing funding and support from central administration would have been a waste of time.

Securing central office support. After buy-in was achieved from the U.S. I History teachers, I set forth to promote Google Expedition with the assistant superintendent, superintendent, and the board of education. I needed their permission to

purchase Google Expedition and add it to the curriculum. I was cordially invited to the board of education curriculum committee meeting which was held on August 15, 2018. Many of the members of the BOE stated that they had no experience with virtual reality and did not understand how it works They were however interested in learning how it could be used, what it was, if it was safe, the impact it would have on the school budget, and the logistics of implementation. Their curiosity was evident as they asked a number of questions centered around assessment of the material, how students with medical issues would be impacted, if teachers supported the initiative, and logistical aspects of the software. One board member in particular was concerned about spending close to $20,000 on virtual reality when the district faced many other pressing needs. Fortunately, the president of the board addressed the budgeting question for me citing past transformational changes to the department including digital portfolios which had been enthusiastically accepted by the community. She believed this would garner similar acclaim from parents and students, making the expenditure a worthwhile endeavor. Other questions were posed about the safety of students with glasses and those suffering from concussions with the use of virtual reality. Concerning their medical queries, I assured them that research from Google, CNN, and Scientific American had indicated that virtual reality was believed to be safe for students with glasses. I also explained that textbooks and traditional resources were available for students who felt uncomfortable for any reason.

Additionally, questions about teacher willingness and teacher training were posed. By discussing the outcome of our teacher meeting that was held during the first week of September and summarizing the numerous conversations I had with the Social Studies

Department, I was able to assure them that teacher buy-in had already been accomplished. I also explained that I would be creating and providing professional development for the teachers involved teachers with the support of the IT department and school nurse.

To seal the deal, I closed the discussion with a fifteen-minute demonstration of Google Expedition in the meeting. I had asked the IT Department ahead of time to set up Google Expedition in the board of education conference room with field trips being taken to the Statue of Liberty, National History Museum, the Coral Reef, and Hawaii. We spent about five minutes on each virtual field trip allowing board members to take a cursory visit to each location. Board members were very excited to participate and enjoyed their opportunity to interact with the goggles and to share the experience that was being afforded to the students. They spoke with one another about how clear the pictures were, how much education had changed since they were in school, and wondered aloud where else they could visit. One wanted me to "leave her in the Hawaii" virtual field trip for a while and asked if she get have a pina colada.

By the end of the meeting, all members were exceptionally complimentary about the direction in which the department has gone over the last couple of years. One member said that she would have enjoyed social studies a lot more if she could have used virtual reality when she was in school. Two others concurred with her assertion. Another asked if she could come watch the students' reactions on the first day. The board president again offered effusive praise on the overall growth of the social studies department concerning final exams, digital portfolios, and now the implementation of virtual reality. One member suggested that this could be the model department for the

entire district. Another expressed excitement and offered that "my son will be a freshman in two years and I can't wait for him to be exposed to such innovative learning practices" (Brownridge, 2018). They asked me to return at the end of the year to share data about how students responded to virtual reality and if Google Expedition improved learning outcomes.

I left the meeting excited and amazed at how well it went. I was especially grateful for the support I had received from central administration and all members of the board of education. It would have been understandable if an unknown risk and a large change to instruction had caused board members discomfort, mistrust, and a resulting denial to my proposal. I felt especially appreciated and knew that I had earned the longstanding board members' trust through previous successes and open communication. This was the first time I truly believed that virtual reality was becoming a reality at Harmony High School.

Parent buy-in. After gaining the support of my supervisors, it became necessary to engage a crucial constituent. I focused my attention to the next important subgroup in this evolutionary change which were the parents and guardians of the students. I was apprehensive as I know that parents who do not accept change or new technology can quickly voice their disdain which could lead to a BOE that no longer supports Google Expedition. I wanted parents to be able to ask questions and feel comfortable with the concept of their children using Google Expedition. Offering parents, a forum to ask questions beforehand is a great strategy for reducing issues moving forward. In my experience as an administrator, proactive communication is usually a sound process for eliminating resistance. This process took shape through two methods. First, a letter was

sent out on August 18, 2018 to every parents of every incoming freshmen, (See Appendix B). This letter informed parents that virtual reality would be added to the U.S. History I curriculum as a way to improve student interest in and learning of the content of the course. The letter also contained my contact information as an invitation to reach out to me with any questions or concerns. At this point, no letter of permission was necessary as this was only a slight modification to the pedagogy.

Second, the topics associated with freshmen using virtual reality in history class were addressed during the Freshmen Orientation Night held on September 4, 2018. This is a night organized by the district every year to provide information to freshmen and their parents about high school. It is well attended every year with close to 75% of freshmen families attending on average. At this meeting, I introduced Google Expedition as the form of Virtual Reality to be used in the History curriculum. The basics of Google Expedition were explained and a brief overview was offered. The description included an overview of what virtual reality is, the learning opportunities it presented, and some basics like how students would be seated while using it and that the goggles were not strapped to students' heads. I briefly discussed my research on students' perceptions of History, as a subject boring and irrelevant outside of the classroom setting. I elaborated on the History department's feelings about student performance and engagement in History, and that using virtual reality was a sound instructional practice to increase student motivation and interest. I explained that it would be incorporated into specific lessons, based on the unit of study, as a way to provide a more sensory and interactive experience for the students when engaging with the content. Finally, I provided examples of the virtual field trips students would take in order to experience landscapes

and settings like Angel Island, Westward Expansion, museums, space, and Washington D.C.. I expressed my excitement at offering a revolutionary new way for students to engage with the curriculum and expressed my gratitude to the board of education and superintendent for allowing us to take this initiative. Finally, I illustrated the teachers' enthusiasm for developing lessons with virtual reality. At the end of the meeting, parents were encouraged to come ask personal questions if they had specific concerns after the presentation was over. The few parents who did come forward expressed excitement for their student's opportunities and lamented that schools did not offer these opportunities when they were in high school.

Professional development for virtual reality in the classroom. Osterman (1993) emphasizes the importance of professional development in the support of teachers if we hope to improve learning experiences for students. If a significant improvement in the classroom is possible, it would be imperative to offer the necessary support. For such a large and powerful company, Google does not have a strong support staff for all of its educational initiatives. Questions on the logistics of using Google Expedition were forwarded to Best Buy. Questions about implementation of Google Expedition into curriculum, pedagogy, or assessments had no obvious help desk or support. This lack of support was viewed as an opportunity to create products that will offer guidance for any teacher attempting to use virtual reality in their classroom. Fortunately, an I.T. employee made this her personal mission. She was excited by the technology and delved into the project with amazing aptitude. She was able to create instructions, laminate them, and provide a copy to each teacher. None of the pictures or directions provided to the teacher actually comes with the hardware (See Appendix C).

Familiarity with equipment. For this project to be successful, professional development was required in several areas. The first training was held on September 4, 2018, during teacher professional development time and attended by the Information Technology Department (I.T.). They were brought in to troubleshoot and answer logistical questions. The Ethernet connection was explained, goggles were experimented with, and sample virtual field trips were downloaded. Teachers chatted after the presentation and Alice and Alan stated that this was going to be easier technologically than they had anticipated. Teachers Anna and Dan concurred and Dan offered that he "was excited and knew that the students would probably be even better with the technology than the teachers were" (Brownridge, 2018).

Health concerns. Next, the nurse was asked to attend the second Professional Development meeting on September 5, 2018 to provide an opportunity for teachers to ask about health concerns, what to watch for, and what their responses should be. She provided an in-depth power point to address staff concerns' well-being while using virtual reality (See Appendix C). Her presentation focused on cybersickness, dizziness, and students with concussions. Alan asked about modification strategies for students with concussions and the teachers agreed that they would allow these students to use the textbook or the teacher's tablet (Brownridge, 2018). The nurse offered to make herself available during the first couple of weeks in case teachers wanted her to be present in the classroom. The main advice offered to teachers included limiting the length of exposure to virtual reality, exempting students with concussions, and allowing students to close their eyes and refocus if they felt dizzy or before walking around the room (Brownridge,

2018). The nurse also suggested having a one-minute wait time at the end of the period before students left the classroom and had to walk down the hall.

Technical assistance and trouble shooting. The final professional development took place on September 6, 2018, the day before students arrived. First, the basic I.T. requirements were reviewed, such as how to install Google Expedition in the classroom, download virtual field trips, and trouble-shoot technical issues. Teachers asked questions about connectivity, joining field trips, and what to do if goggles froze (Brownridge, 2018). The I.T. person was able to assure teachers that if freezing occurred or there were connectivity issues, goggles could be turned off and restarted. She suggested having more goggles ready to go than the teachers needed so there would be backups available (Brownridge, 2018). Second, teachers were taught how to login to field trips, download them, and given the passcodes they would need. The Ethernet connection was also reviewed and teachers were taught how to move the Ethernet to another room if a colleague wanted to borrow the virtual reality. Teachers expressed that they felt confident and supported at the end of these important sessions.

The development of a PLC. Preparation is the key to any successful lesson. This could not be truer than when endeavoring to incorporate new technology such as virtual reality in the classroom. Everything from opening the goggle case, to lecturing with the tablet, was brand new and a bit intimidating to the teachers charged with using it. According to DuFour and Eaker (1998), educational reforms fail more often than not. They believe the causes are many and include the complexity of the task, misplaced focus, a lack of clarity as to why the change is necessary, the intended results, a lack of perseverance, and failure for the change agents to continually attend to the change

process. To combat these obstacles, I chose to work with a small group of teachers that were easy to monitor. I communicated regularly with this group and was fully invested in the process. I also included them in every step of the plan and allowed for them to take ownership of the change initiatives. Teachers, given the right circumstances and support, can support each other through the use of a professional learning community (PLC) (Dufour and Eaker, 1998). This philosophy allows for an enhancement in organizational capacity that leads to a boost to student learning (Dufour & Eaker, 1998). From my experience, empowering teachers to partake in self-guided, and peer-directed development through a PLC is a powerful way to not only create meaningful change, but also to show teachers that their experiences are valued and that I am looking to partner with them as educational colleagues.

Shared mission and vision. To implement Google Expedition into the U.S. History I classrooms, a PLC was created with the four teachers tasked with using it and myself. Dufour and Eaker (1998) discuss the various important steps to creating a PLC. They include a shared mission, vision, and values, collective inquiry- including public reflection, shared meaning, joint planning, coordinated action, collaborative teams, and being, results oriented. Following the professional development on September 4th, 2018, our PLC met in order to establish a shared mission, addressing the overall lack of interest students report in social studies. The four teachers came together for a common mission to improve pedagogy and student experiences in their classrooms. Their vision was an engaging classroom that motivated students to learn through the use of virtual reality. Moving forward, each teacher agreed to share their experiences and support each other as they learned about virtual reality and how it would impact their assessments, pedagogy,

and student motivation. As none of the teachers had prior experience with this technology, they were committed to each other and formed a reliance on each other's feedback. Student grades and an interest survey would be evaluated to determine results.

Joint planning. At the beginning of the school year, meetings were set by me for every two weeks. Additional, informal meetings occurred regularly to share successes, failures, and tips. The four teachers looked forward to these meetings for a couple of reasons. First, they felt that the work was important. They shared a common interest in improving the experiences of freshmen students in their classrooms. Finding new and better ways of implementation and suggesting virtual reality field trips became almost a competition with bragging rights and pride. Teachers could not wait to discuss subtle strategies that made implementation easier, students' reactions, and changes to pedagogy. Anna stated "I can't wait to see how students react when they see we are using virtual reality" (Brownridge, 2018).

The fact that teachers were discussing "practice" instead of "theory" was motivating. Teachers can quickly tire of professional development on concepts and philosophy, but truly become invigorated when they have a new opportunity to improve pedagogy. Additionally, they were the only teachers in the county using virtual reality to teach social studies in a high school classroom and it was easy to understand their dedication. Initially, the PLC meetings were scheduled during faculty meeting time, or during teachers' common prep time. Anna had offered her room for meetings to allow teachers access to the virtual reality labs. While they were only scheduled for thirty minutes, we would find that they often ran over and teachers willingly stayed after school

when this occurred. Additionally, a shared Google folder was created to allow for continued dialogue and follow ups to points that had been shared in person.

Selection of field trips. After determining our shared mission and establishing a meeting schedule, the four teachers scoured the list of potential virtual reality trips and selected the ones they felt were appropriate for the U.S. History I curriculum. Teachers did not know how long the virtual trips would take or how many were plausible. Therefore, they began the selection process by reviewing the curriculum and comparing it with the virtual field trips that were offered. Suggestions were made and a consensus was reached by all four teachers. Every teacher had to agree since consistency in the classrooms was important. The virtual trips selected included: (1) Alexander Hamilton and the Ratification of the Constitution; (2) Alexander Hamilton and Washington's presidency; (3) America Expands West; (4) Exploring America's Past; (5) Gettysburg National Military Park; (6) Immigration and Cities; (7) Reviving the Past; (8) The American Revolution Begins; (9) The Civil War; (10) The Declaration of Independence; (11) The Industrial Age; (12) The Statue of Liberty and Ellis Island; (13) Thomas Edison Historical Park; and (14) Women's Suffrage in the United States. By selecting varied opportunities, each aspect of the curriculum could be impacted.

Assessment and pedagogy. Finally, on September 6th, the PLC was ready to take on the truly challenging work. Teachers began meaningful conversations about assessment and pedagogy. To infuse a new tool and continue with the same educational practices is impractical. Traditional pedagogy places the teacher center stage as they disseminate facts and engage students. With the implementation of virtual reality, the teachers' role would be drastically different. Teachers noted that asking the basic, low-

level questions from past years was no longer appropriate after students had encountered a more in-depth, interactive learning medium, requiring basic recall of information seemed contradictory. Strategies for the teachers' new role, best practices, and formative and summative assessment strategies were explored.

Teachers continued their dialogue concerning questioning techniques. Before students could "experience" the learning, teachers would often ask questions that measured students understanding of a place or time period. After visiting a location, it would no longer be appropriate to ask fact-based questions about items or events students have just witnessed. Questions needed to be reimagined. The questions that come from Google Expedition are written at a low level to accommodate as many grade levels as possible. In this case, the teachers needed to rewrite questions to meet the learning needs of their students. For example, one question offered by Google asked students "what are the wheels of the wagon made out of." Students would be able to easily provide the answer after looking at the wheels. Teachers found it necessary to change these types of questions to ones that prompted students to apply the information in thoughtful, creative ways. An important resource for this questioning challenge was Bloom's Taxonomy. Teachers revisited the most essential aspects of learning for each unit and developed questions based upon the highest appropriate level of Bloom's Taxonomy (See Appendix E) (Bloom, Englehart, Furst, & Krathwohl, 1956).

When teachers were pressed to imagine what difference the questioning technique was going to have on learning outcomes, they became pensive. The PLC seemed to realize that with the creation of higher-order questioning, came stronger understanding of

material. Students would no longer memorize material, but instead, use information to create, analyze, and evaluate.

Conclusion

Cycle one focused on the preparation of teachers in several capacities. Teachers were trained in using virtual reality with support from the I.T. department; learned about health risks and the concerns for students with certain types of injuries; and were provided with opportunities to plan units, prepare lessons, and develop assessments. The creation of the PLC allowed teachers to generate a shared mission and guaranteed joint planning and collaborative opportunities for sharing experiences. Additionally, the PLC offered me the opportunity to monitor the implementation, provide continued guidance and clarity, and demonstrate commitment to the goals of this initiative. Teachers were exposed to critical topics including technological concerns, medical issues that could arise, as well as troubleshooting and remediation strategies. They selected the virtual field trips to be used in accordance with the curriculum and collaborated on improving questioning techniques and related pedagogy. Without a manual of what to expect, teachers were as prepared as possible; although it was apparent that more dialogue and support would be necessary throughout the school year.

Cycle II: Implementation, Pedagogy, and Learning

Field notes/observation. Cycle two served as an opportunity to put theory into practice and to address the needs of students who Milo (2015) asserts have historically disliked social studies. Cycle Two occurred between September 7, 2018 and June 21, 2019. I utilized the literature reviewed and the information collected during Cycle One to develop a technological advancement transition in the U.S. I History courses. Cycle Two

looks at the change to pedagogy, the role of the teacher as virtual reality is added to the curriculum, and the qualitative and quantitative data collected at the end of the course.

My positions as principal of the school and the supervisor of the social studies department afforded me a number of opportunities to observe the U.S. History I classes. Rossman and Rallis (2017) believe that it was important for the researcher to define their role during an action research study. It is important that a collaborative relationship exists between the teachers and myself as I need the teachers to be invested in the process and to know that their opinion is just as important as mine. I needed for the classroom environment to remain consistent; therefore, it was not my intent to enter the classroom as a supervisor, nor was it my intent to act as an active participant. Instead it was my objective to enter the classroom as an observer – to observe and take notes about pedagogy, students' reactions, technical issues, student engagement, and the overall successes and challenges of using virtual reality in the classroom. Conducting a formal, worthwhile observation and adjusting my strategies associated with the observation process was critical. "Observing includes a formal, structured noting of events, activities, speech, and participant observation. Gathering aspects of material culture includes artifacts and written material that may be available in or about the setting or about individuals (Rossman and Rallis, 2017, p. 147)." They go on to offer that "data gathering is a deliberate, conscious, systematic process that details both the products (data) and the processes of the research activities so that others may understand how the study was performed and can judge its adequacy and strength." Denzin (as cited in Rossman and Rallis, 2017, p. 172) notes that "an event or process can be neither interpreted nor understood until it has been well described." My observation notes provide detailed

remarks about students' responses, students' interactions with each other and the equipment, and students' interactions with the teachers. My field notes consist of two components: the descriptive data which encompasses what I observed and my reflective comments on the data and the study itself.

The four teachers involved with this study were given pseudonyms to protect their identities. Visitations to their classrooms occurred two days a week and for approximately the same amount of time. Conducting an action research study at the high school where I currently work gave me amazing access to observe the U.S. I classrooms where virtual reality was being added. As stated, virtual reality was implemented by three different teachers in two different classrooms during the first semester and an additional teacher during the second semester. One of three first semester teachers is an ICR teacher who works collaboratively in Anna and Dan's classrooms and has a pull out resource (POR) class all by herself. Throughout the year, I was able to conduct fifty-two observations, each lasting between forty to sixty minutes. There are approximately twenty-two to twenty-five students per class except in the POR class. The block periods that the school utilizes last for seventy-six minutes per period. Below are findings from my observations.

Observations of pedagogy. Traditionally, teachers are the epicenter of the classroom. Teachers are accustomed to being the presenter and disseminator of information. With the addition of previous technological endeavors, teachers maintained their place as the alpha in the classroom as they deftly manipulated the tools for the students. Past technological innovations, such as whiteboards, projectors, globes and maps all provided opportunities for improved instruction from the teacher. Virtual reality

disrupts this role and casts the teacher into a secondary role; one that teachers had not experienced and to which they will definitely have to adjust. Immediately after putting on the goggles, students could no longer see the teacher and were captivated by a new, arguably more enthralling stimulus. No longer the focus, teachers had to redefine their new role and determine how best to support students.

After the typical start to the course that included handing out textbooks, syllabi, and explaining grading and course expectations, classroom instruction shortly followed. For the first couple of days, teachers lectured, engaged students in discussion, and introduced important vocabulary. Traditionally, the first unit taught in U.S. History I is Westward Expansion. This unit can be especially bland for high school students (Luck, 2018). The lack of wars, technological innovation, and major events can reduce enthusiasm. The U.S. History I teachers believed this was an ideal opportunity to implement virtual reality and evaluate students' responses to their experiences of the wild west in a novel manner. They were able to find a virtual field trip called "Westward Expansion" and added to it to their lesson plans for the first unit. This virtual field trip consisted of three different scenes, nine questions, and some notes. An introduction was offered, teaching students how to hold and use the goggles, explaining what students would be seeing and experiencing, and what the teacher's expectations were for the students after the virtual field trips concluded.

One of the most unexpected and exciting aspects to come out of using Google Expedition in the classroom was the impact on pedagogy. During the first couple of attempts, teachers instructed in a traditional manner, with whole group instruction, whole group virtual reality, and whole group formative assessment. While this method was

plausible, it was apparent that it was probably not the best practice. While students were engaged with virtual reality, teachers realized they were not playing an active role in instruction. Teachers had to accept that they were not the focal point of instruction and students were not even looking at them.

Developing pedagogy. A mentioned, an unexpected and exciting development, occurring as a result of the implementation of Google Expedition in the classroom, was the impact on pedagogy. The teachers associated with this action research study had no blueprint for how to teach with virtual reality and could not anticipate the drastic change to instruction that would be the end result. During the first implementation of the Westward Expansion Unit, teachers allowed students to use the goggles while attempting to read the notes provided by Google on the teacher tablet. After reading the notes, teachers then posed the questions that had also been provided. To their dismay, it quickly became apparent that students could not listen to a lecture and be submerged in virtual reality. Teachers quickly modified their practice. On occasion teachers would lecture first, prepare students for what they were going to see, and then allow them to retrieve the goggles. On other occasions, students would come in and explore their virtual field trip for a set amount of time before the teacher would lecture about what they had just seen. Both of these methods proved to be effective.

During the first couple of attempts, teachers instructed in a traditional manner, with whole group instruction, whole group virtual reality, and whole group formative assessment. Although this method was plausible, it was apparent that it was probably not the best practice. While students were engaged with virtual reality, teachers realized they were not playing an active role in instruction. Teachers had to accept that they were not

the focal point of instruction and students were not even looking at them. This became most apparent during the first usage when a teacher tripped and was slightly embarrassed until she realized that no one had seen her trip. The four teachers, through PLC meetings during the months of October and November, 2018 explored new ways to teach their classes. Teachers agreed to try a station-based learning approach to instruction. The rationale was that with teachers' now limited role in direct instruction, they should more heavily focus on facilitating learning while students were engaged in virtual reality. Furthermore, teachers believed that there would be less technological issues if they were only using five-six pairs of goggles instead of twenty-five. Small group stations included a lecture station, a virtual reality station, a primary source document station, an essential question station, and a hands-on activity station. Students were either heterogeneously or homogeneously grouped depending on the unit and resources that were available

The last area teachers focused on improving was questioning technique. During the first unit, the U.S.I teachers asked the questions provided by Google Expedition and questions they had posed in the past. Students had no problem answering these questions and teachers realized that the questions provided by Google Expedition were not age appropriate. Teachers also realized that many of the questions they had previously posed lacked depth and complexity and were easily answered because of the immersive learning practices. Teachers referred to Bloom's Taxonomy and developed questions that focused on analyzing, comparing and contrasting, synthesizing, and developing student critical thinking skills.

There were some units that really exemplified the impact of virtual reality on pedagogy. One of the highlights that exemplified the possibilities for teachers was a

google expedition to the Statue of Liberty. Traditionally, discussing immigrants experience coming to America is at best, a brief interlude within a much larger chapter. The teacher's abbreviated notes have traditionally done very little to truly expose students to the trials and tribulations of someone coming to this country for the first time. Now, with the use of virtual reality, students were able to experience this epic moment in a truly different capacity.

Anna began the class period in a small office that is adjacent to her classroom. All twenty-four students crammed uncomfortably in the space. Clearly, many were uncomfortable sharing their personal space with their peers. Anna passed out the goggles and explained to the class that today they would be exposed to a simulated experience or entering the country. As students put the goggles on, Anna played typical, loud noises that immigrants would have heard on the ship along the route. Anna continued the lesson, discussing how long people could expect the trip to take and flipping through different scenes of what life was like on the boat. After a couple of minutes, anna walked the students into her room and had them line up. Goggles were removed and students were given the same quiz that would have been typical upon arrival to the United States. Some students, who lacked the knowledge of the language or did not have a job or money were denied entry. Others were granted permission to enter the dormitories. The next expedition was loaded for everyone and students were immediately put into cramped dorms with many beds. Anna explained how immigrants could spend weeks in this modest dwelling with strangers as they awaited the next phase of entry. After, this 50-minute activity ended, students were asked about their experiences. Students discussed how uncomfortable the trip must have been, how scary it must be for people to enter into

a new country, not be familiar with the language, and to be exposed to a "pop quiz" right off of the boat. They also lamented the lack of privacy, especially considering the sleeping arrangements and community bathrooms. Dialogue between students lasted for the duration of the period. An important experience that so many American citizens had been exposed to came to life in the classroom due to updated pedagogy and virtual reality.

During a separate observation, I arrived to Alan's classroom to find that he was joined by the physics teacher. The fact that the physics teacher was there was a surprise since this was the first time that she had been in this classroom in my eight years as principal. I stood in the back of the room to see what they were working on. Alan explained to the students that they would be taking a virtual field trip to the Thomas Edison National Historical Park. Alan directed students to review varying inventions and discussed the importance of Edison. After the fifteen-minute virtual field trip had concluded, the physics teacher commenced on an interdisciplinary discussion about the inventions, how they worked, and their importance in American society. Students were exposed to the history of the inventions as well as to the scientific concepts behind them. The teachers later collaborated again, in the physics teacher's classroom. This type of instruction had never taken place before.

On the last day of class, students traditionally spend the time returning textbooks, discussing grades, and preparing for the new semester. The day is generally not geared towards instruction and is more of a farewell. This year, the teachers decided to try something a little different thanks to virtual reality. What had become apparent to the teachers over the course of the semester was the lack of travel and exposure to cultures

outside of the small town they live. Students seemed to believe that most of the world was comparable to where they were from. Teachers seized the remaining time to expose students to the seven wonders of the world. First, students were asked if they could name of the seven wonders. One student was able to identify the statue of Zeus at Olympia because she was into mythology. This was sadly the only wonder that the class identified. The teachers took this opportunity to virtually visit all 7 of the Wonders of the World, find each country on the map, and explain briefly the history of each. Students asked about how such amazing architecture and artwork was possible without advanced machinery. The teachers explained how some of their techniques were still not completely understood and there were mysteries and controversies associated with many. Students were also unable to locate many of the countries on the map, especially ones that were in locations that have since changed names. On a day that was traditionally not instructional, students had been exposed to an impromptu lesson that excited them and perhaps, motivated them to learn more about these wonders.

Virtual reality's impact on students. Students love working with technology (Aldoobie, 2015). It is part of their lives and does not phase or intimidate them. The first day that virtual reality was implemented students excitedly dashed into their classrooms. Their excitement was evident as they rushed into the room and several confirmed with their teachers that they were, in fact, going to use the goggles on that day. When the teachers affirmed that they were going to use them, students reacted with high fives, "yes," "this is gonna be off the hook" and other positive comments.

Their first engagement was with a virtual field trip referencing Westward Expansion. As students peered into the goggles, comments were enthusiastic. One

student exclaimed “oh my god, this is so flippin cool” (Brownridge, 2018). Another asked “how big are those cows.” A third student asked if they were going to use virtual reality for every topic. As the virtual field trip went on, students took pleasure in calling each other’s name and telling them to look at something that had interested them in the virtual world. Students told each other to check out the wagon, the cowboy, the cows, a cowboy that was cooking, and a dog that was in the background. Other students wished they had always learned history this way. A small group conversing in the corner focused on the town setup, what life must have been like with limited resources, and the obvious dangers. At the end of each period, the entire class took a couple of minutes to anxiously recall their experience. Some discussed buying their own set of goggles because it was “awesome” (Brownridge, 2018). These types of responses were consistent for every period. One student was overheard telling his friend that “virtual reality days are way better than normal class days” (Brownridge, 2018). While the initial reaction was positive, my concern was whether or not this reaction and student engagement would be consistent for the entire semester. As the semester wore on, students maintained their level of excitement and positivity when entering the room on virtual reality days. Positive comments and support were the norm and students asked for the teachers to find new virtual field trips for as many classes as possible. One student summed up the positive feelings by offering that “virtual reality was the only reason he came to school that day” (Brownridge, 2018).

One of the more interesting responses from students arose from their use of google expedition to explore women’s suffrage. Although, women gained the right to vote approximately 100 years ago, women still struggle with equality in the work place

and in general society. Students, who are close to fourteen-years-old, can struggle with understanding what life was like before women achieved such victories. As the teacher exposed students to marches and outlined some of the most important figures of the movement, students began to ask questions about equality. This included questions about divorce, working outside of the home, and legal rights. The teacher explained how women were discouraged from working outside of the home except for a few professions. Students listened attentively and reflected on the clothing that the women were wearing in the scenes and how much their lives had changed. Some students were able to make the connection between the struggles that these women had faced and the rights that their generation enjoy. One student wished aloud that the expedition had sound because she wanted to hear the chants, slogans, and propaganda associated with the movement as well as the argument against women having more equality. Putting faces and visual stimulus in front of the students had a significant impact on many of them, especially the young women in the class. Many of the girls in the room made remarks about what they would do if their husband, boyfriend, or boss treated them like this. One girl asserted that she will be the first female president and her mission would be to continue pushing equal rights for women and minorities. The teacher interjected and attempted to inspire the students suggesting that the only thing that has caused change throughout our history was a group of motivated individuals. Students seemed to grasp the importance of what women in the 1920-s had accomplished and how much more there was to do.

Two of the more impactful, and somewhat surprising virtual field trips were the Gold Rush during westward expansion and Lincoln's Assassination. Students had strong reactions to these two experiences for very different reasons. While students had a

general familiarity with both of these topics, seeing the atmosphere seemed to provide vastly different perspectives for them.

One of the surprisingly more popular shows among the teens in the room was Gold Rush or some version of Gold Rush. Students had seen gold mining using massive trucks and machines that did most of the difficult work. Students expressed their dismay at how much manual labor was associated with gold mining. They had also not anticipated the heat issues and how many men lost their lives because of this work. Most students thought of gold mining in Alaska and had failed to consider the differences that workers would endure in California during westward expansion. One student exclaimed, "no way, not for me. Maybe I would just buy the gold after they found it or something." Another suggested just stealing the gold at the end of the day because the workers were so tired. The teacher went on to explain how little workers earned for this backbreaking task and how dangerous the conditions actually were. Students discussed the physical toll that would be extracted from shoveling dirt all day long in the hopes of finding flecks of gold. Students also lamented the lack of medical facilities available to those who became injured on the job. A few students asserted that they would not have made the trip to the west. They would have been happy to stay on the eastern coast and farm. One student suggested that gold mining was great, "if you own the mine." Being the owner seemed to be the solution for most.

Similarly, students were aware and somewhat knowledgeable about Lincoln's assassination, but seemed to gain more clarity when seeing 360° pictures of the event. One student asked, "how could someone carry a gun into such a crowded venue without being caught." Another asked, "Why couldn't the hospital save him." These questions

led to a teacher-led dialogue about the time period, and safety measures that were in place then and how they compare to security associated with the president today. Connections were made between Lincoln and Dr. King. These two events served as reminders that just because students are familiar with a concept does not mean that they have a strong grasp of the details. Virtual reality took a familiarity with these important dates and expanded student appreciation into a strong grasp of the reality. This higher-level comprehension is what virtual reality offered in each of the assigned units for U.S. 1.

While student reactions were overwhelmingly positive, some comments and interactions made it apparent that there were aspects of virtual reality that students wished were different or better (Brownridge, 2018). One girl complained that the goggles were messing up her makeup. Several students expressed unhappiness that the scenes were not interactive and that they could not work collaboratively with their friends. A special education student spent the majority of her first time using the goggles, looking for her virtual legs. She addressed the teacher stating that "she could not find her legs." While the teacher assured her that this was normal, this topic became the focal point for her for several minutes. Many students wished that the characters in the scene could speak with them and answer their questions. One student suggested that his classmate's avatars in the scene would have been pretty cool. Overall, students wished for more interaction and engagement with each other and the scenes. Anna suggested to some of her classes that in a few years she was sure there would be major advancements. Students responded that they would have graduated by then and it would not be helpful for them.

Throughout the semester, students maintained their level of excitement and positivity when entering the room on virtual reality days. Positive comments and support were the norm and students asked for the teachers to find new virtual field trips for as many classes as possible. One student summed up the positive feelings by offering that "virtual reality was the only reason he came to school that day" (Brownridge, 2018). However, one of the biggest complaints from students and teachers was the overall quality of the pictures and experiences. A majority of students interviewed and surveyed believed the picture quality could have been clearer and wished that the environments had been interactive. Students wanted to walk around, pick up items, talk with the characters, and work collaboratively to explore. None of these features were possible. With better picture and movement quality, the number of students experiencing motion sickness would certainly diminish as well.

It was evident that students responded well to using virtual reality within the units associated with the curriculum for U.S. 1. The vast majority of the comments were positive and supportive. As noted in Cycle III, test scores improved suggesting that student retention had increased. What is hard to quantify, is the increase in empathy and compassion that students expressed for the cultures and time periods they studied. Students often commented on how hard life must be in this time period or in this region of the country. Students lamented how difficult travel to this country must have been for people leaving family members behind, not speaking the language, and having to start over. While many of our students lack the ability to travel and none can go back in time, it is important to expose them to these types of opportunities so greater understanding can occur.

Technology in the classroom. Implementing new hardware and software can be a scary proposition for teachers especially on the first day when teachers are being watched by a class full of students. This was the impetus for all of the training offered by the I.T. professionals in September. On the first day of implementation, different teachers met with varying levels of success. First, I decided to visit Dan's classroom. He had a class first period and was anxious to get started. Dan logged in on the tablet and shared the first trip which was all about wagons. Students immediately encountered technical issues. Dan had failed to turn all the goggles on ahead of time, take off the protective plastic that enveloped each goggle, and download the virtual field trip before student arrival. The goggles started updating their software and caused a significant delay. Twelve minutes after the initial attempt, every student was able to join the shared trip.

Later the same day, the second teacher, Anna, had a U.S. History I class which meets directly across the hall from Dan. She provided a similar introduction, had the students wipe down the goggles with wipes, and began her virtual field trip. Surprisingly, students had no trouble accessing the program immediately. The total time it took to have every student engaged in the field trip was less than a minute. Impressed, at the end of the period, I asked her what she did proactively to have such amazing success. Anna provided me with a list of steps that allowed students to forgo the downloads and technical difficulties. (See Appendix D).

At the end of the day, Alice used the goggles for her POR class. They were the same goggles that Anna had used earlier that day, so the virtual field trip had already been downloaded. Students wiped down the goggles with wet wipes and sat down. With

only six students in the classroom, the entire process of joining a virtual field trip took significantly less time than it had taken Dan. No delays were evident and students were all logged in within a minute. Later in the semester, Alice learned that trying to conduct virtual reality in a neighboring classroom without moving the Ethernet cable was not a sound instructional strategy. Goggles constantly spooled and students were not able to complete the trips. It became apparent that the signal was not strong enough to carry to other classrooms.

After their first experiences which began in the middle of September 2018, teachers came back together to discuss their experiences. Anna elucidated her successful implementation and strategy. She shared a step by step guide with the other teachers who appreciated her support. Dan acknowledged that he should have done more to prep for the first day and saw the delay that ensued. While Alan was not teaching U.S. I during the first semester, he sat in the meeting and listened attentively to the dialogue. He took notes, so he would be prepared to implement the procedures during the second semester window.

Over the next several weeks, the teachers and students grew with their comfort level using the goggles. Teachers began to modify their pedagogy to station-based learning which meant that only four-to-six goggles were being used at any given time. This eliminated most of the connectivity issues. Occasionally goggles did have problems spooling, but they were easily replaced with one of the goggles not being used. Prep time for teachers diminished greatly since the number of goggles needing additional support dropped by eighty percent.

Throughout the remainder of the year, occasional connectivity issues occurred, but teachers had spare goggles to replace the ones that were having difficulty connecting. Teachers did note that the battery life of the goggles was not sufficient to make it through the school day without being charged at some point. As teachers became more adept with the goggles, less and less issues ensued. As teachers transformed from whole group instruction to station-based learning and only small pockets of students were using the goggles, technology issues disappeared. The connectivity seemed significantly stronger with only five to ten students logging in at a time.

Overall, connectivity issues were minimal when teachers were prepared ahead of time. Teachers also learned that the battery life of each goggle was only a couple of hours before they would die. It was important to charge goggles in between classes during teacher prep periods. With fewer students logging in at any time, connectivity issues were nonexistent. Students had no problems using the goggles and adapted seamlessly.

As teachers reflected on their experiences, they offered a great deal of feedback. Dan acknowledged that "I should have been more prepared during the first day. If I had, I don't think it would have been such a big deal" (Brownridge, 2018). Anna acknowledged how nervous she was on the first few occasions that the goggles were not going to work and she would have to scramble to come up with a different activity, but she gradually became more comfortable with the process. Alice benefitted from working with both teachers and observing their different approaches. Alice said that she learned a great deal about using the goggles before her class started and this gave her a great deal of confidence. All four teachers hoped that Google offers a better search engine that

allows for easier searching for pertinent field trips. Alan expressed frustration throughout the year that he knew there were probably more options, but finding them was a burden because you could not conduct a general search of a topic (Brownridge, 2018).

Medical issues. As discussed, there is limited information about how much exposure students should have to virtual reality and if it is safe for people under a certain age. Teachers were especially concerned about this as they did not want to negatively impact their students. The majority of medical issues occurred during students' first exposure to virtual reality. Health concerns included dizziness, cybersickness, and blurry or strained vision. These problems were almost completely eradicated with a couple of changes to pedagogy and student direction. First, by switching to station-based learning, the amount of time students spent engaged in virtual reality dropped from fifty minutes in a class period to twelve to fifteen minutes over the course of several days. Second, students were told to stop spinning their heads back and forth so quickly while taking in the 360° scene. Lastly, students with glasses were told to leave their glasses on while using the goggles. Teachers had noted that most of the medical issues were for students who wore glasses. Therefore, students with glasses were told to leave their glasses on while using the goggles. Once these modifications were made, less than 2% of students complained of any of the aforementioned maladies. Additionally, a student with high anxiety told her ICR teacher that virtual reality helped her relax in class because she did not have to see her classmates (Brownridge, 2018).

Overall health and wellness. As discussed, several times in previous chapters, the health and wellness of students is the first priority. Without knowing what to expect, this was my biggest concern. After spending close to $20,000 of the district's money,

training teachers on the equipment, and deciding that virtual reality was going to be my dissertation topic, the knowledge that it could all be a terrible waste of time and money if it made the students ill weighed heavily on my mind. In total, 308 freshmen used virtual reality during the school year, approximately 150 during the first semester. During the first usage, a total of six students complained about eye strain or slight nausea. Each of these symptoms occurred after eighteen minutes of continued use. This percentage was consistent during the second semester as well. This equates to about 4% of the student population experiencing minor effects. While this percentage sounds reasonable, the solutions to the medical issues were so easy to implement that the number of students experiencing any medical issues after first use dropped down to 1% after the teachers were able to explore potential solutions (Brownridge, 2019).

Working in a PLC to discuss these and other related health issues proved critical. The four teachers and I discussed the medical problems each teacher was seeing and came up with several modifications that were easy and did not interfere with instruction. First, students were told not to spin around while looking at the 360° pictures. While this may sound elementary, teenagers were excited about seeing the pictures and were clearly adding to their own dizziness. Next, students with glasses or eye strain were told to open the goggles and look at the device directly. This alleviated a great deal of the issues and still allowed student to be exposed to the scenes. For students with more significant issues, such as concussions, allowing students to use the teacher's table worked well as a remedial strategy. Finally, and most importantly, limiting the number of consecutive minutes students were exposed to virtual reality seemed to be the most effective teaching strategy. As noted, students did not encounter any concerns until after eighteen

consecutive minutes. Through the use of stations, teachers limited the number of minutes students used the goggles to twelve-fifteen minutes. Through the combination of these simple strategies, almost no issues persisted and all students were able to actively engage in the remainder of the virtual reality field trips (Brownridge, 2019).

Cycle Two required teachers to be invested in creating new learning environments, accepting a new role in the classroom, developing new questioning techniques, and learning how to work with a new technology while being watched by an entire classroom full of students. These tasks were challenging, but worthwhile as students took to the technology seamlessly. Active learning was the end result as students circled around the room engaged in various, meaningful activities. The department will look to expand the role that virtual reality plays both in the same classrooms and in a greater number of classrooms.

Post-implementation PLCS. On September 18, 2018, after implementation occurred, I allowed for the teachers to have their advisory period covered by a substitute so that we could meet as a PLC and discuss successes and failures. Teachers were asked to discuss the following topics:

1. How they felt their role in the classroom had changed.
2. How their questioning technique needed to be modified.
3. How they felt their students had responded to the experience.
4. What they would do differently next time.
5. What issues arose that they were not anticipating.

All four teachers remarked about how significantly their primary responsibilities and overall roles in the classroom had changed. Teachers reflected on the "weird" feeling

that they encountered the first time their students used the goggles. Anna remarked that her main function seemed to be managing technology and troubleshooting connection issues. Anna (Anna, personal communication, September 18, 2018) continued to offer that "it was hard for her to adjust to not being the focal point for students." At one point, she was struggling with her tablet and realized none of the students had noticed. Dan felt that his role in the classroom had gone from "the purveyor of questions and not answers" (Dan, personal communication, September 18, 2018). He continued to say that the excitement from learning had not come from him, but instead, the virtual field trip. All three teachers became flustered as they tried to read the notes off of the tablet while trying to conduct class in a traditional manner and supporting students' individual technical hiccups. It was decided that the focus of the upcoming PLC meetings would be strategies for the teachers' new role, best practices for implementing VR, and formative and summative assessment methods.

Implementation of technology. Rarely, does something run perfectly the first time it is attempted. Further, exacerbating a situation is when the first attempt is with a large group of teens who have no experience and a great deal of enthusiasm. Before the first class, all four teachers had numbered each of the goggles which made dissemination much easier. Students in each class were asked to come to the front of the room and take the pair of goggles that had the same number as their desk. This was a fluid process in all four classrooms. Problems arose for one teacher who had failed to remove the plastic from the goggles causing a delay in students using the equipment. Once all of the goggles were properly prepared, students in each class were unsure what to click on and so were the teachers. Some of the goggles had problems logging into the virtual field trip

(Brownridge, 2019). Apparently one of the problems experienced by everyone, occurred when twenty-five students attempted to log into the same field trip at the same time. This appeared to cause a disruption in the system and several students had to reload until they were successful. The teachers in each classroom and I circled the room connecting each pair of goggles to the virtual field trip. It took several minutes to get to every student. After approximately twelve minutes, every student was able to view the trip. The ethernet cable connection worked well and there were no further issues experienced in three of the classrooms. In the fourth room however, goggles began to die about 25 minutes into the period. The teacher had failed to charge the goggles the day before, and, as it turns out, only charging them the morning of use, is not nearly enough time (Brownridge, 2019).

Overall implementation. After each teacher had implemented virtual reality on three occasions, the teachers and students had formulated a process that allowed for smooth integration. Students knew their assigned goggle numbers, how to clean the lenses before using them, and how to connect to the virtual field trips. Teachers had come to realize that exploratory time was pivotal when students were introduced to a new field trip. Teachers also mastered the new, more rigorous questioning technique that was necessary now that students were being engrossed in the material. Through the use of station based-learning, teachers found their role in the classroom was more personal and supportive. Teachers commented on their new-found ability to differentiate instruction, answer more questions from students, and evaluate understanding on an individual basis. Medical issues were almost non-existent and students maintained their enthusiasm for virtual reality and social studies class.

Cycle III: Implementation

If schools are going to meet the needs of all students and evaluate the effectiveness of implementing virtual reality, it is important to reflect on the intended and unintended consequences that virtual reality had on instruction and learning. The purpose of Cycle 3 was to evaluate "best practices," areas in need of improvement, and the overall success of virtual reality. In this cycle, I looked at the varying themes based upon my literature review, the chosen theoretical basis, and the previous cycles of study. Themes included pedagogy, student motivation and learning as gauged by assessments, and health implications. Quantitative data was collected through Power School and EPass to allow for comparisons to test scores and the amount of time students spend out of the classroom respectively. Surveys and observations were used to collect qualitative data. By dovetailing this information, it is possible to evaluate the effectiveness of virtual reality in the classroom.

Best teaching practices associated with virtual reality. Dedicated teachers and administrators want to provide as many different types of learning opportunities as possible (Will & Schwartz, 2019). Students benefit from varied approaches to instruction. As new technology and manipulatives are added to the classroom, teachers must reflect on their practices and be willing to reform as necessary (Ferlazzo, 2019). The teachers involved with this action research decided that station-based learning was the most effective method of virtual reality implementation. Station-based learning allows teachers to engage and empower students by accommodating their individual needs, partnering them either heterogeneously or homogeneously, and chunking the period to avoid boredom (Ferlazzo 2019). Assignments can be tiered without drawing

attention to the varied levels. Station-based learning also allows for student movement around the room which is great for students who get antsy after sitting for too long. The four U.S. History I teachers in this action research study created five stations with students spending twelve-twenty minutes at each. Combined with an opening and a closing activity, these activities last for two-three periods on a block schedule.

As teachers personalized their instructional strategies and engaged more directly with smaller groups of students, they realized that their formative and summative assessment strategies also needed reformation. As discussed, Bloom's Taxonomy was relied on heavily as teachers developed their strategies from basic retention to higher order thinking questions. Teachers also realized an unintended consequence concerning questioning. All four teachers believe that students were significantly more inclined to ask questions because they saw things they did not understand. This phenomenon created a shared ownership of learning as many of the students' questions could be redirected to their peers and did not have to be addressed by the teachers.

Qualitative data collection. The qualitative data for this actions research study consisted of three different data collection methodologies. Data gathering is a deliberate, conscious, systematic process that details both the products (data) and the processes of the research activities so that others may understand how the study was performed and can judge its adequacy, strength, and ethics (Rossman & Rallis, 2017, p. 153). First, field notes were collected by me as I watched students engage in virtual reality. The field notes consisted of both the descriptive data that I observed and my comments about what happened. Rossman and Rallis (2017) refer to these as running records and emotional reactions. Second, surveys that the students completed at the beginning and end of the

course were analyzed. This survey allowed me to assess if using virtual reality changed how students felt about social studies as a subject. Lastly, there were interviews conducted with both the teachers and students. Patton (as cited in Rossman & Rallis, 2017, p. 155) refers to this method of interviewing as an "interview-guided approach" because the purpose of the questioning is to garner participants' overall perspectives. Interviews were conducted in my office one-on-one with all four teachers and students who were selected by the teachers and who represented the different subgroups including gender, minorities, and lower socio-economic status. These interviews were transcribed and coded. Saldana (2016, p. 5) suggests using a code in qualitative inquiry for a word or short phrase that "symbolically assigns a summative, salient, essence-capturing and/or evocative attribute for a portion of language based or visual data." This strategy proved effective as I coded a number of students who had provided comparable responses.

Surveys. A survey was given to all students enrolled in U.S. History I at the end of the 2017-2018 school year and the same survey was administered to students in the U.S. History I course at the end of each semester during the 2018-2019 school year. Students enrolled in the course during the 2017-2018 school year did not have the opportunity to use virtual reality to learn. Their results can be compared against the results of the 2018-2019 cohort that did have the opportunity to use virtual reality to learn the U.S. History I curriculum. One of the purposes of the student survey was to assess how students feel about social studies when virtual reality is not implemented and then to see if their opinion changes when virtual reality is used as a resource. Another reason for the survey was to find out how students felt about social studies overall and if they believe social studies would play an important role in their future plans. The 2017-2018

cohort had approximately 250 students enrolled in the class and the 2018-2019 cohort had just over 300 students enrolled. It was expected that a high percentage of the students would complete the survey because it was being completed during class time. Students enrolled in the course during the 2017-2018 school year did not have the opportunity to use virtual reality to learn. Their results can be compared against the results of the next cohort that did have the opportunity to use virtual reality to learn the U.S. I curriculum. The four-question survey was emailed to student's school accounts and collected through Google surveys. Students were asked the following questions with responses listed underneath. All of the questions were scored on a five-point Likert scale with "Poor" being assigned a value of 1 and "Excellent" being assigned a value of 5 except for the last question where the order of options is reversed.

Table 1

How interesting were the topics/units in this course?

Likert Scale	Poor	Fair	Satisfactory	Very Good	Excellent
2017-2018 Responses	31 (12.6%)	67 (27%)	49 (20%)	66 (27%)	33 (13%)
2018-2019 Responses	5 (2%)	33 (12%)	83 (30%)	104 (38%)	48 (18%)

It is apparent from question one that students found the topics significantly more interesting when they were taught using virtual reality. When the 2017-2018 group learned social studies without virtual reality, thirty-one students expressed that the topics were not interesting, but when virtual reality was implemented the following year, the number dropped to five. Additionally, one hundred-fifty-two students rated the topics as very good or excellent in 2018-2019 compared to only ninety=nine the previous year. Overall, the mean score for the first school year was a 3.01 while the mean score for the 2018-2019 school year was a 3.95 indicating that students found the same topics and units to be far more interesting while using virtual reality.

Table 2

How engaging were the resources used to teach this course?

Likert Scale	Poor	Fair	Satisfactory	Very Good	Excellent
2017-2018 Responses	28 (11%)	32 (13%)	71 (29%)	71 (29%)	44 (18%)
2018-2019 Responses	7 (3%)	26 (10%)	74 (30%)	103 (38%)	63 (23%)

The results gathered from question two garnered similar results. There is a substantial increase in students' rankings of the resources as very good or excellent during the use of virtual reality. The mean score of the first year equates to 3.79, but it jumps to a 4.1

during the 2018-2019 school year. With virtual reality being the only new resource, it is fair to imply that the significant increase is due to virtual reality.

Table 3

How important will social studies be for your college or career plans?

Likert Scale	Very Important	Important	Neutral	Somewhat Important	Not Important
2017-2018 Responses	17 (7%)	49 (20%)	59 (24%)	68 (28%)	53 (22%)
2018-2019 Responses	34 (12%)	35 (13%)	87 (32%)	55 (20%)	61 (22%)

Virtual reality may not directly impact the plans that students have for college and careers, but increasing their interest in a subject matter may open up social studies as a possibility for students who had not previously considered it as a major. The data above shows that students are now slightly more inclined to consider social studies as a future endeavor. During the 2017-2018 school year, the mean score for this survey question was a 3.37, and the results for the 2018-2019 school year were a 3.6 indicating small growth in this area.

Table 4

Where does social studies rank in order of your favorite classes?

Likert Scale	Favorite	Second Favorite	In the Middle	Near the Bottom	Least Favorite
2017-2018 Responses	29 (12%)	65 (27%)	74 (30%)	57 (23%)	31 (13%)
2018-2019 Responses	41 (15%)	72 (26%)	105 (38%)	36 (13%)	19 (7%)

The last question on the survey was developed to determine if using virtual reality improved students' overall feelings about social studies as a class. Would adding virtual reality be enough to make social studies more interesting than other classes students were either required to take or had taken as an elective? During the 2017-2018 school year the results indicated that social studies ranked between "in the middle" and "near the bottom." Students clearly were not enamored with this course. During the 2018-2019 school year, students ranked social studies closer to being their second favorite class. It is evident that students had a significantly more favorable perspective about U.S. History I after using virtual reality in class.

Virtual reality's impact on student motivation. Measuring student motivation is a difficult task. It is impossible to measure internal motivation, but there are some behaviors that we can link to motivation. The first variable selected for this action research study was the amount of time students spent out of the classroom. I believe that

students who are motivated by the subject matter will be less likely to leave the room. I was able to evaluate how much time students spent out of the classroom using the EPass system. EPass is a resource used by teachers when students ask to leave their classroom for any reason. A second evaluative method chosen for assessing motivation was students' discipline issues in the classroom. Students who are engaged in the material and interested in learning are less likely to act out. Finally, through field notes, comments that students made while engaged in the subject matter can serve as indicators as to how students feel about content, pedagogy, or teaching tool. These will be the three variables evaluated in this section.

While time that students spend out of the classroom may not be completely indicative of a student's interest in the material, it is interesting to compare how much time students spend out of one classroom compared to another. It is possible that different periods of the day lend themselves to students leaving more often or for longer periods of time. Because we are comparing fourteen class sections, courses run every period of the semester and are consistent with other subjects. As previously discussed, Harmony High School uses a program called EPass which teachers use to send students to the bathroom, to other classrooms, the main office, nurse, or anywhere else the students may wish to go during instructional time. At the end of the year, a full report was run to determine if students were more or less likely to miss instructional time connected with virtual reality when compared to traditional classrooms. EPass indicated that students spent a total of 4,240.94 minutes out of the room. When considering that this number is connected to over 300 students over 180 days, the average number of minutes spent out of the room on a given day is just over six. When the same data is run

through EPass for the other 96 teachers employed by the district, the average minutes missed per class period jumps to almost double at 11.76. This is a considerable difference in the amount of time spent outside the classroom.

Students act poorly for a variety of reasons and different teachers respond in varying manners. Traditionally, I have found that teachers who are judged to be boring, lack the ability to create student-centered learning environments, and fail at creating meaningful pedagogy have the greatest number of discipline issues. Student discipline is being evaluated in this section to see if students who are engaged with active learning through virtual reality are less likely to become discipline issues. All discipline data is stored in a program called Power School at Harmony High School. At the end of every month, a detailed report is run to assess the most frequent discipline issues incurred and how many in school and out of school suspensions students have earned. This data can be further broken down by grade level.

Using Power School, I was able to ascertain that students had accrued 3,324 general classroom discipline infractions and sixty out of school suspensions during the ten months of school. Before evaluating how many issues this is per student or course, I removed any discipline issues associated with late arrival to school or incurred in the cafeteria or hallway. There were 996 disciplinary issues associated with being late to school and 816 behavioral issues in the hallways or cafeteria. There were also forty-two incidents in the bathrooms or via social media. This leaves 1,470 general behavioral infractions in the classrooms committed by approximately 1,200 students. If we factor that each student is enrolled in eight classes during the course of the year, there are a total of 9,600 student sections. U.S. History I accounts for approximately 300 students or

about three percent of the total student population. On average, three percent of the discipline issues that occurred in classrooms should have taken place in a U.S. History I classroom. This would average to thirty general discipline issues and almost two suspensions earned during class time. As I evaluated the actual results, I was astonished to find that there was not a single disciplinary infraction recorded by any of the four teachers throughout the entire school year. These results are unlikely to be random, especially when the results are compared to the rest of the social studies department who did not have the benefit of virtual reality and are aligned to the school average for disciplinary issues encountered during the year.

Impact on performance. To compare the impact that virtual reality had on retention of information, I performed a comparison of the final grades earned by students during the 2017-2018 year and the 2018-2019 year. I performed this comparison by analyzing the records stored in Power School in the grades section. Students during the 2017-2018 school year did not have the luxury of using virtual reality so they will serve as my comparison group. I have also broken the data down into subgroups to see if any groups benefitted more or less than others. Students enrolled in U.S. History I during the 2018-2019 school year used virtual reality as a key tool in learning. All of the summative assessments used for comparative purpose remained consistent between the two years to maintain a consistent rigor.

Table 5

Final Grade Comparison Overall

	Boys	*Girls*	*Minorities*	*Spec. Ed.*	*Overall*
2017-2018	*80%*	*85.3%*	*81.7%*	*81.3%*	82.6%
2018-2019	*86.1%*	*88.8%*	*85%*	*83.9%*	*87.5%*

It is apparent when analyzing the quantitative data that students performed significantly better during the 2018-2019 school year. Every subgroup showed improvement in their final grade. The only known change to the instructional strategy was the addition of Google Expedition. It is interesting to note that boys showed the greatest growth. This may be because teen boys have a shorter attention span than teen girls and virtual reality helped them to focus for a longer period of time (Riley et al., 2016). Virtual reality could serve to diminish the achievement gap in some circumstances. It is impossible to tell if virtual reality supports all learning styles and disabilities equally, but it does appear to have a positive impact on every subgroup.

Student perspective. Regardless of what adults think, if teens are not invested in a learning tool, it will fail. The U.S. History I teachers created their own questionnaire to determine if it was worth their time and effort to continue infusing virtual reality into the classroom. The survey was created on Google and offered anonymously at the end of the semester. Almost every student completed all of the questions because the teachers offered it at the end of the class period as opposed to during students' free time such as lunch or advisory periods. The three questions that were posed included:

1. How did the use of virtual reality enhance your learning?

2. How could the use of virtual reality be improved?
3. Do you want to continue using virtual reality in every unit for the duration of the semester?

Learning. A common theme among the collected answers is that virtual reality made learning more fun. Students enjoyed the immersion into the subject matter and many students commented that they remembered more because material was presented in an engaging and enveloping manner. Many responses equated learning with virtual reality to playing a game. Perhaps, most convincingly, 100% of students responded that they would like to continue using virtual reality in other high school academic courses and would recommend using virtual reality to their friends, teachers, and other schools.

Overall opinions were strongly in support of virtual reality helping students learn and retain information. This was a common refrain as twenty-two students noted that they had an easier time remembering concepts, relating to the material, and making connections during teacher lecture or formative assessments. Sixteen of the students mentioned how this was significantly more engaging than the usual textbook and teacher notes. A hearing-impaired student really enjoyed it because it focused the lesson on sight and not listening to a teacher. Three students enjoyed recalling how when they were taking their summative assessments, they recalled the scenes and were able to give answers specifically because of what they had seen.

Many students focused on how it was so much easier to remember details because they had seen them and not just heard about them. One student highlighted the fact that he noticed details not mentioned by the teacher. He felt he learned more because he was not bound to what the teacher shared, but he was free to learn and explore from a

secondary source. Sixteen students believed they developed greater empathy, compassion, or understanding of what people from different cultures or timer periods experienced. One student highlighted the pacing of virtual reality. He detailed how he typically falls behind when the teacher is lecturing because he does not read or write quickly. He felt that virtual reality moved at his speed and he could explore things that interested him. This made him feel comfortable and relaxed. Thirteen of the twenty-five students believed that virtual reality had directly led to improvement in their grades. They elaborated by offering that it was easier for them to remember content and focus throughout the entirety of the block period. Of note, few of the high achieving students felt that virtual reality improved their grades. This could be due to the fact that there was little room for their grades to improve.

Technology in the classroom. It is not controversial to say that virtual reality is truly in its infancy. Developments are ongoing, especially in the realm of education. While students fully supported using virtual reality in the classroom, they were not oblivious to the technological limitations of the hardware and software. Several responses focused on the pixilation of the images and the overall poor quality. Other students admitted that there were instances where they became frustrated with crashing and spooling during class time. Another common refrain focused on the lack of interaction with images in virtual reality. There is no animation, games, searches, or creative activities for students to complete while engaged with virtual reality. Battery life and download speed continue to be hindrances to a more attractive learning environment.

Student interviews. A total of twenty-five students were selected by the social studies teachers to be interviewed as part of this action research study. Teachers were

asked to select students representing different subgroups for the freshman class. A Google spreadsheet was shared with the teachers and they added the names of students who they believed would have interesting insights. Specifically, teachers were asked to select special education students, boys, girls, high performing students, differing races, and students who were repeating the U.S. History I class. One of the selected special education students was deaf and the other was autistic. In an attempt to make my youngest students feel more comfortable, interviews took place in the conference room instead of the principal's office. Before the interviews took place, parent permission was sought and students were given a form to sign off that they were aware of the purpose of the interview and were willing to participate.

After reviewing the responses from the students, common themes were evaluated. Miles, Huberman, and Saldana (2014) suggest that it is important to look for patterns and themes when reviewing answers. They also suggest making contrasts and comparisons with contrast tables, growth gradients, and predictor-outcome consequences. The following are the questions posed, and the common themes elicited from reviewing the transcribed interviews.

Question 1: Describe your experience using virtual reality in U.S. History I.

Question 2: What were the benefits of using virtual reality in U.S. I History class?

Question 3: What were the negatives of using virtual reality in U.S. I History class?

Question 4: Compare your U.S. History I class with other social studies classes you have taken in the past.

Question 5: What other subjects do you think would benefit from using virtual reality to teach students the material?

Question 6: How did virtual reality impact your performance and motivation?

Motivation. Motivating teenagers to learn social studies and stay focused for seventy-six minutes a day can be a complicated task. Students were asked if virtual reality improved their ability to focus and enjoy the lessons in United States History I class. All twenty-five students believed that virtual reality was beneficial and each was able to immediately articulate about what they had enjoyed. All twenty-five students expressing how much they enjoyed the experience. Twenty-two students spoke to the merits of virtual reality making class more interesting by involving them with the lesson. Three expanded upon this point as they discussed how social studies is generally boring, but this kept their attention and allowed them to focus for longer periods of time. One student specifically acknowledged that he had enjoyed it because it helped him see and understand what was going on during different time periods. He said because of the visual ability of the virtual reality, he could understand the lesson better and felt more connected with the people of the time periods. A few students commented on how boring westward expansion could be, but this made it fun. One student highlighted the independence he felt. He could look at what he wanted for however long he desired.

All students agreed that virtual reality was significantly more fun than using only a textbook. Students believed that the increased enjoyment came from their involvement with the learning, the reduced time teachers spent lecturing, and the captivating way that the material was presented. One student favorably compared virtual reality to the traditional text book and believes there is no comparison between photographs and virtual reality. She specifically spoke to the virtual field trip to the Eiffel Tower. Another student was surprised to find his peers talking about social studies class in lunch and after

school. He said that social studies had never been a topic after school because it was usually boring. His friends were excited to discuss the virtual reality scenes and tell students who had not had class yet, what they were going to see. Another student, said that she felt that virtual reality had really helped her because she has a great deal of difficulty reading. She truly enjoyed the decreased emphasis on the textbook and the opportunity to learn visually. One female student summed it up when she offered, "It's virtual reality! What's not to like?"

Critical feedback. Not all of the feedback was positive. Other students noted that a couple of the virtual field trips seemed to have little to do with what they were studying. Students wished that there were more relevant virtual reality field trip opportunities. One student was not pleased that she had to sit in her chair throughout the experience. When discussing the safety that walking around the room without the ability to see, she suggested that using swivel chairs would have made it easier instead of traditional desk chairs. Eight students did not offer any negatives even when previous students concerns were offered. They said they enjoyed every aspect and thought it was a great way to learn,

Medical. Overall, there were very few medical issues and the ones that did occur were minor and easily ameliorated. Three students said that they had experienced eye strain or dizziness. All three of these students recounted that opening the goggles and watching on the phone eliminated the problem. The fourth student to be interviewed, who is prone to migraines and motion sickness, mentioned that she had experienced dizziness on occasion. The tenth student interviewed, was prone to migraines, and virtual reality exacerbated her medical condition the first time. When asked if there were any

modifications, she said yes. She said the teacher had her open the goggles and watch the phone inside and that solved the issue.

Technology. While students were typically unfamiliar with virtual reality, they are generally, exceptionally knowledgeable about technology and what it can do. While students enjoyed virtual reality, they were honest about a lot of areas of potential growth and improvement. Seven students highlighted some form of technical issue they encountered including batteries dying, freezing, and trouble connecting to virtual field trips. Seventeen students wished that the environments were more interactive. They did not like being passive in the environment and wanted to engage with their surroundings. Six mentioned that they would have enjoyed engaging with their peers in the virtual world to explore together. Six students discussed technological issues such as rebooting, trouble connecting, or batteries that would die in the middle of class.

Developing pedagogy. While students are not always attuned to teaching pedagogy, they know when a lesson interests them. Nine students commented about how much they had enjoyed the station-based learning when they were allowed to work in groups. They felt that this was a far more engaging way to learn as opposed to whole group instruction. They also said they got more teacher attention than normal because it was four-five of them in a group instead of twenty-five students in the whole class.

Expanding virtual reality in high schools. They were asked what other subjects they would like to learn using virtual reality. Students seemed stumped by this question. Six immediately said that they could not think of another subject matter that would be appropriate. When suggestions were given based upon the virtual field trips already offered, students were quick to change their mind and offer other subjects. Their initial

negative response seemed to be based more on a lack of understanding of what other options there may be rather than a lack of interest in using virtual reality in other subject matters. All twenty-five students believed that social studies was a great fit and that virtual reality should be used in all three required history courses as well as some of the electives including advanced placement classes. The second most relevant curriculum was in the science department. Fourteen students believed that biology, anatomy, physics, meteorology, and earth and environmental science would be appropriate. English was the only other class identified by three students. Students could not see a natural fit in the arts, physical education, or math.

An additional question was asked of four students who were taking this course for the second time because they had failed it during their freshman year. These students were asked to discuss the differences they experienced between the two years even though it was the same course with the same teachers. All four of these students passed the course the second time and credited virtual reality with having a tremendous impact on their ability to focus. In fact, one student's grade improved by twenty-nine points from his first attempt to the second. All four students spoke directly to class being more fun and information being easier to remember. One student's grade improved by twenty-nine points from his first time to the second.

Teacher interviews. All four teachers associated with this action research study participated in an interview at the end of the school year. As mentioned before, one teacher is a special education teacher, two are non-tenured, and one is tenured. All interviews took place in my office where I would occasionally meet with this group for

PLC's and planning purposes. Teachers were asked a series of ten questions. Follow up questions were added as necessary.

Question 1: Please describe your overall feelings about teaching with virtual reality.

Question 2: How did students feel about using virtual reality and did they believe virtual reality impacted students' motivation and achievement.

Question 3: What challenges did you encounter using virtual reality?

Question 4: How effective was the professional development that you received and what additional professional development would be useful?

Question 5: What changes have you made to your pedagogy because of the implementation of virtual reality?

Question 6: Are you looking forward to using virtual reality again in the future?

Question 7: What were the benefits of working in a PLC as you learned about virtual reality?

Question 8: How have your assessment strategies changed?

Question 9: What medical issues did students encounter?

Question 10: How did virtual reality impact student discipline and time on task?

Teacher experience. The fear of implementing a new technology that could cause logistical issues weighed on their minds. The teachers have all been subject to teaching classes in the past that were interrupted because of internet issues. All four teachers expressed both excitement and trepidation at the beginning. Dan expressed his enthusiasm for adding virtual reality. He believed the course had become monotonous as he has taught the same material in the same manner for seven years and was excited for something new. Three of the teachers immediately had to address issues with the

technology. Trying to connect 25 pairs of goggles to a tablet seemed to cause the most trepidation. Dan remembered his first time trying to download a virtual field trip only to be met with a system's update that caused students to sit and wait. Anna related a story about reconnecting the ethernet cable and hoping the goggles would connect. Teachers felt helpless and a bit embarrassed as they struggled through. All four teachers said that the technological issues were minimal after the first attempt. Occasionally, goggles would fail to connect, but they had grown in their confidence to troubleshoot.

After their initial implementation, teachers were asked how they felt about using virtual reality again in the future. All four teachers had the opportunity to opt out of using it for the next school year if they wanted to switch social studies topics. Each teacher expressed an interest in continuing with the U.S. I curriculum and refining their practices with the virtual reality. Although interviews were done separately, each teacher's initial response echoed the same sentiment that they were very excited to use Google Expedition again. Alice equated it to difficulties you would have as a first-year teacher. She believes that, because it was new, planning took a lot more time, but that it will be easier in the upcoming semester and next year. Anna relished the opportunity to use it again and was hoping that each semester allowed for more expeditions to be added to the menu. She reflected back on some of the virtual field trips and lamented that some did not match the curriculum as well as she had hoped. She planned to explore what new offerings are available and make the necessary changes, but overall, she was very happy to have it as a tool. Alan was disappointed that he is only able to use virtual reality in his United State I class because he believes that it has merit in the other classes that he is teaching: Model Congress and Law.

Student motivation. Before implementation, teachers believed that students would be excited to use virtual reality. The assertion was grounded in the belief that technology is a natural part of teenagers' lives. They have grown up in the digital age and rely on technology to accomplish many of their daily tasks. Two of the teachers spoke to schools being antiquated compared to the rest of students' lives. Teachers believed this could be the cause of the boredom students experience.

As virtual reality was introduced and implemented, the teachers admitted to nervously awaiting students' response. All four teachers said they immediately saw an excitement in their students that they had never seen before. Alice heard students talking about "how cool it was" and excitedly sharing what they were seeing. Anna remarked about how even students who tend to be quieter came out of their shell and were eagerly sharing their experiences. Dan said that students were anxious to continue on their virtual field trips. To accentuate this point, two of the teachers spoke about students walking by their room before class and looking to see if the goggles were set up for their class. When they saw the glasses on the desk, they high-fived Anna. Three of the teachers wondered aloud if the momentum would last. They discussed whether or not the novelty of virtual reality would wear off or students' motivation would be diluted if multiple subject areas used virtual reality to learn.

Determining whether or not increased enthusiasm would lead to improved performance and motivation is at the crux of this topic. While the quantitative data will provide great insight into this discussion, it may paint only half of the picture. As teachers focused on the achievement aspect of this question, they focused on students' ability to remember and make connections. Alice specifically focused on the special

education population. She believes that many of her students are visual learners. She suggested that memorizing dates and names may prove to be difficult for students with a specific learning disability, but allowing students to use a multisensory approach could create a more level playing field. Academically, they have been able to master skills faster because they get to live it and experience it. Alan believes that teenagers are more likely to equate technology with fun and therefore didn't even realize they were learning while engaged with virtual reality. He believed that "responses to questions come faster and easier for my students now" (Brownridge, 2018)

Impact on pedagogy. The bigger issue all four teachers faced was updating their pedagogy to incorporate virtual reality as a positive resource. Teachers expressed their lack of certainty as to what the impact on pedagogy would be. They knew this would change the way they were conducting class, but they were not sure to what extent. Most of the teachers acknowledged that their traditional teaching pedagogy entailed a great deal of lecturing, whole class instruction, with some occasional partner work sprinkled into periods. After initial implementation, teachers realized the need to update their teaching strategies and questioning technique. Questions that asked for fact-based regurgitation were too easy and needed to be rewritten. Teachers felt unsure of their role, what the proper questioning technique was, and how to assess students in a meaningful way. All four teachers relied on the questions provided by Google, but all soon realized the questions were not age appropriate or rigorous. Rewriting questions on a deeper level and referring back to my Bloom's Taxonomy chart was crucial offered Alan. Three teachers spoke to how eerie it was for them to not be the center of the class. Figuring out the best ways to teach and go about it without kids looking at you was hard, but turning

to station-based learning was huge. Redefining their roles became an integral process. Anna remembered her first time lecturing with the goggles. She said that it did not take long for her to realize that the students were not paying any attention to what she was saying because they were too engrossed in the expedition. Alice summed it up by saying "the whole class instruction felt robotic. I did not have as much to do so I had to reexamine my role and my pedagogy and changed to the small group stations. I learned to be a facilitator."

Dan noticed that virtual reality students had the ability to self-learn. He noted, that "students were less reliant on me and could find information simply by looking around. This made me redefine my role and alter my strategies." Dan, Alice, and Anna all focused on creating station-based learning that allowed for remediation and small group instruction. Dan found this methodology beneficial for remediation and allowed for significantly greater teacher-student engagement. Anna realized that students clamored for the small group approach. She said that after the first time they did stations, students approached her and asked if they could do that again. Anna noted that this was the first time in her short teaching career that students had requested learning activities. Alan agreed that students were more engaged, but he did note that there are new challenges with stations. Specifically, he acknowledged that planning for several different stations can be more challenging. He also believes that this pedagogy can lead to more discipline issues because students are given more independence.

Once teachers developed station-based learning with groups working on primary source documents, essential questions, teacher led discussion, and virtual reality, they were able to redefine their positions in the classroom. All four teachers spoke to the

increased interaction with students and the ability to personalize instruction as they created either heterogeneous or homogenous groups. The other pedagogical change related to questioning technique. All four teachers compared their original questions with the ones they are using now. Alice realized quickly that her questioning technique had to improve because she went from questioning to "questioning well with higher order questions that focused on thinking, evaluating, and analyzing." Dan understood that it would be foolhardy to create an engaging classroom and ask mundane questions. He focused on matching his questioning technique with the new opportunities afforded to students. He also liked the ability to ask different levels of questions to different groups. These differentiated instructional and assessment strategies made a difference for varying learners. Alan enjoyed the opportunity to engage almost every student through the small groups instead of calling on one or two students in the entire class. He believed this gave him greater insight into topics that students may need remediation.

Assessment and questioning technique. With the monumental change to instruction, assessments strategies naturally had to be altered. Anna believed that virtual reality could almost act as a formative assessment. She said that as she questioned students about what they were seeing and why it was important, she could assess whether or not a student was understanding the larger concepts and grasping enduring understandings. Anna and Alan agreed that their questioning technique had to be updated drastically. Anna started keeping a copy of Bloom's Taxonomy on her desk and referred to it in an attempt to start questions with higher-order thinking words. Questions were now more likely to start with words such as: analyze, interpret or infer instead of who, what, and when. She believed these new strategies led to better answers from students.

Alan started to evaluate what was truly important for students to know. He removed some material from his instruction because he realized it was not important or students could see it in virtual reality and there was no reason to ask about it. Alice emphasized the process that the teachers were undertaking to update assessments. She suggested that the PLC is still learning and evaluating the best methods of assessment and tests are slowly changing as the teachers get comfortable with new evaluation strategies.

Professional development needs. For all of the educational initiatives undertaken by Google, they lack an education department that can support teachers and provide professional development. All of the professional development that teachers received was created in-house by the school nurse, IT, the PLC, or myself. Professional development included a day with I.T. to understand the technical aspects, a session with the nurse who educated teachers on cybersickness, concussions, and other medical concerns, time spent as a PLC to address pedagogy and assessment strategies, a faculty meeting that the teachers ran to introduce virtual reality to their peers, and training from me on virtual reality.

Anna credited the time spent with technology as being the most useful. She believes that this training instilled the confidence in her that she could address any logistical concerns that she faced while twenty-five students watched her. She also enjoyed training teachers from other departments. She reflected how isolated members of different departments can be from each other and relished the opportunity to work with all departments. She has now had members of other departments come to her with questions and she has been able to make suggestions about how they may be able to institute virtual field trips into their curriculum. Alice preferred the time spent with the

nurse. Being super vigilant about any medical concerns her special needs students may face caused her to hyper-focus on the issues addressed by the nurse. Dan and Alan both spoke to how great an impact the PLC had on their ability to lead the classroom in a meaningful way and try new ideas. Not only did the PLC improve teaching and learning, but Alan believes it helped bring the teachers together and created a team mentality to teaching. He felt that he was very fortunate to work in this capacity and felt incredibly supported by his colleagues.

While the training was well-received, teachers did address future offerings they would like to explore. All four spoke directly to strengthening their pedagogy and expanding upon the station-based teaching concept. Alan asserted that the work the PLC has done has driven instruction a long way, but still has tremendous room for growth. He is hoping to find professional development on best practices that can incorporate virtual reality. Alice is going to pursue training on assessment and questioning strategies that could be associated with virtual reality. She pined that "creating higher order thinking questions was a great start, but I don't currently have any assessment tools that make direct use of virtual reality" (Brownridge, 2018).

Benefits of a PLC. Dan believed that it was imperative to work with people who were going through the same trials and tribulations that he was experiencing. He was especially happy that his in-class-resource teacher was a member of the PLC. He truly felt that students benefited from their collegial and collaborative approach. Anna thought that working together helped her with the virtual reality implementation, but also with her overall, developing teaching skills. Anna offered that she had some great ideas and a strong grasp of the concept, but other members of the PLC had a more creative approach

and she was able to reflect on their input and make meaningful changes to her pedagogy. Alice noted that the changes to her questioning technique and ability to teach the material seem to have improved because of the work completed in the PLC and she was "very proud of her growth." Alan noted that his reflections after working with his colleagues altered his perspective on teaching. He became more reflective about what the students really need to know, how to make them connect with the material, and how to offer opportunities that allow students to take different perspectives than their own. Each credited the group with their growth and understanding of virtual reality, but also with their advancement as a professional.

Medical issues. With this topic, teachers had slightly different experiences. Dan and Alice reported almost no issues with students. Dan reported eye strain in only 2 of his 100 students and Alice only had an issue with 2 of her special education students. They had no reported incidents of cyber sickness or headaches. Alan and Anna reported fourteen students complained of eye strain, cyber sickness, or headaches. All four teachers believed that the precipitating factor was whether or not a student wore glasses. Every medical concern was from a student who was currently wearing glasses. Teachers hypothesized that the goggles did not cause eye strain, but it did identify it. Alan and Anna noted a tremendous decrease in complaints when they switched to station-based learning because students were only using virtual reality for 15 minutes at a time. All four teachers simply asked students to open the goggles and watch the phones inside when they complained of any issues. This alleviated any medical issues that students were having. Alice did not experience any additional medical issues with her special education population. She did have to come up with a strategy to alert a deaf student

when it was time to put the goggles down. Alice also noted that one of her students who is diagnosed with high anxiety was much calmer on days they were using virtual reality. This student did not have to leave the classroom and take a walk when virtual reality was a resource for the day. Alice believes it was because using the goggles removed the student from the classroom and gave her an escape from the other people in the room. An interesting experiment conducted by Anna and Dan entailed them warning students during the first semester about the potential cybersickness and eye strain issues and not mentioning it to students during the second semester. They found no differences in the number of students affected.

Student discipline. Students are less likely to lash out or get in trouble when they are enthusiastic, active-learners and wish to remain in class. The hope was that with the use of virtual reality, students would be reenergized about the curriculum and discipline issues would decrease. At the end of the school year, Power School was evaluated to assess how many discipline issues these four teachers had incurred throughout the year. To our surprise, none of the four teachers had written a single disciplinary referral during the first semester. Anna noted that while discipline has been outstanding this year, she does have to constantly remind students not to call out or talk to their friends while engaged with virtual reality. She believes that students got so excited about what they are seeing; they automatically wanted to share it with their friends. Alice was quick to acknowledge that there was a huge discrepancy in her special education classes between how many students left class on days with or without virtual reality. Dan also noted that fewer students left his room when using virtual reality. He joked that students "apparently forgot they had to go to the bathroom on virtual reality

days." Anna believed that students were so worried about missing scenes in virtual reality, they did not want to leave the classroom at all. She credits the Google Expedition trips for keeping interest and engaging students. Alan noted that students had been great this semester, but they were more likely to want to walk around the room while engaged with virtual reality. He worried about the safety of walking around when students could not see. He found himself constantly reminding students to sit down.

Evaluating the next course of action. Evaluating the next course of action when working with technology can be exceptionally challenging. It is hard to anticipate the technological advances and associated cost. It is entirely possible that the virtual reality available to schools will look completely different, offer significantly more interaction, and be appropriate in far more settings. Google expedition, and virtual reality as a whole, still offers far greater promise and opportunities

The overall results and experiences with virtual reality were exceptionally positive.

On March 20th the four teachers who were given the opportunity to use virtual reality and receive training in various aspects of its implementation were asked to conduct professional development for the entire high school staff. This was done to assist in determining what the next steps should be and if virtual reality was generalizable to other subject areas. Teachers from mathematics, special education, science, English, and business eagerly entered the classrooms and participated in the session. Teachers from the visual and performing arts and the physical education departments were not invited. Art teachers had a seminar they were required to attend and physical education did not seem like an appropriate setting for Google Expedition at this time. The PLC teachers

had downloaded virtual field trips relevant to the subject matter of the teachers assigned to their rooms except for the math teachers. Amanda and Alan were unable to identify appropriate field trips for math. Math teachers were instead, exposed to a virtual college tour and a virtual atom since they were partnered with the science department. Science teachers explored an atom, world language teachers were exposed to countries related to the languages they teach, business teachers were shown varying industrial locations and business leaders, and English teachers explored locations associated with Shakespeare. Special education teachers followed along with the subject matter they support.

When the presentation was over, the participating teachers asked a series of questions including, "What medical issues are associated with the use of these goggles," "what about motion sickness," "are there any virtual field trips for math," what special education modifications can we incorporate," "can we tell which student is looking at what aspects of the picture," "when can we play with these and see if they are appropriate for our classes," and "are we going to be purchasing more labs for the rest of the departments." One of the special education teachers found some virtual field trips that could be used for the multiple disabled students. She believed that these students could benefit from the exposure to social situations that normally may prove to be either challenging, dangerous, or socially awkward. By allowing them to enter stores, restaurants, museums, and other public locations, social norms could be discussed in the safety of the classroom.

Conclusion

No one could have anticipated the impact that virtual reality would have on every aspect of teaching and instruction. Student's academic scores improved in every

conceivable manner for every subgroup. Teachers did not experience any discipline issues and students' motivation appears to have been significantly increased. Virtual reality freed teachers from having to perform in front of class and instead gave them flexibility to facilitate learning. Teachers refined their pedagogy to create more active, student-centered learning environments. Medical issues were minimal and easily resolved. Overall, the addition of virtual reality was an overwhelming success for everyone involved.

Chapter 5

Discussion, Summary, Conclusion

Virtual reality can be a dynamic tool in high school U.S. History I classrooms. It is interactive, engaging, and inspires alternative approaches to the traditional lecture format which currently dominates many History classroom settings. Allowing students to engage with the virtual images, virtually placing them in the historic, physical setting offers them the opportunity to fully engage with the event and environment about which they are studying. For any school district, questions surrounding virtual reality are many when considering what role it will play in formal education. School administrators have a lot to consider when deciding whether or not to pursue the addition of virtual reality into their classrooms. Several important questions must be considered, such as: (1) At what age is it safe to expose children to virtual reality and for how long? (2) Is virtual reality an effective learning tool? and (3) Can schools afford to keep up with the developing technology? The answers to most of these questions will depend on the individual district, teachers, and medical considerations.

Through this action research study, virtual reality was determined to be a valuable asset in the U.S. History I classes. Integrating virtual reality increased student participation in the learning environment by decreasing both the time students spent out of the classroom and disciplinary issues in the classroom. Likewise, it encouraged teachers to improve their questioning techniques and prompted the integration of station-based learning. Thus, teachers found ways to improve the delivery of the content to make it more interactive for students, and students responded by staying engaged in class. Both students and teachers have provided invaluable insight into the impact that virtual reality

has played in its first year in the United States History I classrooms. Further investigation will continue as future classes embark on this path, additional field trips become available, and the technology improves. As more and more districts make the investment into virtual reality, more qualitative and quantitative data will be available for a more thorough analysis.

Discussion of Findings

Impact on students. To examine engagement, an EPass program was used to evaluate how much time students spent outside of class and how many discipline infractions occurred in the freshman social studies classes compared to every other curriculum-based class. With the ability to collect data through PowerSchool and EPass that charts how many minutes students spend outside of the classroom and how many students incurred disciplinary referrals, we can evaluate the noticeable differences in these United States History I Classes compared to other classes. Although it is a relatively small sample size when compared to the total population of high school students at Harmony High, the subset of U.S. History I students chosen for this study actually provided substantial information that can be used to make inferences about the effectiveness of Virtual Reality on student engagement. Every ninth grade student entering high school, as well as some students required to repeat the course, experienced learning the U.S. History I content with the addition of virtual reality. These students expressed much more enthusiasm for History class, especially on days when virtual reality would be used as part of instruction. Celebratory gestures, such as high-fives, and statements about virtual reality being the reason for coming to class that day, were observed by the teachers. Additionally, the use of an alternative learning approach, such

as station-based learning, which incorporated virtual reality as regular part of the classroom pedagogy, provided a way to keep students engaged with the content, often allowing collaboration between peers and with the teachers.

Therefore, this action research study has given a clear indication that virtual reality can serve as a motivator for high school students. It provides a way for students to take part in the construction of their own learning. It provides experiences in which students can actively take in a historical setting or analyze historical artifacts. It changes the role of the teacher as the presenter of knowledge to the facilitator of constructed learning. Finally, it allows students to understand how they learn best when presented with new information in a variety of engaging ways.

Time spent out of class. Through the analysis of quantitative data collected through the EPass system I was able to ascertain that students spent almost fifty percent less time out of the U.S. History I classroom when compared to the rest of their classes. This indicates that students engaged in using virtual reality in their History class preferred to stay in class and participate in the learning activities; conversely, in classes not offering virtual reality as a learning tool, students left the classroom more frequently. Students enrolled in United States History I spent an average of about six minutes outside of the classroom during that class period. This was in stark contrast to the eleven or more minutes, on average, these same students spent outside of the rest of their classes. While I acknowledge that there are several factors that could result in a student leaving the classroom, boredom is clearly one of them. It appears that virtual reality has created a more dynamic classroom resulting in students spending less time out of the classroom.

Discipline. Furthermore, for the 2018-2019 school year, it was remarkable to note that an analysis of Power School indicated that the slightly over 300 students enrolled in the United States History I course this year did not encounter a discipline infraction throughout the entire year while in history class. As documented in chapter four, based on the analysis of discipline issues occurring during a school day and based on the percentage of students enrolled in the U.S. History I classes, these students should have incurred approximately thirty discipline infractions and two suspensions. The fact that these students received neither consequence for behavioral issues stands in stark contrast to the number of discipline issues encountered by these same students throughout the rest of their high school schedules. Again, there are many factors that could impact these outcomes, such as student interest in the content, rapport with a particular teacher, and students' understanding of concepts being taught. However, it is fair to assume that students engaged in virtual reality were less likely to want to leave class for the bathroom or act in a manner that would exclude them from the activities. With an additional amount of time to instruct students, it is easy to surmise that students will retain more information and perform better on assessments.

Student performance. Finally, and perhaps most importantly, is how students responded to virtual reality academically. For a tool to be a worthwhile investment for a school, it must improve learning outcomes. As evidenced from the grades entered by the four teachers in Power School, students' grades in the 2018-2019 year were outstanding and far exceeded their 2017-2018 cohort. As all of the quantitative data was examined, it is fair to state that virtual reality played a pivotal role in increasing the comprehension, engagement, and performance of a large percentage of the students involved with this

action research study. The most significant increase was seen with freshmen boys whose overall scores improved by over 6% from the preceding class. Freshmen girls also saw their overall scores grow by 3.5% while students from various sub-cultures and special education students saw similar gains. Overall, the freshmen class enjoyed an almost 5% improvement on grades. These are tremendous gains to realize in one academic year. Teachers have few, if any, resources currently at their disposal that can positively influence the learning environment like virtual reality did. As teachers continue to refine their pedagogy as it relates to virtual reality and virtual reality grows as an academic tool, students could perceivably continue to grow and maintain these gains in a multitude of subjects.

Impact on Pedagogy

Student growth and motivation were not the only educational factors to see growth and development due to virtual reality. One of the biggest changes was realized by the teachers. No longer the focal point in the room, teachers were freed from their traditional role and given the freedom to roam around the classroom, engage students, create stations, and develop higher-order thinking questions. Station based learning became the norm as teachers could separate students either heterogeneously or homogeneously and allow for exploration in a multitude of student-centered activities. Since one group of students was captivated by virtual reality and challenged through the essential questions developed by teachers, other students could receive small group instruction tailored to their specific needs and questions. As students were entrusted with ownership of their own instruction, a positive classroom environment emerged as students eagerly engaged with the content and collaboration with one another and the

teacher. Giving up control and trusting students to stay on task and work collaboratively appeared to be the biggest challenge for teachers who were accustomed to being the center of students' attention. Once roles and expectations were set, teachers focused on asking higher order thinking questions, allowing students to move beyond simply recalling the material towards analysis, making connections, and applying information to previous as well as new learning. Teachers were able to assess each individual student's comprehension by creating meaningful activities that allowed students to explore what they were learning. Finally, teachers could facilitate thinking and problem solving through inquiry and discussion instead of relying on lecturing and note taking. Teachers focused more of their time on understanding their students than they did on making sure their students understood their power points. This was an important step because it helped teachers improve pedagogy to make learning both interesting and valuable for their students. For virtual reality to truly influence learning, teachers must be comfortable in this new role or limited change will be evident. Teachers must accept their roles as facilitators of learning and not disseminators of information. Developing higher-order, essential questions and being creative with both formative and summative assessments is now significantly more important than continuing their role as the "sage on the stage."

Medical Concerns

As discussed at length in every chapter in this action research dissertation, there is no greater responsibility that school administrators have than to protect the students entrusted to them. This point is emphasized in the ISLLC standards and the New Jersey Department of Education. Every board of education in New Jersey has included

somewhere in the district policies the need for students to be provided a safe and appropriate learning environment. Including educational resources in the classroom that pose an exceptional risk, even if the academic results are positive, is not acceptable. Assessing the danger that virtual reality poses to students was a critical aspect of this research.

Virtual reality, in its various forms, has been known to cause cyber sickness and eye strain in some people. Manufacturers of virtual reality hardware do not recommend prolonged use for children. This seems to be an appropriately cautious approach as there has been limited research determining what age should use virtual reality. There is also little known about the impact virtual reality will have on students with disabilities. Conducting this action research study in a public high school has given valuable insight as to whether or not virtual reality is safe to use in instructional environments, what is the appropriate amount of time to for use, and what accommodations are possible when a student encounters medical issues.

This study exposed 311 freshmen to virtual reality in their United States History I class. These students were between the ages of 13-15 years old and varied in race, gender, and medical history. Data was collected on any medical complications experienced using virtual reality through the interviews conducted with the twenty-five students chosen and the four teachers, through the surveys submitted by 296 respondents from the (how many?) classes, and my field notes developed over the course of approximately sixty observation periods. Throughout the duration of the study, nine different students experienced eye strain at a very minor level and one student complained of a low level of cyber sickness. This equates to roughly three percent of

students having medical issues. When this occurs, students need to be provided with alternatives, such as opening the goggles or using the teacher's tablet, so they can still participate in the learning activity without experiencing the adverse effects.

What is reassuring about the medical concerns is that none of the complaints required treatment by the school nurse or were followed up on by parents with their own physicians. Once students removed the goggles, the eye strain dissipated almost immediately. It is important and interesting to note that the nine students who experienced eye strain also wore glasses. Many chose to remove them when they used the Google Expedition goggles. It appears that the eye strain that students experienced were, at least in part, due to previously eye sight issues. There is no evidence as of yet that Google Expedition negatively affected any students who had not been previously recommended for glasses. The percentage of students experiencing eye strain through the use of virtual reality is only slightly higher than the percentage of students who experience eye strain from reading for extended periods of time or through traditional computer usage ("Eye Strain," 2019). There are two main reasons believed to be important factors in relation to the low levels of medical issues associated with this study. First, the length of daily exposure was significantly limited. Students rarely used the Google Expedition goggles for more than 15 minutes consecutively. Limiting the amount of time appears to be pivotal, not only for health reasons, but also for appropriate chunking of the class period. While I believe there is no definitive number of minutes that all students can use virtual reality before experiencing medical issues, most seem to respond well to a fifteen minute maximum. The second important factor appears to be that the goggles were not strapped to the students' heads. As students became physically

uncomfortable, or wanted to take a break, they could simply put the goggles down for a moment. Teachers did not force students to put them back on or to complete a scene before removing them. The understanding and flexibility of the teachers was paramount to student safety.

For students with other medical issues such as concussions, teachers were able to modify their instructional practices quickly, without losing the virtual reality experience. The most common modification was to open the goggles and to allow students to look directly at the phone inside. This strategy alleviated most of the issues because the extended distance from the images seemed to offer the necessary support. One student, who was still uncomfortable looking directly at the phone was allowed to use the teacher's tablet. The larger screen, farther from the student's eyes, was an acceptable modification. Only one additional modification became necessary and that was for a deaf student. Since teachers could no longer regain her attention through visual cues, it became necessary for them to tap her on the shoulder when it was time to focus on a different activity.

An interesting subgroup in this research was special education students. How students with anxiety, autism and other disabilities would respond to virtual reality was unknown. There are fifty-six students with individualized educational plans (IEP) in the freshmen class. None of these students experienced any medical issues through the use of virtual reality. While there were some additional challenges, such as (?) and more proactive steps necessary to prepare students for the experience, it appears that special education students responded exceptionally well. Students with ADHD reported being able to focus longer on the images because they found the stimuli to be appealing and

engaging. This focused their attention for a longer period of time. A student with school anxiety and school phobia lauded virtual reality for allowing her to feel alone and escape the pressures of the classroom. She found it easier to attend school on days when virtual reality was implemented. The special education teacher associated with this study confirmed the students' assertions by reporting that the student engaged in fewer off-task behaviors and more exhibited more engagement through the learning strategies associated with virtual reality.

Social Justice Promise

Far too many students, especially in underserved groups and communities, lack robust access to the core elements of a quality education (DOE, 2019). That includes free, quality preschool; high school, challenging standards and engaging teaching and leadership in a safe, supportive, and well-resourced school; and an affordable, high-quality college degree. The challenge of ensuring educational equity is formidable. We know that when traditionally underserved students, including minorities and low-income students are denied a strong foundation in education they are far less likely to attend and complete college than their peers (DOE, 2019). These families rely on school field trips to provide culture and experiences that are otherwise inaccessible.

The school field trip has a long history in American public education (Greene, Kisida, & Bowen, 2014). For decades, students have piled into yellow buses to visit a variety of cultural institutions, including art, natural history, and science museums, as well as theaters, zoos, historical sites, and colleges. Greene, Kisida, and Bowen (2014) believe that schools gladly "endured the expense and disruption of providing field trips because they saw these experiences as central to their educational mission: schools exist

not only to provide economically useful skills in numeracy and literacy, but also to produce civilized young men and women who would appreciate the arts and culture." More-advantaged families may take their children to these cultural institutions outside of school hours, but less-advantaged students are less likely to have these experiences if schools do not provide them. With field trips, public schools viewed themselves as the great equalizer in terms of access to our cultural heritage. Disadvantaged students needed their schools to take them on enriching field trips if they are likely to have these experiences at all. Furthermore, disadvantaged students may not have the ability to tour colleges or even have an understanding of what college-life is like.

It is understandable, yet unacceptable that schools, especially in urban areas, that struggle to adequately pay teachers and to provide even the most basic learning tools, are not able to provide non-critical experiences such as field trips. Even schools with the money to pay for a few field trips a year may not be in a geographical area that lends itself to enriching locations. Solutions instead of excuses to this problem are necessary. Finding creative alternatives that allow for submersion and exposure to various cultures is pivotal. Virtual reality can provide the necessary technology to combat the inequity that exists. If manufacturers are willing to work with low-income districts or grants become available, virtual reality could allow low-income students to have impactful experiences from around the world and visit colleges from the comfort of their own high schools. These educational experiences are crucial to leveling the playing field and are becoming increasingly possible. Suddenly, visiting museums, exploring natural wonders, viewing historical figures, and seeing sights from the rest of the world become real possibilities. All children, regardless of race, ethnicity, or socioeconomic status suddenly have an

opportunity to develop socially and understand the world, experience different cultures, and dream.

Limitations to Virtual Reality

Virtual reality's foray into education is in its infancy. The technology necessary to be an effective tool is emerging. What we have available now is essentially the "black and white television" of the virtual reality world. Pictures are pixelated, opportunities to explore scenes are minimal, batteries overheat and die quickly, and the number of quality, educational, field trips that are available is relatively small. The cost associated with virtual reality is also a contributing factor to the limited number of schools that have explored the possibilities that virtual reality offers. This concern is understandable as each set purchased to conduct this study was close to $10,000. Additionally, virtual reality is somewhat isolating. Students are separated from their peers and isolated in a new location. While this may have appeal for some, it is not ideal for many high school students who thrive on the socialization that high school offers. Students enjoy engaging with one another through group work, collaboration, and discussion; therefore, teachers, like those in this study, may need to find ways to incorporate virtual reality as part of an instructional activity rather than relying on virtual reality to carry the activity.

For virtual reality to succeed in schools, the aforementioned technological issues have to be addressed. Teachers need to feel comfortable that virtual reality batteries will last for the entire school day before they will feel comfortable adding goggles to every day instruction. The picture quality and interactive features, including opportunities for students in the same classes to work together, must be improved otherwise students will tire of the isolation and the novelty of virtual reality will fade. Higher quality field trips

that capture the imagination of students must continue to be developed. Along with their development, stronger search engines that allow teachers to find suitable material for their classes must be developed.

Making it even harder to incorporate virtual reality is the lack of educational support offered by tech companies and a lack of research as to whether or not virtual reality is a wise investment for a school. Deciding where virtual reality fits into curriculum is also complicated. Few school administrators have the technological background to make strong assertions in this area and even fewer technology companies have the educational experience to make informed suggestions. For full virtual reality immersion into school districts, professional development will have to be offered by the companies selling it. Teachers and administrators lack the time and resources to purchase technology and then figure out how to use it as they go.

Determining what curricula are best suited for virtual reality and how to expand its presence throughout the required courses is an exciting look at what is or will be possible in the future. As stated before, social studies is the least popular subject for high school students. Students find the materials boring, unrelatable, and unnecessary to their preparation for college or careers. Finding an innovative tool to create excitement for this subject could play a crucial role in developing civic-minded students. Every student and teacher interviewed and every student surveyed for this study believed that social studies was an ideal fit for virtual reality.

While the topics span the globe and every era of history, schools have traditionally lacked the ability to create meaningful, real-life opportunities to expose students to situated learning opportunities in this content area. Through this study virtual

reality has exposed students to cultures, countries, and time periods that were previously impossible. Besides using virtual reality in social studies classes, science was the subject most requested by students during the survey and interview. Students saw a natural fit in earth sciences, anatomy, physics, biology, and meteorology. English was the only other subject mentioned by students as a possible fit.

The Future of Virtual Reality

As with any new technology, growth occurs rapidly and takes many shapes. New technologies are emerging making virtual reality possible in subjects other than social studies. The Tilt Brush is an amazing new resource that allows students to explore 3D art like never before. While the initial cost to schools is exorbitant, Tilt Brush does offer the continued savings on brushes, paints, clay, and canvases. It is also substantially cleaner than traditional art supplies. Finally, Tilt Brush does require a larger classroom space than would typically be needed for a high school art class. Another cutting-edge example is the Halolens 2 which offers amazing opportunities in architecture, medicine, engineering, and other careers. It is currently marketed to corporate America, but will undoubtedly be modified for high schools and colleges in the near future.

Many companies are exploring opportunities for virtual reality n physical fitness. While virtual reality cannot work out for someone, it can create a more stimulating environment in which to exercise. There are a few applications that allow for runners and bicycle riders to run on treadmills or stationary bikes, but see multiple locations from around the world. Virtual classes will soon be offered allowing people from around the world to attend yoga, aerobics, and other classes from the comfort of their own home. These resources would be ideal for physical education classes.

Besides incorporating virtual reality into the classroom, there are some innovative opportunities that could ameliorate a number of issues for both families and schools. Currently, the United States Department of Education, estimates that there are 1.5 million students being home schooled in this country (USDOE, 2019). Parents choose to home school their children because of medical concerns, religious beliefs, negative school environments, poor schools available to them, athletic commitments, relocation, and safety (Calvert Education, 2019). While these parents are well intentioned, it is impossible for them to have the expertise necessary to teach all of the courses offered by a traditional high school. Classes offered by schools or companies with certified teachers through virtual reality would allow students to learn complicated subjects from experts at predetermined times. Courses would still be guided by state standards. Parents would benefit from allowing experts to provide instruction in the safety of their home. In the same vein, thousands more students require home instruction for part of the academic year due to illness or other medical concerns. School district face challenges enticing teachers to go to student's homes to provide instruction. Teachers who are willing, often find scheduling with parents extremely difficult because of the policy that a parent must be home while the teacher is present. If teachers could provide home instruction through virtual reality, many of these issues would be extinguished and multiple students could be serviced at one time. Not only would this be efficient; it could save districts a substantial amount of money.

Finally, schools around the country are facing a substantial teacher shortage, especially in certain subject areas like physics, mandarin, chemistry, world language and math (NJDOE, 2019). One study found that at least thirty-six states are currently

struggling to fill teaching positions (Betancourt, 2018). The situation has become so dire in some areas that some states are turning to emergency or short-term licensure to put more teachers in the classroom.

Allowing students to learn virtually in large, supervised instructional areas could provide an answer to these shortages. Educational companies could employ top level teachers in these subjects and schedule classes for students throughout the day. This access could serve students across the country regardless of location or socio-economic status. Schools could establish virtual reality labs overseen by proctors to supervise behavior and provide basic support. Virtual reality labs are not handcuffed by the number of desks that can fit into a classroom, allowing for hundreds or even thousands of students to listen to lectures and partake in a community-based learning opportunity all at the same time.

Final Thoughts

At the beginning of this study, I had no idea what to expect with the addition of virtual reality to the social studies curriculum at Harmony High School. The technology is novel and rather unproven in an academic setting and I was cautiously optimistic that students would respond positively to learning United States History through virtual reality. Additionally, I was asking a lot from central administration as to the budgetary expense involved. There were many expectations resting on the success of this endeavor. Evaluating how much time and support was necessary from IT, how many medical issues would arise, and how students with special needs would respond were integral to my action research study. The results after the first year were outstanding in every facet. IT provided initial support through professional development and to run the ethernet, but

their support was not often required after initial installation and use. Minimal medical issues arose, and those that did were easily resolved through minor accommodations by the teachers. Special education students, on average, grew academically and enjoyed using virtual reality.

The most unexpected results were the necessary changes in pedagogy and formative assessment strategies. Virtual reality transformed the teacher's role from the deliverer of lectures and provider of information to facilitator of knowledge and evaluator of understanding. Teachers were able to increase rigor, spend more time with individual students, create meaningful stations, and offer an enriched learning environment. With such an improvement in the learning environment, students increased their participation in class and were enthusiastic, engaged, and involved in the creation of their own learning.

While the current technology is crude, opportunities are lacking, and a great deal of research and work are necessary to make this a useful tool for high schools around the world, this action research study demonstrated that the inclusion of virtual reality in a high school classroom has significant promise for student engagement and achievement. If better field trips are offered through a more comprehensive search engine, and opportunities to interact with the environments and with classmates are infused, virtual reality could evolve traditional classrooms into places of empathy, growth, and promise.

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Appendix A

United States History Course Evaluation

United States History Course Eval

Please submit feedback regarding the course you have just completed, including feedback on course structure, content, and instructor.

1. **How interesting were the topics discussed in this course?**
Mark only one oval per row.

	Poor	Fair	Satisfactory	Very good	Excellent
Row 1					

2. **How engaging were the resources used to teach? (texts, movies, Google Classroom, etc.)**
Mark only one oval per row.

	Poor	Fair	Satisfactory	Very good	Excellent
Row 1					

3. **How important will social studies be to your college or career plans?**
Mark only one oval per row.

	Very Important	Important	Neutral	Somewhat Important	Not Important
Row 1					

4. **Where does social studies rank in order of your favorite subject areas?**
Mark only one oval per row.

	Favorite Class	Second Favorite Class	Somewhere in the Middle	Near the Bottom	Least Favorite Class
Row 1					

Powered by Google Forms

Appendix B

Letter to Freshmen Parents

Attention Parents of Freshmen Students:

Every year, Burlington Township High School attempts to improve the educational opportunities afforded to our students. This includes new electives being offered, advanced training for our teachers, and innovative resources being made available. This year, we are pleased to announce an exciting new resource that has been added to the curriculum for all United States History I course. Two Google Expedition virtual reality labs will be utilized this year to allow all freshmen students to experience concepts in American history like never before. Google Expedition offers hundreds of virtual reality field trips encompassing almost every curriculum area taught in our school. We will only be piloting it in all our United States History 1 courses for the first year. Our teachers have received extensive training on how to infuse Google Expedition into the current curriculum. With any new technology there are concerns that arise and obstacles to overcome, but the potential is exciting. The biggest health concern is something called cyber sickness which is the equivalent to motion sickness. These risks are minimal, but we wanted to make you aware ahead of time and answer any questions you may have before the class begins. Special arrangements will be made for any students who have suffered a concussion or can otherwise not use Google Expedition Goggles. If you do not want your child to use Google Expedition, please let us know and accommodations will be made. We are looking forward to an exciting school year. Thank you for your time.

Appendix C

Google Expedition Standard Operating Procedure

Equipment included in Pelican Case:

- *Google phones within goggles (30)*
- *Asus tablet and power cord (1)*
- *Router and power cord (1)*
- *Sabrent USB fast chargers (3)*
- *Google phone chargers: USB cable & wall plugs (30)*

Passwords:

Phone PIN: 0000

Tablet PW: 0000

Packing & Storing:

Please pack everything in the Pelican Case as shown below to ensure the contents are stored properly and safely.

Phones are hooked into closed goggles (one phone per goggle) and placed in individual slots.

Router on the left, Sabrent USB fast chargers in the middle, and two boxes with 10 phone wall chargers in each.

Phone charging cords, Asus power cord, Sabrent charging cords, and router power cord on the left; Sabrent chargers in the middle, phone wall chargers in three boxes on the right, and Asus tablet in slot above the phone wall chargers in boxes.

Charging Equipment:

Prior to beginning an expedition, make sure the phones and tablet are fully charged.

Phones can be charged two ways.

1. Via USB cord to wall plug

2. Via USB cord to Sabrent USB fast charger stations

Charging stations will be helpful if you are using the phones all day and can be easily charged in between use. The tablet can be charged using the USB cord and wall plug.

Set Up Equipment

1. Plug in the power cable to the router and wall outlet. If power lights do not come on, press the on/off button next to the power plug.

2. A day or two prior to using the Google Expedition, please contact the Tech Department to review your room setup so we can designate a proper internet port for the router's ethernet cable. Plug in the ethernet cable into the blue INTERNET port on the back of the router.

3. Turn on the Google phones by pressing the power button at the top of the phone. If phones are inserted in the goggles, the power button will be on the upper right.

4. Phones should already be hooked into the googles. To insert a phone into goggles:

a. To open goggles, press the button down on the top center.

b. Turn phone horizontally so that the power button is at the top left and the screen is facing you.

c. Place the bottom edge of the phone in the two bottom hooks on the interior front flap.

d. Push these two hooks down to create space so that you can hook the top phone under the center top hook.

e. Close flap with phone attached to secure phone in goggles.

f. To remove a phone from the goggles, open the front flap. Press the bottom two hooks down to create space and remove the top from the top hook.

5. Turn on the tablet by pressing the small power button above the word ASUS. The tablet will be used by the teacher to guide through an expedition.

6. The phones and tablet will connect to the router and establish a connection with the EXP1 network. They all must be on this specific network.

Set Up an Expedition

Open the Expeditions app and pick a role:

- *Guide - Usually a teacher who leads an expedition on the tablet. In this role, the Guide chooses the expedition, focuses on scenes, and highlights points of interest.*
- *Explorer - Usually a student who follows an expedition on a phone. In this role, the Explorer loos at what the guide highlights as a point of interest or a scene.*

When going on a group expedition, only a Guide can lead an expedition. Explorers can't join a group expedition without a Guide.

Guide:

1. On the tablet, choose the EXPEDITIONS app.

2. If not already signed in to google, log in using the below account.

Username: username@school.edu

Password: gexpedition

3. Select LEAD to be a Guide.

(If you accidentally selected FOLLOW, at the top of the home screen tap EXPLORER to switch. The same can be done if a student accidentally selects LEAD.)

4. Find an Expedition:

a. Scroll - On the Expeditions homepage, scroll vertically to browse featured expeditions.

b. Search - On the Expeditions homepage, tap SEARCH and enter a subject or select one of the categories.

c. Spreadsheet - In a separate web browser, view the complete list of available expeditions, then return to the Expeditions app and search for that title.

https://docs.google.com/spreadsheets/d/1uwWvAzAiQDueKXkxvqF6rS84oae2AU7eD8bhxzJ9SdY/edit#gid=0

5. Download an Expedition:

Make sure the tablet is connected to the Internet in order to download expeditions.

a. On the tablet, open the Expeditions app.

b. Click Menu (three horizontal lines) and next to DOWNLOADED ONLY, confirm this setting is OFF.

c. Confirm that your role is set to GUIDE. If your role is set to Explorer, tap Explorer and change to Lead.

d. Find the expedition you want to explore and tap to download. After you download an expedition, in the bottom right corner you see a check mark, which indicates that the expedition downloaded and can be used offline. If you do not connect the tablet (guide device) to the Internet at least every 60 days, your downloaded expeditions are removed from your device. To prevent expeditions from disappearing:

a. Connect the tablet to the Internet at least every 60 days and pull down the expeditions list to refresh content.

b. Verify that the tablet has the correct date and time so content isn't prematurely removed.

6. Remove an Expedition:

a. Tap More (three vertical dots), select REMOVE DOWNLOAD, Select REMOVE.

b. Tap the checkmark, select REMOVE.

c. (iOS only): Tap Menu, select SETTINGS, select REMOVE DOWNLOADED EXPEDITIONS.

7. Lead an Expedition:

a. Once you have downloaded an expedition, tap anywhere on the expedition, then tap play.

b. Instruct Explorers to join the expedition. At the top right next to the people icon, you can see how many Explorers are connected.

c. Focus on a Scene

i. Play a Scene - After opening an expedition, scroll horizontally to pick a scene and tap play. Swipe up to review notes, questions, or other information.

ii. Pause a Scene to get Students' Attention - Anytime you pause a scene to ask a question or discuss it, Explorers' screens freeze and display the message "Paused by Teacher." The scene returns when you Play again. Tap Pause. Tap and hold a spot in a scene. Explorers will see an arrow directing them to that spot.

d. Highlight Points of Interest

Scenes have suggested points of interest (POI) such as objects in a scene you may want to discuss with Explorers.

i. Select a Point of Interest - You can find POI in the scene description. Tap the POI icon in the description and Explorers will see arrows to guide them to the item.

Create your own Point of Interest - Touch and hold on the area you want Explorers to view. Explorers will be directed to it with arrows on their screen.

ii. Remove your Point of Interest - Touch and hold the POI icon. The POI disappears and Explorers will not see arrows on their screens.

e. Draw on a Scene

You can draw on a scene to highlight any feature you want your Explorers to focus on.

i. Draw on a Scene - Tap Draw when you are viewing the area you wish to highlight for your Explorers. With your finger, draw on the screen and it is immediately visible to all your Explorers.

ii. Erase your Drawing - Either tap CLEAR or exit the scene.

iii. End Drawing Mode - Tap Draw. If you have not cleared your drawing it will remain in place for you and your Explorers to see until you leave the scene.

f. End an Expedition

i. Tap Close at the top of the screen next to the expedition title. Select LEAVE.

8. Go on an Expedition by Yourself:

a. Pick your Role either as a Guide or Explorer

Guides can use the solo mode to preview what their Explorers will see. You can access self-guided mode from any expedition. Explorers can use the self-guided mode to go on expeditions without waiting for a Guide to take them.

b. Open the Expeditions app.

c. Tap LEAD.

d. Open an Expedition.

e. Tap CARDBOARD.

f. Tap CONTINUE.

g. If not already done, place phone into the goggles and close.

Explorer:

1. Go on an Expedition as a Group:

a. Open the goggles to view phone and unlock using the phone PIN.

b. On the phone, tap the EXPEDITION app at the lower right.

c. Tap FOLLOW to be an Explorer.

d. Next to the expedition the Guide started, tap FOLLOW.

NOTE: If Explorer doesn't see FOLLOW, an expedition might not be started.

e. Close goggles with phone hooked in properly.

Move your head to look around.

1. Go on an Expedition by Yourself:

a. Pick your Role either as a Guide or Explorer.

Guides can use the solo mode to preview what their Explorers will see. You can access self-guided mode from any expedition. Explorers can use the self-guided mode to go on expeditions without waiting for a Guide to take them.

b. Open the Expeditions app.

c. Tap FOLLOW.

d. Open an Expedition.

e. Under EXPLORE ON YOUR OWN, tap EMBARK.

f. If not already done, place phone into the goggles and select one of the tabs to find expeditions or search.

Featured - Lists the most popular expeditions Categories - Lists expeditions under common topics Downloaded - Contains the expeditions you've already downloaded to your device. Downloaded expeditions have a checkmark in the corner of the preview. Tap the expedition to open it.

NOTE: If a guided expedition is currently happening on the same wifi network, you see a "Live" tile at the beginning of the expeditions list. Tap the tile to join that tour.

g. Once an expedition is open you can explore different scenes. Each scene has an information panel that describes the scene and sights you can select to learn about. If a scene has pre-recorded narration, audio plays automatically. If it does not, tap AUDIO GUIDE for computer-generated narration. In the information panel, tap a point of interest to learn more about it. Follow the arrow until you see the sight you selected.

NOTE: If you are using Daydream, use your controller and touchpad to select scenes and points of interest (Makuka, 2018).

Appendix D

Medical Power Point

Virtual Environments

How They Affect Health and Wellness

Side Effects of Exposure To Virtual Environments

- Nausea/vomiting
- Pallor/sweating
- Disorientation
- Eye strain
- Blurred vision
- Fatigue
- Headache
- Upset stomach
- Burping
- Difficulty focusing
- Dizziness
- Balance problems
- Anxiety and discount

Cybersickness

- May be caused by sensory conflict (Reason and Brand 1975)
  - Being physically stationary while perceiving self motion
- Females have greater susceptibility
- Frequency and amplitude of movement (whether real or perceived) is an important factor
- Virtual Environments may trigger anxiety and aggravate fears (being up high, being underwater)

Cybersickness

Unintended psychophysiological side effects of participation in virtual environments

Results from sensory and perceptual mismatches between visual and vestibular systems – eyes and ears are receiving conflicting information

Severity depends on individuals participants, virtual reality system, virtual environment used, and task being carried out

Components of Cybersickness

Gastrointestinal Symptoms – including nausea, pallor, sweating, upset stomach, burping, increased salivation, rarely vomiting

Postural instability – dizziness, balance problems, disorientation

Visual side effects – eye strain, headache, difficulty focusing, loss of depth perception – most obvious with head mounted displays

Three Factors that Cause or Affect Cybersickness

- Individual susceptibility
  - Greatest between the ages of 2 and 12 and then decreases rapidly
  - Females more susceptible (hormonal influence)
  - Asian ethnicity
  - Past history of motion sickness
  - Anyone suffering from fatigue, sleep loss, head cold, respiratory illness, ear infection, hangover, upset stomach, emotional stress
- Virtual Environment system – improving with technological advances
  - Head mounted display often problematic because screen is inches from the eyes
- Task to be performed – minimal with school use, more of a factor in gaming

Management and Prevention of Cybersickness

- Stop the activity for the affected student
  - Symptoms are usually mild and subside quickly
  - Nausea and disorientation are the top symptoms
- Frequent breaks are needed at least every 30 minutes
- For hyperventilation and symptoms of anxiety use Mindfulness apps – Calm, Headspace
- Safety factors – make sure students are safely seated, remove all obstacles and cords if moving to prevent tripping hazards
- Remember to avoid the power of suggestion – if you tell them they may get sick – they will :)
- Avoid use with students suffering from concussions and seizure disorders

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Appendix E

Technical Operations

Setup
Turn tablet on
Make sure tablet is on correct Wi-Fi (EXP 1 or EXP 2)
Open expedition on tablet
Plug phones in to charge/turn on each phone
Make sure all phones are on the correct Wi-Fi (EXP 1 or EXP 2)
Swipe down from the top
Press and hold the Wi-Fi symbol
Click correct Wi-Fi network
Open the Expeditions app (flag icon)
Either tap "follow" (if the expedition is "found") or simply close goggles (if the cardboard viewer icon is on the screen and it is telling you to do so)
Leave phones and tablet plugged in until a few minutes before use

These simple, but important steps created a seamless experience for everyone and allowed Anna to relax and enjoy the virtual field trip with her students. Students were immediately engaged and had a significantly better introduction.

Appendix F

Bloom's Taxonomy