Sponsoring Committee: Professor Gregory Ramsay, Advisor
                        Professor Nancy Hale
                        Professor Susan Feather-Gannon

THE IMPACT OF INTEGRATING A VIRTUAL WORLD INTO

A FEDERALLY MANDATED DIGITAL CITIZENSHIP AND

CYBER SAFETY UNIT ON STUDENT ACHIEVEMENT,

HIGHER ORDER THINKING SKILLS, AND

TEST MOTIVATION

Amy Fox Billig

Submitted in partial fulfillment of the requirements for the degree of
Doctor of Professional Studies in Computing in the
Seidenberg School of Computer Science and Information Systems
Pace University
2011

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

RESEARCH OBJECTIVE

Introduction

Technology is rapidly becoming a dominant aspect of our society

(Harvey-Woodall, 2009). Future occupations will require collaboration across

international and cultural boundaries and new ways of integrating knowledge

(Haste, 2009). Learning technological skills is therefore necessary for students'

occupational prospects (Lebens, Graff, & Mayer, 2009).

To meet this need, new technologies and access to the Internet have been

changing secondary education. As access to the World Wide Web becomes

ubiquitous in schools, educators continually look to find appropriate ways to use

this technology as a learning tool (Bradshaw, Bishop, Gens, Miller, & Rogers,

2002). As a result, new ways of thinking and learning have emerged which

cannot be easily addressed with teacher-centered pedagogies (Sims, 2009). These

new ways of learning require more student-centered models of teaching, such as

constructionist, constructivist, and cooperative learning.

Advances in e-learning have been enabled by new platforms having the

potential to "revolutionize *synchronous and semi-synchronous* information

delivery" (Jennings & Collins, 2007). Among these are learning management

systems, such as Blackboard® and Moodle™, and Multi-User Virtual

Environments (MUVEs), which are three-dimensional (3-D) virtual worlds such

as Active Worlds©, Open Sim virtual worlds, and Second Life©. Many online

classrooms use e-mail, discussion boards, or listservs to communicate. The lack

of immediate feedback using these forms of communication, however, can be

limiting to the students' and faculty's responses since the conversations do not

flow naturally. Chat rooms can be used where more immediacy is needed in a

discussion and is limiting only to students who are less proficient at typing.

A MUVE is a computer technology that allows users to experience visual,

aural, and tactile stimuli generated in real time (Sanchez, 2009). It is an

interactive environment that promotes experiential learning. For example, instead

of merely reading about Ancient Egypt and regurgitating the information on a

test, students can learn about Ancient Egypt, build a replication of it, and present

and explain what they have learned. Virtual online worlds provide users with a

more personal level of interaction than chat rooms because the students can see

each other's avatars, or digital persona (Childress & Braswell, 2006) and can

interact using either text-based instant messaging, or Voice over IP (VoIP).

Currently, there are at least 197 colleges and universities, 44 not-for-profit

educational organizations, 10 libraries, 7 for-profit educational organizations, and

5 museums in Second Life ("SimTeach," 2011) and additional schools and

organizations in various other MUVEs. Elementary and secondary schools are

increasingly migrating to other virtual worlds, such as the Reaction Grid© and

Jokaydia©, which allow younger age groups. In addition to the myriad of educational resources, the use of MUVEs can help implement the first two standards of the International Society of Technology in Education's (ISTE) National Educational Technology Standards for Students (NET•S). These standards are:

1. Creativity and Innovation

   Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

   a. apply existing knowledge to generate new ideas, products, or processes,

   b. create original works as a means of personal or group expression,

   c. use models and simulations to explore complex systems and issues,

   d. identify trends and forecast possibilities.

2. Communication and Collaboration

   Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

   a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media,

   b. communicate information and ideas effectively to multiple audiences using a variety of media and formats,

c. develop cultural understanding and global awareness by engaging

with learners of other cultures,

d. contribute to project teams to produce original works or solve

problems. (ISTE, 2007)

The focus of this dissertation is on the use of virtual worlds, specifically

the Open Sim virtual world, Grand Central Grid. The purpose is to examine the

use of the Grand Central Grid in secondary education to assess its impact on

student achievement, higher order thinking skills, and test motivation.

Background to the Problem

Educators often talk about actively engaging their students in

learning through books, images, movies, and other information

resources. However a new generation of technology tools provides

the opportunity to psychologically immerse young people in multi-

user virtual environments (MUVE) [*sic*]. Three-dimensional

worlds such as *Teen Second Life* provide a creative playground

where learners create objects, test ideas, and collaborate with

others. (Lamb & Johnson, 2009)

Created from the OpenSim software, Second Life© (SL) and Grand

Central Grid (GCG), are platforms developed and managed by Linden Research,

Inc. (Linden Lab) and Amy Fox Billig and B. Greg Colburn, respectively. At first

glance, SL or Grand Central Grid looks like other Massively Multiplayer Online

Role Playing Games (MMORPGs), such as EverQuest© and World of Warcraft©. However, there are significant differences. Unlike the predesigned environments and rules of play in an MMORPG, Second Life© and Grand Central Grid are user-created environments. They provide a three-dimensional space where users can communicate, collaborate, and design their world. It is up to each individual who enters these virtual worlds to design meaningful social and learning experiences (Lamb & Johnson, 2009; Marsh, 2011).

Grand Central Grid is a relatively young Parental Guidance (PG) rated grid, established in 2010. It was created specifically for education and can provide virtually more than just real world experiences. Like its multi-rating counterpart, Second Life©, it can provide educators with an environment where experiences can take place that are not possible or feasible in the classroom, such as working with a team to create a cell that can be walked in for a biology class, or by recreating a place and period of time, like the Alamo, for a history class, or by building Dante's Inferno for a literature class. The virtual world provides educators with an environment that invites the design of social cooperative learning experiences that can be carried out easily and efficiently with maximum returns on learning (Childress & Braswell, 2006). And, if any type of content can be created, then it would follow that all educational material can be designed, developed, and experienced in Second Life© (Cheal, 2007) or another virtual world such as Grand Central Grid.

One of the ongoing goals of education is to have students move beyond the lower levels of Bloom's Taxonomy, as defined by Bloom (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956) and revised in 2001 (Anderson & Krathwohl, 2001). Students need to move from the two lower levels of the taxonomy of remembering and understanding, to the levels defined as higher order thinking skills: applying, analyzing, evaluating, and creating.

The new terms are defined as:

- Remembering: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

- Understanding: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

- Applying: Carrying out or using a procedure through executing, or implementing.

- Analyzing: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.

- Evaluating: Making judgments based on criteria and standards through checking and critiquing.

- Creating: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. (Anderson & Krathwohl, 2001)

Bradshaw, Bishop, Gens, Miller, & Rogers (2002) cite Ennis's statement that students also need critical thinking skills, which he defines as reflective and reasonable thinking focused on what to believe or do (Ennis, 1985). Beyer also states that problem solving is another cognitive skill needed. Problem solving, as defined by Beyer, is a thinking strategy that involves identifying a problem, representing the problem, and determining an appropriate solution, which is then carried out and evaluated (Beyer, 1988). Although none of these skills has the same exact definition, there is enough significant overlap to say that the ability to think critically requires higher order thinking skills. Higher order thinking skills can be demonstrated through critical thinking and problem solving, and the ability to solve problems requires the use of both critical thinking skills and higher order thinking skills.

In order to develop each of the above skills, educators must provide learning environments that are student-centered, authentic, problem-based, and collaborative (Bradshaw, et al., 2002). Three progressive pedagogies meet this definition: Piaget's Constructivism, Papert's Constructionism, and Bandura's Social Learning Theory. They additionally have the common theme that knowledge construction requires social immersion. As it pertains to online learning, knowledge construction requires interactive social immersion where the students create a virtual community involving cognition, peers, and teachers (Ng & Nicholas, 2007).

The constructivist learning theory maintains that students construct their own knowledge by building on pre-existing knowledge while actively engaged in the learning process. The teacher is the facilitator of the learning, not the disseminator of information. For example, as a facilitator, a teacher sets up a science experiment with all the materials for the lab, including basic instructions on conducting the experiment. Students conduct the experiment and then come together to discuss the results and what they have learned. As a disseminator, that same teacher lectures on the experimental design and results that occur, without student interaction.

Papert extends the constructivist theory by including the essential idea that students must take what they have learned, or internalized, and construct something external, which may or may not be shared (Papert, 1991). An example of this could be the creation of a wiki after a unit on the topic studied. Students would be externalizing what they have learned, thus reinforcing the material learned. Bandura's social learning theory is a combination of behavioral and cognitive learning. One's environment influences his/her behavior. Cognition can be situated, social, and distributed (Bandura, 1977). Situated cognition states that the social and physical contexts in which knowledge is presented is an integral part of learning (Brown, Collins, & Duguid, 1989). Social cognition asserts that how people think and develop ideas are a product of their interactions and negotiations with their communities of practice or their personal learning network (Putnam & Borko, 2000; Wenger, 1998). Distributed cognition occurs

when cognitive properties are distributed across all individuals involved in a learning situation (Lave, 1993; Salmon, 1993).

Proponents of progressive pedagogies assert that these types of learning environments are more likely to foster higher order thinking skills, critical thinking skills, and problem-solving skills (Blaik-Hourani, 2011; Bonk & Reynolds, 1996; Bradshaw, et al., 2002; Hackbarth, 1996; Qiyun, Huay Lit, & Jianhua, 2009). "The use of technology in the classroom was supposed to promote more student-centered instruction and result in a shift from traditional instruction (often called "transmission") to more constructivist-compatible instruction" (Matzen & Edmunds, 2007).

Virtual world learning environments, such as the Grand Central Grid, fit within the framework of constructionist, constructivist, and social learning theories by providing users with a medium for student-centered, collaborative, and immersive learning experiences. Simulations, role-playing, creating educational materials, and safely testing dangerous situations are all possible in virtual worlds. All higher order thinking skills from Bloom's taxonomy can be achieved (Cheal, 2007). Lim (2009) defines a framework for designing curricula inworld. Each of the six modes of learning defined supports these learning theories. He recommends that each lesson incorporate at least one of the following experiences, although he acknowledges that no one lesson can incorporate all. They are the following:

- learning by exploring - learning by exploring means the learning results from explorations of installations, communities, and landscapes within the virtual world.

- learning by collaborating - learning by collaborating results when students work in teams, either on problem-solving tasks or in other forms of structured inquiry.

- learning by being - learning by being is the learning that results from explorations of self and of identity.

- learning by building - learning by building occurs from tasks that require the learners to build and/or script objects.

- learning by championing - learning by championing refers to the vast variety of initiatives by various communities in virtual world learning environments to adopt, champion, and evangelize causes from Real Life.

- learning by expressing - learning by expressing focuses more on the representation of inworld activity to an audience that might not be inworld. (Lim, 2009)

Statement of the Problem

There is a plethora of research defining successful integration of technology in education. Successful technology integration has been shown to improve students' academic performance when the teachers, school community,

and building and district administrators all buy into the technology as an instructional tool (Honey, Culp, & Karrigg, 1999; Martindale, Pearson, Curda, & Pilcher, 2005) and is pedagogically sound (Martin, Strother, Beglau, Bates, Reitzes, & Culp, 2010).

Traditional methods of teaching no longer capture the interest of children growing up in this computer age (Harvey-Woodall, 2009). Students demonstrate higher motivation and engagement when using technology, which results in increased achievement (Harvey-Woodall, 2009). The successful implementation of educational technology with low socioeconomic students can significantly improve motivation, engagement, and achievement (Mouza, 2008; Page, 2002). The benefits of motivation, engagement, and achievement for students with learning disabilities have been demonstrated time and again by maintaining focus and attention and an interactive learning experience (Coleman-Martin, Heller, Cihak, & Irvine, 2005; Heinmann, Nelson, Thus, & Gillberg, 1995; Williams, Wright, Callighan, & Coughlan, 2002).

Successful technology integration can also develop higher order thinking skills when students are taught the process of problem solving and then use technology to develop solutions (Coley, Cradler, & Engle, 1997; Pogrow, 1996). It has also been shown that home access to computers substantially increases writing skills, gives students a better understanding and broader view of math, and greater problem solving and critical thinking skills (Rockman & Sloan, 1995; Wittwer & Senkbeil, 2008).

Many anecdotal examples exist of successful uses of virtual world learning environment integration in a variety of academic areas at the secondary and post-secondary levels. Christian Wagner (2008) documents his use of Second Life© in his Virtual Organizations and Global Teamwork course, an information systems course to prepare students for virtual work environments. He gave a four-week assignment requiring five-person teams to build a virtual organization and/or business inside a virtual world (inworld). Student feedback showed that the assignment was slightly demanding. Students valued the learning experience and thought the assignment should be repeated in future years. His students on the whole, however, did not think the assignment adequately gave them the opportunity to practice business ideas, and they did not receive enough feedback for it to be helpful (Wagner, 2008).

Esteves, Fonesca, Morgado, & Martins (2009) have been investigating the effectiveness of using Second Life© to teach beginning programming. Object-oriented programming is difficult for beginning students to learn. In their investigation, the use of the Linden Scripting Language (LSL) is chosen as the beginning language in an attempt to make learning object-oriented design and programming easier, because Second Life© provides a "powerful visual impact that allows people to freely program behaviours into objects" (Esteves, Fonseca, Morgado, & Martins, 2009). Different programming projects were given to students to work on using Second Life©. Through their observations on the learning process and students' motivation, they concluded that using Second

Life© as a platform for teaching and learning a programming language could benefit novice students. However, it is necessary to be mindful of the type of project presented, as it must meet the students' interests (Esteves et al., 2009). Other uses for Second Life© at the college and university level are shown in Appendix A, reproduced with permission from IGI Global.

Until its closure in January 2011, middle and secondary level schools, organizations, and school districts had been using Second Life© to reach their students in ways never before possible. Global Kids, Inc., a New York City-based non-profit, is one such organization. Global Kids (GK) is committed to educating and inspiring urban teens to become successful students as well as community and global leaders ("About Global Kids," 2011). Within Teen Second Life©, Global Kids had established an island, which hosted interactive, experiential programs for teens from around the world ("Global Kids' Online Leadership Program," 2011). Some of their uses for Teen Second Life© were as a learning environment for after school programming, leadership programs for Teen Second Life© residents, partnering with other institutions to provide audio and video streaming for events, and as a professional service to other organizations learning about the possibilities of Second Life©.

Peggy Sheehy, a middle school Library Media Specialist, is an advocate for the effective integration of technology in education. As such, she was one of the pioneers of public school education in Teen Second Life©. Over the last five years, she has brought hundreds of students into Teen Second Life©, by helping

teachers find meaningful uses of the technology to support the curriculum. At a regional conference in 2007, Sheehy stated the following benefits resulting from working in Teen Second Life© that she and her teachers have observed: increased student engagement, students raising their own bars, self-differentiating technology, more productive reflections and debriefings, increased participation and risk taking by special needs students, and strong development of social skills (Sheehy, 2007). Since the closure of Teen Second Life©, many of these schools and organizations have moved to other MUVEs such as The Reaction Grid©, Jokaydia© and Active Worlds© .

Although much anecdotal documentation of success exists using MUVEs in education, there is very little supporting empirical data. One study at Loyalist College in Canada used Second Life© to train students to work for the Canadian Border Services Agency (CBSA) (Hudson & Degast-Kennedy, 2009). They provided a simulation environment with some students as active learners participating in the simulation, some students as passive learners observing the simulation, and a last group of students as the volunteer traveler participants. Although pre-simulation interviews of the students revealed some level of skepticism about the potential effectiveness of Second Life© as a learning environment, in the end, most felt the simulation provided them with a level of experience they would not otherwise have received. Students are assessed in their training by a standard rubric for interview skills, which is administered in a live action role-play. The evaluation process and content are consistent with the

evaluation process within the CBSA. The results showed a 28% increase in scores for students who participated in the simulation, compared to prior classes where Second Life© was not used. No other differences were noted between the groups of learners (Hudson & Degast-Kennedy, 2009). Some additional benefits they did not anticipate included an increase in the number of teachable moments stemming from the open-ended nature of role-play, and the speed with which students committed to memory the interview process.

Having little other hard data at the post-secondary level and even less at the secondary level, this researcher investigated whether the integration of the virtual world learning environment (VWLE), Grand Central Grid, into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship, has an impact on student achievement, higher order thinking skills, and student motivation. This study focused on the following research questions:

1. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on student achievement?

2. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on higher order thinking skills?

3. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on test motivation?

Definitions

e-learning - for the purposes of this dissertation, e-learning will refer to all learning environments where technology, specifically computer technology, is involved and the delivery method is primarily network or Web based.

virtual world - a three-dimensional, persistent graphical space where users create an avatar, or digital persona, which allows them to interact and communicate with other users, create content, and conduct business in a persistent real-time environment.

virtual world learning environment – any three-dimensional virtual world space designed for educational use.

Significance of the Study

The No Child Left Behind Act of 2001 (Public Law 107-110) ("No Child Left Behind Act of 2002," 2002) amends Title I to reflect the need for all students to receive a high-quality education and meet or exceed minimum proficiency on state academic achievement standards and assessments. Additionally, the Children's Internet Protection Act (CIPA), enacted December 21, 2000, requires libraries and schools to comply with certain Internet filtering and policy

16

requirements. The Protecting Children in the 21st Century Act, enacted October 10, 2008, adds an additional Internet Safety Policy requirement covering the education of minors about appropriate online behavior ("Internet safety policies and CIPA: An e-rate primer for schools and libraries," n.d.) In other words, for school districts to receive federal funding for technology, they must provide students with instruction on Internet safety and digital citizenship.

This study adds to the body of knowledge about the effectiveness of a new instructional technology, virtual worlds, specifically Grand Central Grid, when integrated to support federally mandated requirements. It provides research data establishing the impact of this particular technology on academic achievement, as determined by assessments driven by state curriculum standards, as well as on higher order thinking skills, as determined by the Cornell Critical Thinking Test, and on student motivation to do well on the unit test, as determined by self-reporting.

The study is based on the following assumptions: 1) technology can support the learning process by providing multiple modes of communication, both synchronously and asynchronously; 2) the current integration of virtual world learning environments into state curricula is showing anecdotal success at the middle and secondary school level; and 3) Grand Central Grid provides an environment conducive to student-centered pedagogies.

With the increase in demand for students to be productive members of the workforce by having 21st Century literacy skills, educators must find ways to

make the learning process as effective to this end as possible. Developing life-long learning skills in our students requires us to find motivating and engaging tools to deliver the state-mandated curricula in such a way as to increase the probability that students will want to continue learning. Additionally, in difficult economic times, school districts must be careful how they spend their dollars. Money earmarked for curriculum and technology needs to go to resources with effective student outcomes. This study is timely in its attempt to determine the effectiveness of one of the newest technologies to be integrated into schools at a point when both academic and fiscal accountability are high.

CHAPTER II

RELATED LITERATURE

<u>Introduction</u>

To investigate the impact of using virtual worlds in education, specifically

three-dimensional virtual worlds such as Second Life©, the Reaction Grid©, or

Grand Central Grid, on both student achievement and higher order thinking skills,

we need to first investigate the various learning theories supporting educational

technology as an effective learning tool. We also need to take a broader look at

the effects that instructional technology, in general, and the Internet and other

Web-based learning environments, specifically, have on these two critical

components of learning. Finally, we need to make the connection between the

learning theories and the virtual learning environments. Research in these areas

are replete with findings indicating successful integration of these technologies

can, in fact, have a positive impact on student achievement and higher order

thinking skills, given the right conditions.

<u>Learning Theories</u>

Although there are many learning theories that can be used to effectively implement educational technology, three that this researcher will look at for the purposes of this research are Piaget's Constructivism, Papert's Constructionism, and Bandura's Social Learning Theory. The overarching theme across these learning theories, as it pertains to online learning, is that knowledge construction in an online learning environment requires interactive social immersion where the students create a virtual community involving cognition, peers, and teachers (Ng & Nicholas, 2007).

Constructivist learning theory holds that students construct their own knowledge by building on pre-existing knowledge while actively engaged in the learning process. Common terminology for this is that the teacher role is as a facilitator in the learning process, as opposed to the disseminator of information. Constructivism also supports a current trend in education to more personalize the learning experience with differentiated instruction (De Freitas & Yapp, 2005; West-Burnham, 2005) and improve autonomous learning (Field, 2007). This learning takes place at the operational level (physical manipulations) and/or at the cognitive level (processing information) (Piaget, 1955, as cited in (Nicholas & Ng, 2009). Vigotsky's social constructivism adds to this theory by introducing a scaffolding of social interactions into the learning process. Students help each other construct knowledge by negotiating meanings of new material and reflecting

critically on the new knowledge. Through negotiation and reflection, students help each other reach a common knowledge base, regardless of the amount of prior knowledge with which each individual student began.

Seymour Papert extends the constructivist theory by including as essential the idea that knowledge construction is most effective when students are constructing something external, which may or may not be shared. In his constructionist theory, knowledge is internalized by incorporating it with pre-existing knowledge. This new knowledge is then externalized by the creation of something, which can then be shared with others (Beisser, 2005; Papert, 1991). For example, students might learn about dinosaurs by reading books, watching videos, and visiting museums. They might then use what they have learned to create a Jeopardy® style game which can be used as a learning tool for others or to reinforce ideas for those involved in the activity. Such products allow teachers to assess understanding of a concept or topic rather than merely acquisition of information.

Bandura's social learning theory is a combination of behavioral and cognitive learning. Behavioral learning suggests that one's environment influences how they behave and learn. Human behavior is learned by observing others' behavior. That behavior is then translated into one's own actions in similar situations. It is the twist of the common saying, "Do as I do, not as I say," because it is really the adults' behaviors from which children learn, not from what they are told to do. Social learning theorists state that learning can also take place

without necessarily changing behaviors as not all knowledge requires a

corresponding behavior. Learning is a combination of cognitive, behavioral, and

environmental influences (Bandura, 1977; Kim & Baylor, 2006). Bandura's four

requirements to learn and model behavior are: attention, various environmental

and personal factors influence one's attention; retention, remembering what one

paid attention to; reproduction, reproducing the behavior; and motivation, a

significant reason to want to reproduce the behavior (Bandura, 1977).

Cognition is viewed in three distinct ways: cognition as situated,

cognition as social, and cognition as distributed. Situated cognition asserts that

the social and physical contexts in which knowledge is presented are an integral

part of learning (Brown, et al., 1989; Darvin, 2006). The environment and social

interactions in which students learn becomes part of the knowledge they gain.

Social cognition states that how people think and develop ideas are a product of

their interactions and negotiations with their communities of practice or personal

learning network (Eshach, 2010; Putnam & Borko, 2000; Wenger, 1998).

Sharing ideas with others in one's learning circle, to come to a common

understanding of a concept are key to learning the concept. Distributed cognition

maintains that cognitive properties are distributed across all individuals involved

in a learning situation (Gomez, Schieble, Curwood, & Hassett, 2010; Lave, 1993;

Salmon, 1993). Different pieces of knowledge come from various people within

one's personal learning network.

Instructional Technology: Impact on Achievement and Higher Order Thinking Skills

In order for instructional technology to be integrated successfully, it needs to be pedagogically sound. The mere presence of the hardware in schools does not guarantee successful integration and achievement. It is the process of designing effective instruction that incorporates computer and other media technology appropriately that has the greatest impact (Martin et al., 2010). The CEO Forum on Education and Technology conducted a five-year exploration of the impact of educational technology on achievement in order to assist educational decision makers in how instructional technology can best enhance academic performance. Based on its findings, the Forum (2001) determined that four building blocks are essential to effectively use technology to increase student achievement, blocks which include 21st Century skills. The four building blocks are as follows:

1. alignment of the use of technology with standards, educational objectives, curriculum, and assessment

2. assessment to ensure all the skills defined as important for students are measured, including the development of 21st century skills

3. accountability based on measurement of progress against educational objectives across the entire system and strategies for continued improvement to ensure success

4. equitable access to technology and analysis of the effectiveness of various technologies on student achievement. (*The CEO Forum technology and readiness report: Key building blocks for student achievement in the 21st century.*, 2001)

Extensive research has shown that technology is most effective in improving student performance when the application directly supports the curriculum objectives being assessed. Kingsley and Boone (2006) investigated the impact of integrating a multimedia-based American history software program on student achievement. The subjects were 184 seventh grade students in public middle schools in a large urban school district in the southwestern United States. Ninety three students were in the experimental group which integrated the software into lecture and textbook based instruction, and 91 students did not use the software. Pretest and posttest unit scores were compared using a two-tailed t-test with unequal variance. The study found that the group that integrated the software increased their mean test scores an average of 12.2% and students in the control group increased their mean test scores an average of 6.1%, a statistically significant difference (Kingsley & Boone, 2008). In Virginia, Boster et al. (2002, 2004) conducted a randomized study using digital video clips specifically selected to align with standards in third- and eighth-grade social studies and science. Pretest and posttest assessments, specially developed to examine students' knowledge of those standards, showed increased student achievement compared

with students not shown the video clips (F.J. Boster, Meyer, Roberto, & Inge, 2002; F.J Boster et al., 2004).

Reading comprehension in textbooks can be challenging for students. Fry and Gosky (2007) studied the use of an electronic pop-up dictionary on student comprehension. One hundred twenty nine middle school students were broken down into three groups. One group read a hard copy of the text, another read an online copy of the text, and the last group read an online copy of the text with a pop-up dictionary for every word in the text. All students were given the same two-part tests after each of four readings to measure understanding of the main idea and reading comprehension. The test results from the pop-up dictionary reading method showed statistically significant differences over the other two reading methods. The results suggest pop-up dictionaries are an effective method for improving reading comprehension in texts (Fry & Gosky, 2007).

Technology integration improves students' academic performance when it is implemented in environments where teachers, the school community, and school building and district administrators support the use of technology. It is important to have district-wide buy-in to the use of technology as an instructional tool to improve student achievement. One of the elements of a recent evaluation of Microsoft's peer coaching and technology integration program, piloted in Florida during 2005, was to determine the positive and challenging aspects of implementing the program. School culture and administrative support were found to be the most important elements of successful technology integration for

districts participating in the peer coaching program (Barron, Dawson, & Yendol-Hoppey, 2009).

Other studies have looked at specific educational software's effects on specific tests. Florida requires students to take the Florida Comprehensive Assessment Test (FCAT) to measure student achievement on grade-specific standards and benchmarks. FCAT Explorer, developed by Infinity Software, Inc., was provided by the Florida Department of Education to their public schools to be used as practice for the state assessment. Twenty-four schools were used in the study, half of them in the treatment group and the other half in the control group. Students in grade levels four for reading, and five, eight, and ten for mathematics participated in the study. The treatment group used FCAT Explorer and the control group did not. Data were collected for the school years ending in 2001 and 2002. For fourth-grade reading and fifth-grade mathematics, regardless of school year, there was a statistically significant difference between students using Explorer and those who did not. At the high school level, however, grades eight and ten showed no statistically significant differences in scores of users and non-users (Martindale et al., 2005).

The use of educational technology with low socioeconomic students can have a significant effect on motivation, engagement, and achievement. Page (2002) compared the gains of elementary students in technology-enriched classrooms with those taught in classrooms without technology. He found that the students in the classrooms with technology scored significantly higher on

mathematics achievement assessments and experienced increased student self-esteem (Page, 2002). Taking advantage of a laptop program initiative in a low-income minority school, Mouza (2008) investigated the implementation and outcomes of laptop use in classrooms on students' attitude towards computers and its impact on the learning process. She found that there were no significant differences in attitude toward computers between students in classrooms with the laptops compared to those without laptops. However, she did find significant differences between the groups in motivation, engagement, and achievement in mathematics and writing (Mouza, 2008).

The benefits of motivation, engagement, and achievement using technology can be used effectively to increase academic achievement in students with learning disabilities, including children with autism (Coleman-Martin et al., 2005; Stroud, 2009). Referencing prior research, Campbell and Melching (2009) note that observational and incidental learning is an efficient means for teaching content to small groups of students with learning disabilities. The problem of maintaining students' attention in groups can interfere with learning non-target information. Using interactive technology is one way of maintaining that attention (Williams et al., 2002). Using the interactivity of SMART Board (interactive white board) technology, Campbell and Melching (2009) showed that small group instruction using an interactive medium was able to keep students' attention, and that kindergarten students with learning disabilities could learn the names of letters and letter sounds (Campbell & Melching, 2009).

As the world becomes more communications centered and our world economy and businesses become increasingly intertwined, the playing field between nations and economies has been leveled. Today's students require new abilities to be successful in the knowledge-based economy. Knowing how to locate information, quickly weigh and evaluate information for bias and accuracy, and synthesize and apply that information to solve problems are essential skills. Higher order thinking skills are required to meet the demands of a world economy.

One way in which technology can enable the development of higher order thinking skills is through the use of information communication technology (ICT). McMahon (2009) conducted a case study on the relationships between use of ICT, time on the technology, and the age of the technology on higher order thinking skills. The subjects were 150 ninth-grade students in a metropolitan independent girls school, where all students in all subjects throughout the school year used notebooks. Results of the study show there is a significant statistical difference in critical thinking skills of students who use information communication technology for more than five years, compared to those who use it for less than five years (McMahon, 2009).

Higher order thinking skills can be defined as the cognitive skills that allow students to perform at the higher levels of Bloom's Taxonomy: analysis, synthesis, and evaluation (Hopson, Simms, & Knezek, 2001). Hopson et al. (2001) sought to determine whether "students in a technology enriched classroom

28

demonstrate better use of higher-order thinking skills than students in a traditional classroom" (p. 110). Students enrolled in a suburban North Central Texas school district participated. The students in the treatment group were randomly selected from the district's technology-enriched classroom magnet program. Students in the control group were selected at random from comparable elementary schools in the district without a technology-enriched environment. Using the Ross Test of Higher Cognitive Processes to measure the effectiveness of the instructional technology on higher-order thinking skills, the researchers found that the scores were generally higher for analysis and synthesis, and significantly higher for evaluation. The short duration of the study and the inability of the researchers to control for home use of the computer were suggested to have minimized the statistical differences of these findings. The results of this study suggest that technology is the tool that allows students to move beyond mere acquisition of knowledge to application of that knowledge and development of higher order thinking skills.

The Internet in Education: Virtual Education's Impact on Achievement and Higher Order Thinking Skills

Integration of computers and technology in the classroom has clearly had a positive impact on achievement and higher order thinking skills. The effects are the greatest when the technology is used judiciously, when teachers are properly trained, when the technology supports the curriculum, and when there is district-

wide buy-in for the technology. When schools bring the Internet into the

buildings, a whole new level of learning, thinking, and engagement develops.

The World Wide Web, and especially the Web 2.0 technologies such as social

networking, blogs, and wikis, provide users with a higher level of communication

than was previously possible. This environment affects all aspects of our lives,

including education. It influences how students think and learn and how they

gather and analyze information. Access to the Internet, its content, and

communication tools allow students to learn anywhere, anytime.

Learning in the virtual environment of the Web can be synchronous or

asynchronous. One of the earliest studies on the impact of computers and the

Internet on academic achievement used the data from the Programme for

International Student Assessment (PISA) for 2000. The researchers analyzed the

data from 31 countries in math (96,785 students) and reading (174,227 students).

Although the tests were given for mathematics and reading, the authors report

used the results from mathematics tests because they are more closely tied with

successful future job performance, and because they are more universal across the

countries. The results indicated that having access to a computer at home or in

school had no significant effect on student achievement on these tests. A positive

effect exists on student achievement in these areas for access to the Internet at

home and in school (Bielefeldt, 2005).

The effectiveness of distance education consistently shows no significant

difference from face-to-face education (Thirunarayanan & Perez-Prado, 2002). In

a study to determine the effectiveness of web-based distance education on academic achievement, Thirunarayanan and Perez-Prado (2002) worked with students enrolled in two sections of a course on teaching English to speakers of other languages (ESOL). The pre-service teachers in the study were required to take this class for their Elementary Education Program with ESOL endorsement. The delivery tool for the online class was WebCT, a software tool designed for online learning. The researchers found that students in the online section of the course scored significantly lower than students in the traditional classroom course on the pretest. A posttest analysis determined that there was no significant difference in achievement. Numerically, the students in the control group scored 13.19 points higher on the posttest than on the pretest, whereas the online group scored 15.21 points higher, suggesting higher achievement by the online group.

In a more recent study conducted by The National Bureau of Economic Research, Figlio, Rush, and Yin (2010) looked at the impact of delivery method for a large Principles of Microeconomics class taught at a large, selective, doctorate-granting university. Approximately 1,600 to 2,600 students per semester register for this course. However, the lecture hall seats only 190 students. Typically 50-60 students attend each live lecture. The lecture is videotaped and subsequently posted online for all students. The professor was able to obtain 327 students to participate in the study by giving a small incentive of a half grade increase. They were assigned (not randomly) to either the live-lecture section or the online section. Live lecture volunteers had their accounts

modified to restrict access to the recorded lecture but had full access to all other resources. Background information on the students revealed no significant differences between the two groups in a variety of areas including SAT scores, whether mothers graduated from college, and GPA. The study showed that students perform better in the live setting. However, the raw differences were uneven and statistically insignificant. The strongest findings in the study favor live instruction for the relatively low-achieving students, male students, and Hispanic students.

Another study comparing student achievement and satisfaction in an online environment versus a more traditional face-to-face environment for a statistics course had similar results. Thirty-eight undergraduate nursing students at a large midwestern university were selected for the study. Seventeen students took the web-based statistics course, while 21 took the face-to-face statistics course. Independent samples t-tests were used to determine whether significant differences existed between the online group and the face-to-face group in terms of statistics knowledge and student satisfaction. No significant differences were found between the two groups on entry level statistics skills and on statistics knowledge (Summers, Waigandt, & Whittaker, 2005).

Burkhardt, Kinnir, and Cournoyer (2008) compared the results of a comprehensive exam taken by undergraduates in both face-to-face and online sections of a course in information literacy. They concluded that the students who took the online comprehensive final exam performed at least as well as the

students in the face-to-face sections. However, they noted that the small number

of students in the online classes (a total of 23 students in two sections) could

exaggerate the percent of students who got a question correct or incorrect

(Burkhardt et al., 2008).

Online, or distance, learning can be synchronous or asynchronous.

Asynchronous communication provides students with the opportunity to reflect

on ideas before responding to questions and comments posed by teachers and

other students. This allows for more thorough responses, better critical thinking,

and a greater contribution of information. Synchronous communication allows

for brainstorming and immediate feedback (Maushak & Ou, 2007). While there

was much prior research conducted to support asynchronous learning (Weinreich

& Tompkins, 2006), Maushak and Ou studied the effects of synchronous

communication on collaboration. They collected data from Instant Message (IM)

transcripts of students required to meet online at least once synchronously to

complete a project. The general categories they looked at were mutually

constructing knowledge, mutually negotiating, mutually supporting, group

facilitating, and group processing. Maushak and Ou found that 44% of the online

synchronous communication was mutually constructing knowledge that supported

the Vygotsky model of collaborative learning. Sixteen percent of the

communications were mutually supporting, 15% group processing, 14% group

facilitating, and 12% mutually negotiating, an essential feature of collaborative

learning. Thus, both synchronous and asynchronous learning are needed for successfully implementing Web-based learning environments.

This research supports earlier findings on the benefits of various types of communication in online learning. A study investigated the benefits of asynchronous representational knowledge mapping between dyads versus text-based threaded discussions on problem-solving skills and knowledge construction. The researchers found that students engaging in asynchronous knowledge mapping were more likely to create more hypotheses earlier in the experimental session and elaborated on them more than users of threaded discussions (Suthers, Vatrapu, Medina, Joseph, & Dwyer, 2008).

In a study of the effects of computer-mediated communication, Garrison, Anderson, and Archer (2001) proposed four stages in the development of critical thinking: 1) trigger (state the problem), 2) exploration (search for relevant information), 3) integration (construction of possible solutions to the problem), and 4) resolution (critical analysis of the solutions). After transcripts of the online discussions between students were coded, the researchers found that 8% were triggers, 42% were exploration, 13% integration, and 4% resolution. They suggested that the low numbers for integration and resolution could possibly be due to the need for more time for reflection on the problem as well as the reluctance of students to give incomplete or inadequate contributions to the discussion (Garrison et al., 2001).

Meyer (2003) looked at the time component of these discussions to determine whether the increased time frame for threaded discussions had a positive impact on higher order thinking skills. Face-to-face discussions have the energy and immediacy that many students and teachers like. Threaded discussions in which one speaker at a time makes a contribution or a comment on a previous post allow time for thoughtful responses and the inclusion of outside information. She models her data collection on Garrison's stages of critical thinking and adds social as an additional category. In the analysis of her findings, Meyer states that there is evidence that higher level thinking occurs but not as much as desired. She attributes these mixed results to a small sample size and lack of statistical testing (Meyer, 2003).

Access to the World Wide Web in schools, in common with sound pedagogy, can improve not only academic achievement, but higher order thinking skills as well. To be most effective, teachers need to provide learning environments that are learner-centered, authentic, problem-based and collaborative (Bradshaw et al., 2002; Neo & Neo, 2009). In 2002, Picciano investigated the relationship between online interactions and achievement. He divided the interactions into three categories: low, moderate, and high. Although the final exam showed no significant difference in achievement among students in these three categories, there was a significant difference on the written assignment. This suggests that any amount of online communication is effective

for achievement and that high levels of online communication improve higher order thinking skills (Picciano, 2002).

The ability of technology to develop higher order thinking skills is not limited to high achieving students. Zohar and Dori (2003) studied whether teaching methodologies encouraging higher order thinking skills improved these skills in low-achieving students compared to high-achieving students. They found that scores from both groups increased after the four experimental programs, and in one of the four the net gain of low achievers was significantly higher than that of the high achievers. These results show that students of all abilities can benefit from pedagogy that encourages higher order thinking skills (Zohar & Dori, 2003).

Virtual Reality: Impact on Achievement and Higher Order Thinking Skills

Virtual reality (VR) is an artificial reality that projects the user into a 3-D space generated by a computer to create an illusion of a real or imagined space. One type of virtual reality system uses stereoscopic goggles and data gloves that provide the 3-D imagery and a tracking device for head, body and hand movement. Flight simulators, for training airplane pilots and astronauts, were the first form of this technology that provided a very realistic and very expensive simulation. More recently, medical and nursing schools have been using virtual reality for effective training in everything from patient care to surgical procedures. In the first double-blind research study, Seymour et al. (2002) sought

to demonstrate that VR training transfers skills to the operating room (OR) environment in response to the increased complications from laparoscopic gall bladder surgery. Sixteen residents were given baseline psychomotor ability tests and randomly assigned to either traditional training or VR training for gall bladder surgery. After the training, the residents were required to perform the surgery with an attending surgeon who had no knowledge of the training given. The findings were amazing. VR-trained residents performed the surgery 29% faster than non-VR trained residents. Furthermore, the accuracy and the success of the surgery were significantly different for the two groups. Non-VR-trained residents were nine times more likely to fail to make progress and five times more likely to injure the gall bladder. The researchers concluded that the success of this experiment should "set the stage for more sophisticated uses of VR in assessment, error reduction, and certification of surgeons" (Seymour et al., 2002).

Virtual reality has other variants. Spatially immersive displays are multi-sided rooms that you walk into, and an immersive theater or immersive wall uses a large screen that completely fills your peripheral vision. Another type of virtual reality is desktop VR which uses a computer to play games and view environments in which you move around, although they lack the 3-D reality of true VR systems. Massively multiplayer online role playing games (MMORPGs) such as World of Warcraft©, Everquest©, and Call of Duty© are examples of desktop virtual realities as are massively multiplayer virtual worlds such as Second Life© or The Reaction Grid©.

Second Life© (SL), The Reaction Grid©, Grand Central Grid, and similar environments are virtual worlds created entirely by their users, also known as residents. The experience one has in these environments is entirely individual and grows out of the purpose and need one has for being there. Education in virtual worlds has become a growing trend in higher education, at the secondary level, as well as for training purposes in business. As a result of the experiences of educators, many qualitative case studies have been written about their individual courses and experiences. In fact, there are so many best practice suggestions, that this past March Second Life© held its third and largest Virtual Worlds: Best Practices Conference. It was held entirely inworld, that is in SL.

Interactive virtual learning environments provide all the essential ingredients to support constructivist, constructionist, and social learning theory. These environments can be as simple as using Web 2.0 technology to communicate or as complicated as text based or 3-D virtual worlds. In her 1997 dissertation, Bruckman asserts that cyberspace is a place where users are creators of knowledge, not recipients of information. Her study centered on the text-based virtual world, MOOSE Crossing, which was designed to be a constructionist learning environment for children ages eight to thirteen. This environment was created to teach programming in the MOOSE programming language. She collected data from observations of children's activities and learning experiences in this virtual world. Bruckman found that this virtual environment provided an

intellectually engaging community supportive of learning through designing and constructing virtual world content (Bruckman, 1997).

One action research study of particular interest to this researcher is on the use of Second Life© for problem-based learning in computer science programming (Esteves et al., 2009). Motivated by loss of interest in the computer science field and the perceived difficulty of the material by students, researchers sought to determine whether SL presents conditions suitable for creating a platform that could be used for teaching and learning a programming language. To do so, they looked at the experiences of both students and teachers. The authors concluded that it is, in fact, a viable medium for teaching a programming language, but teachers must create projects that are of interest to the students. Subsequent qualitative and quantitative research planned by the researchers aims to determine if SL really does improve students' comprehension of basic programming skills (higher order thinking skills) and whether the visual environment improves students' performance (achievement) and comprehension.

In another study, Vogel et al. (2006) compared the effects on academic achievement of using virtual reality with and without gaming. The authors looked to see if the success of simulation software, or traditional computer-aided instruction (CAI) on achievement could be generalized to non-simulation-based games. The findings showed that there was significant improvement in the group using CAI with simulation and no significant improvement in the group using non-simulation-based games. The conclusion showed that for gaming technology

to be most beneficial it should have a simulation component (Vogel, Greenwood-Ericksen, Cannon-Bowers, & Bowers, 2006).

A very large mixed methods study of 2000 students investigated the impact of integrating a virtual world learning environment on building and assessing higher order inquiry skills in science using a virtual town, called River City, built in the 3-D virtual world Active Worlds©. The students came from eight schools and 61 classrooms in major urban areas of the Northeast and Midwest, and from a suburban district in Mid-Atlantic US with high populations of ESL and free-and-reduced-lunch pupils during the 2004-2005 school year. Students in the study used avatars to interact with "other students, digital artifacts and computer based agents acting as mentors and colleagues in a virtual community of practice set during the time period when bacteria were just being discovered" (Ketelhut, Nelson, Clarke, & Dede, 2010). Three computer-based variants of River City were randomly assigned to the students in each classroom, while the paper-based control treatment was randomly assigned to whole classes. Each teacher taught both the computer-based classes and the control groups. The results show few differences between the River City group and the control group with two exceptions. Students with poor grades in science did best when taught scientific inquiry with the mentoring and modeling version of River City. Girls tended to do worse than boys, except for those in the community of practice version of River city. Finally, when looking at the performance assessment that mimics lab reports, the researchers found that students in the guided social

constructivist version of River City showed a stronger understanding of the scientific inquiry than did all other students.

Online Role-Play

Role-play is a recognized face-to-face teaching method for developing skills, knowledge, and attitudes (Bell, 2001) and has long been used in schools for teaching in two areas. The first area is for students to have an experience for understanding and changing attitudes and behavior. The second area is for students to develop interpersonal and communications skills. Bell points out that it is now possible to combine the powerful learning experience of role-play with the advantages of an online environment (Bell, 2001).

A case study of an asynchronous, anonymous, online role-play, conducted as part of a teaching course for academic staff, suggests that the use of online role-play "may be an effective teaching method for developing understanding and exploring complex issues, and for experiencing and understanding differing views" (Bell, 2001). The study also found that the asynchronous online environment might reduce the development of empathy through engagement in the role, but had the advantage of making role-play an "emotionally safer and lower risk activity than face-to-face role-play" (p. 258).

Wishart, Oades, and Morris (2007) conducted a study on implementing online role-play to teach Internet safety awareness using Net-Detectives, an online role-play activity designed for nine- to twelve-year olds, but used with Year Five

or Year Six (10th and 11th grade) students. The qualitative study included questionnaires and interviews with teachers. Seventy-five percent of the teachers reported that the online role-play had a significant impact on the students' awareness of Internet safety issues while the other 25% stated it had some impact. When asked about the impact of the online role-play, responses included successfully supporting children's discovery learning, encouraging physical involvement and engagement, and online-role-play was considered to be cross-curricular. Because it was a different environment from their normal learning environments, the students viewed it as a special treat, and were more motivated to work during playtime (Wishart, Oades, & Morris, 2007).

Case studies and anecdotal findings are interesting and motivating to other educators looking to immerse themselves in a virtual learning environment. However, there is little, if any, quantitative or qualitative research showing the effectiveness of using a virtual world as a teaching medium on academic achievement or higher order thinking skills.

CHAPTER III

METHODS

Introduction

The purpose of this study was to determine the impact of using a virtual

world on student achievement, higher order thinking skills, and motivation. An

action research study was used to address each of the research questions. In this

chapter, the researcher provides a rationale for the research design and describes

the research setting, participant selection, duration of the study, curricula,

approaches for data collection and analysis, human subjects' considerations, and

personal stance as a researcher. In addition, this study describes the assessment

tools used to measure academic, higher order thinking skills and student

motivation.

By conducting this research the researcher will answer the following

questions and test the associated hypothesis:

1. What impact does the integration of a Virtual World Learning

Environment (VWLE) into a unit designed to meet the federally mandated e-rate

requirement to teach Internet safety and digital citizenship have on student

achievement?

H_0 = There is no statistically significant difference between the achievement of the treatment group from the control group.

H_1 = There is a statistically significant difference between the achievement of the treatment group from the control group.

2. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on higher order thinking skills?

H_0 = There is no statistically significant difference between the critical thinking skills of the treatment group from the control group.

H_1 = There is a statistically significant difference between the critical thinking skills of the treatment group from the control group.

3. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on test motivation?

H_0 = There is no statistically significant difference between the test motivation of the treatment group from the control group.

H_1 = There is a statistically significant difference between the test motivation of the treatment group from the control group.

Rationale for Research Design

Action research is defined as any inquiry by an educational stakeholder such as classroom teacher, principal, or guidance counselor, for the purpose of

gathering information about how their school operates, how effectively they teach, and how well the students learn (Mills, 2011). This is a quantitative action research study using scores from achievement tests, tests of higher order thinking skills, demographic information provided by the school district and by the students themselves, and test motivation self-survey. It is considered action research because the study took place in the researcher's own ninth grade computer application courses during the 2010 – 2011 school year with the purpose of identifying how well the students learn the content using different instructional media.

The unit was broken down into two sub units: a) Intellectual property and Digital Citizenship: Intellectual property/creative content, creative commons, copyright laws, legal and illegal downloading, fair use, consequences of illegal use of creative content, creative content and social digital citizenship in schools, and digital citizenship on the Internet. b) Cyber safety: Cyber bullying, revealing too much information online, cyber predators, tracking, social networking safety and security, and e-mail/IM/chat room safety. Students in the fall semester were taught the curriculum integrating the virtual world. Students in the spring semester were taught the same curriculum without integrating the virtual world. Data collection took place before and after each of these groups of students' exposure to the unit.

Determining whether there is an increase in student achievement involves measuring a knowledge base before and after the lesson. Scores on the pretests

and posttests were determined by a percentage of correct answers with multiple-choice questions. Scores from each set of assessments were then compared to see if there was any improvement individually and as a group. Questions used for the pretests and posttests were provided with the curriculum material used.

Higher order thinking skills can be evaluated by using tests designed to measure the ability to read and think critically about the passages read and answer questions beyond what is explicitly given as fact. Answering the questions requires reasoning about the facts, drawing conclusions, and responding logically to interpretive questions about the facts. The Cornell Critical Thinking Test Level X tests induction, deduction, credibility, and identification of assumptions in each section of the test. The test is comprised of four sections measuring these skills. Two of these sections were given prior to the unit and the remaining two sections were given after the unit. The results of these scores were compared to determine if there was more of a statistically significant increase in higher order thinking skills for the control group compared to the treatment group. Because of the imbalanced quantity of questions between the pretests and posttests, scores from the posttests were scaled to match the pretests.

To measure motivation, a Student Opinion Scale measuring examinee motivation developed by Donna L. Sundre and Deborah L. Moore from the Center for Assessment and Research Studies at James Madison University, Harrisonburg, Virginia was used at the end of the academic achievement posttest (Thelk, Sundre, Horst, & Finney, 2009). This test was developed to measure

46

students' motivation to do well on exams. It is a ten-question Likert scale questionnaire.

<u>Setting</u>

This study took place in the high school of a small suburban school district in downstate New York. The district serves approximately 1,500 students grades K-12. The high school houses grades nine to twelve, with a combined enrollment of approximately 410 students. The average size of the technology classes is 17 students. District-wide, 8% of students are eligible for free or reduced lunch and 3% have limited English proficiency. The racial/ethnic make-up of the district is predominantly White/Caucasian (64%), followed by Hispanic or Latino (16%), Asian / Native Hawaiian / Other Pacific Islander (9%), and Black or African American (9%.), based on the most recent available statistics for the 2009-2010 school year. (The New York State District Report Card, Valhalla Union Free School District, 2010)

At the high school, 8% of students are eligible for free or reduced lunch and 1% have limited English proficiency. The racial/ethnic make-up of the school is predominantly White/Caucasian (67%), followed by Hispanic or Latino (15%), Black or African American (11%.), and Asian / Native Hawaiian / Other Pacific Islander (7%). Sixty-eight percent of teachers at the high school hold a Master's Degree plus 30 hours or a doctorate (The New York State District Report Card, Valhalla Union Free School District, 2010).

The school district receives E-Rate funding and is compliant with the mandates set forth by the Universal Service Administrative Company and the Federal Communications Commission to receive this funding. The Schools and Libraries Program of the Universal Service Fund, commonly known as E-Rate, is administered by the Universal Service Administrative Company (USAC) under the direction of the Federal Communications Commission (FCC), and provides discounts to assist most schools and libraries in the United States to obtain affordable telecommunications and Internet access. It is one of four support programs funded through a Universal Service fee charged to companies that provide interstate and/or international telecommunications services. ("Universal Service Administrative Company," 2010). E-Rate funding regulations dictate that schools abide by Title II, Protecting Children in the 21st Century Act. This amends the Communications Act of 1934, by adding the requirement that schools provide instruction on Internet Safety and Digital Citizenship to its students ("Protecting Children in the 21st Century Act," 2007).

For this study, the students in the experimental group were taught the standard curriculum, with key components taught inside the virtual world Grand Central Grid. This grid was owned, operated, and maintained by the researcher. It was developed from the Open Sim open source software. This software allows anyone with a server and some basic programming knowledge to create his/her own virtual world. The rationale behind using a private grid as opposed to a public grid such as Teen Second Life© or The Reaction Grid© is multifaceted.

First, the operating expense per region is lower as there is no profit margin to cover. Secondly, Linden Labs closed the Teen Grid during the fall of 2010. Finally, it is significantly easier to maintain control over safety parameters for students, especially minors. The grid administrator can control features such as avatar registration, default avatar appearances, grid rating (PG), region admittance, and group memberships. Students in the control group were taught the standard curriculum without integrating of the virtual world.

Participant Selection

All ninth-grade students are required to take a fundamental computer applications course. During the first half of the school year, half of the ninth grade is enrolled in Computer Applications 9, every day for 20 weeks. The remaining half of the ninth graders takes the course every day for 20 weeks during the second semester. Students are randomly assigned to either the fall or spring semesters. During the 2009-2010 school year, a formal curriculum was developed and integrated into the course to teach Internet safety and digital citizenship. Therefore, all the ninth graders during that year received this instruction. There are currently six sections of Computer Applications 9. For this study, the researcher used all six sections of Computer Applications 9 classes, in which none of the students had received prior instruction in Internet Safety.

<u>Delivery of Instruction</u>

Both treatment and control groups were taught the same curriculum. The primary differences in instruction are in the content delivery methods and the level of interaction with the content. The traditional delivery methods include reading, researching, presentations, videos, Facebook security day, group discussions, group written assignments, and the creation of a videotaped public service announcement on any one aspect of the unit taught.

Content delivery in the virtual world was through the use of inworld instructional media and interaction with the content as it is being delivered. The delivery methods included reading, researching, presentations, videos, Facebook security day, inworld group discussions, inworld group written assignments, inworld constructions, inworld role-play, and the creation of an inworld screencast public service announcement on any one aspect of the unit taught. Students created projects demonstrating their understanding of various principles of digital citizenship and all group discussions and work was done within group pods. Pods are simply a group of sitting-cushions in a circle that are lifted into the air and each group is out of text reach of other groups.

One project in the digital citizenship portion of the unit involving the use of the discussion pods and content construction was creating representations of the four fair use factors. Groups of students had to construct objects or scenarios in the virtual world that depicted one of the four factors. The groups first met in their pods to brainstorm ideas for the factor they were assigned. All conversations

were text based since members of the groups were dispersed in the physical classroom. One group, illustrating the factor regarding the content's impact on the market, chose to build an iPhone© and a PearPhone with a bar chart showing the rising sales of the PearPhone compared with the iPhone©. Another group, illustrating the factor regarding educational use, created a classroom with a copyrighted poem to read and a computer screen shot of a blog posting that poem as if it were the blogger's original poem. After the project, the groups went back to their pods to discuss questions regarding the four factors and to submit the answers to the teacher on an inworld notecard. The researcher was able to monitor each group's text chats and refocus and redirect the conversation as needed.

Another activity in the virtual world was about profile security. Each avatar has a profile that other users can access. After a class discussion on safe practices, students completed their profiles. The next day each student's profile was displayed on the white board. The rest of the class was able to review each profile and make suggestions for further safety improvements. This activity was followed by Facebook Day, an activity in which both groups participated. On Facebook Day the students were shown all of the safety features available and locked down their accounts so they are only visible to friends and so third party applications cannot access their personal information.

Role-play in the virtual world was used to have students learn and practice how to react and behave in various online situations. The students played a role-

playing game in which each student was given a secret identity including a first name, gender, hair color, eye color, and height. They partnered with another student inworld and each was to try to elicit this identity information from the other in instant messaging chat. Their goal was to find creative ways of answering without giving away the information. Their text conversations were logged and evaluated. The final project of the unit was to create public service announcement videos inworld using screen-capture software Jing. These videos, called machinimas, were then brought into iMovie for final editing. Students in the control group engaged in the same activity, but did their filming in the classroom and school.

Some students may have prior experiences using virtual worlds or other social networking communication while others may have limited computer resources and exposure to online communications. Still others might have family members, including parents, who also use various social networks or virtual worlds. In addition, prior achievement may have an impact on how students react to either the control group or the experimental group. Each of these intervening variables can affect students' experiences with using a virtual world as part of their course of study. Therefore, appropriate demographic information was collected and incorporated into the data analysis. The data collected showed that the diversity did not impact any one group more significantly than the other. This is likely because students are required to take the class and scheduling students into each group is completely random.

<u>Procedures</u>

The researcher developed lessons for each section of the Internet Safety and Digital Citizenship curriculum prior to the study. At the start of the course, all students in the computer applications courses received one student information letter and permission slip to participate in the study form and one parent/guardian information letter and permission slip to participate in the study form. Students were instructed to read these forms with their parent/guardian and bring back the signed student and parental permission slips. Permission to participate in the study was required for both the treatment and control groups (Appendix B and Appendix C).

Before the unit of study, information about each of the student participants was collected. Confidential data were obtained through the district's student information system on gender, date of birth, age, ethnicity, special education classification, if any, student ID number, parent/guardian name, and home address to ensure a) students' Individual Education Plans (IEPs) were followed during testing, if applicable, and b) for parent contact information, if needed. Additional personal student demographic information was collected in a survey that identified a) students' comfort level using technology, b) the use of social networking, c) prior experience using various software tools, d) computer access at home, e) how computer is used, and f) frequency of use. The researcher administered the pretest from Cornell Critical Thinking Test. On the following

day the researcher administered the academic content area pretest. The six-week

unit was then taught. At the end of the unit, the academic and critical thinking

posttests and the test motivation survey were given.

Duration of Study

Data collection for the study lasted approximately six weeks during each

semester of the 2010-2011 school year. Schools in the northeastern part of the

United States typically begin the week after Labor Day. Early September is a

time for students to get used to their new schedules, routines, new classmates, and

in our case, the technology they will use. The study began at the end of October

during a lull between the rush of a new school year and the rush of the holiday

season. The data collection portion of this study were completed by April 2011.

Data Collection Approaches

Student Information Systems

Confidential demographic data from the student information system were

collected, including the student ID, gender, and, if applicable, Individual

Education Plan (IEP) modifications. This data were used to verify that the

experimental and control groups both contain similar demographics and to ensure

that any mandated IEP modifications were adhered to during the study.

Surveys/Questionnaires

Students were given a survey from The Panhandle Educational

Consortium Student Technology Survey to collect data on their use of technology.

This survey is aligned with the National Educational Technology Standards for

Students (NETS-S) developed by the International Society for Technology in

Education (ISTE).

Another survey, the Student Opinion Scale measuring examinee test

motivation developed by Donna L. Sundre and Deborah L. Moore from the

Center for Assessment and Research Studies at James Madison University,

Harrisonburg, Virginia, was used at the end of the academic achievement posttest.

This test was developed to measure students' motivation to do well on exams. It

is a ten-question Likert scale questionnaire.

Pretests and Posttests

Achievement Tests

Bloom's Digital Taxonomy delineates six categories of learning:

remembering, understanding, applying, analyzing, evaluating, and creating.

While the first three are hierarchical, the first two do not require critical thinking.

They test for basic facts and understanding.

Student achievement, for the purposes of this study, will refer to the first

two stages of Bloom's Taxonomy on cognitive learning: a) remembering, which

entails recognizing, listing, describing, identifying, retrieving, naming, locating

and finding, and b) understanding, which involves interpreting, summarizing, inferring, paraphrasing, classifying, comparing, explaining, and exemplifying. In addition to academic testing assessments to determine if students achieve these stages, they can also be demonstrated through the use of technology. Remembering can be demonstrated through bullet pointing, highlighting, bookmarking, social networking, social bookmarking, favoriting/local bookmarking, and searching. Understanding can be demonstrated through advanced searchers, Boolean searches, blog journaling, categorizing, tagging, commenting, annotating, and subscribing.

Higher Order Thinking Tests

Higher order thinking skills involve the top four levels of Bloom's Taxonomy: a) applying: implementing, carrying out, using, executing (demonstrated through technology by running, loading, playing, operating, hacking, uploading, sharing, and editing); b) analyzing: comparing, organizing, deconstructing, attributing, outlining, finding, structuring, integrating (demonstrated through technology by mashing, linking, validating, reverse engineering, cracking, and media clipping); c) evaluating: checking, hypothesizing, critiquing, experimenting, judging, testing, detecting, monitoring (demonstrated through technology by blog commenting, reviewing, posting, moderating, collaborating, networking, refactoring, and testing); and d) creating: designing, constructing, planning, producing, inventing, devising, making

(demonstrated through technology by programming, filming, animating, blogging, video blogging, mixing, remixing, wiki-ing, publishing, video casting, podcasting, directing, and broadcasting). The last three are not hierarchical. However, all four of these require the higher order thinking skills characterizing critical thought (Bissell & Lemons, 2006). In other words, critical thinking requires higher order thinking skills as defined by the upper four levels of Bloom's Taxonomy. The evaluation of higher order thinking skills requires tests that measure critical thinking. The Cornell Critical Thinking Test X is designed for fourth through fourteenth grade students measuring the critical thinking skills of induction, deduction, observation, credibility, and assumptions. It is a 74-question test designed for one 50-minute period or the test may be split up into more than one session.

Data Analysis

For each of three research questions defined above, there is a dependent variable. For research question one, the dependent variable is student achievement, their knowledge of digital citizenship and Internet safety as determined by the pre and post content tests. For research question two, the dependent variable is higher order thinking skills as determined by the Cornell Critical Thinking Test. For research question three, the dependent variable is test motivation as determined by the Student Opinion Survey. Each of these

dependent variables is separate but related in that they will give an overall picture of the impact of using a VWLE in the classroom.

The main independent variable in this study, which applies to each of the research questions, is the section of the unit being taught. Other independent variables may come into play such as age, gender, and comfort with technology prior to receiving instruction. The researcher will look at and control for these confounding variables.

Both the control group and experimental took pretests and posttests for academic achievement and for higher order thinking skills. Posttest scores were then compared using two-tailed t-tests between the two groups to test the null hypothesis for each of the three research questions. For the first research, question subject matter achievement posttest score was the dependent variable, group as the independent variable, and subject matter achievement pretest score as the co-variant. For the second research question, critical thinking posttest scores were the dependent variable, group as the independent variable, and subject matter achievement pretest score as the co-variant.

Test motivation was being measured using a self-survey taken at the end of the content posttest. A two-tailed t-test analysis was used to compare the motivation of the two student groups. All data collected were recorded in Excel and analyzed using Statistical Package for the Social Sciences (SPSS).

<u>Human Subjects Considerations</u>

The participants include the researcher/teacher who is a high school technology teacher working with students in grades nine to twelve. All of the students included in the study are in the ninth grade. Students are of mixed gender, ethnicity, and all of sound mind and body. There is no substantial or probable risk to any person involved in this study. Consent was sought through the school district, parents of the students, and the students themselves. Parents were informed of the general purpose and timeline of the study at Back to School Night in September 2010 as well as through written information. Students were informed of the general purpose and timeline of the study during the school day and were provided with written information. Both parents and students were asked to sign consent forms. Any student who did not provide two signed consent forms simply remained in the class and was the recipient of the same instruction but was not given any of the pretests, posttests, or surveys. Copies of all written information provided and associated consent forms are included as appendices.

There are two ways that confidentiality was maintained in this study. Participating students were assigned confidential ID numbers. These ID numbers helped track students' pretest and posttest scores as well as the survey results. The list of students and the corresponding ID numbers were kept in a locked cabinet. The teacher/researcher who was a part of this study is self-identified and will be public from the onset so there are no pending issues of confidentiality.

Researcher's Qualifications

This researcher is uniquely qualified to conduct this study. She is a certified seventh-to-twelfth grade mathematics teacher with eighteen years of experience in the classroom and has been teaching computer science and computer applications for 14 of those 18 years. She is an active member in the International Society for Technology in Education (ISTE), Computer Science Teachers' Association (CTSA), and is a member of her school district's Technology Task Force, where she helps develop district-wide technology policies and grade level curriculum. She has also presented her curriculum on Digital Citizenship and Cyber safety at two regional conferences: LHRIC Tech Expo 2010 and LHRIC Tech Expo 2011. This researcher is also a member of Upsilon Pi Epsilon, the International Honor Society for the Computing and Information Disciplines as well as a former member of the Board of Advisors for Red Apple Digital, Inc., a technology company that designs Web-based educational tools. Additionally, this researcher has been integrated into the educational community in Second Life©, a well-known virtual world, and has been teaching inworld for ISTE since March 2010. Her current enrollment in the Doctorate of Professional Studies (DPS) program at Pace University has provided her with the foundational knowledge in research methods to conduct this study in a manner that is safe, ethical, and will serve to add to the wealth of knowledge in the education field. This researcher has also completed the National Institutes of

Health training course entitled Protecting Human Research Participants

(Appendix D).

CHAPTER IV

DATA ANALYSIS AND RESULTS

Introduction

The purpose of this study is to investigate whether or not the integration of

the virtual world learning environment (VWLE), Grand Central Grid, into a unit

designed to meet the federally mandated e-rate requirement to teach Internet

safety and digital citizenship, has a positive impact on student achievement,

higher order thinking skills, and test motivation. Several instruments were used to

measure the impact of integrating a VWLE on these three factors on both the

control and treatment groups. Pre and post unit tests were administered to the

students to measure changes in academic achievement. The Cornell Critical

Thinking Test was given in two parts as pretests and posttests to measure changes

in higher order thinking skills. At the end of the post unit test, the Student

Opinion Survey developed by researchers at James Madison University was

administered to measure the students' motivation to do well on the post unit test.

The results of this survey were compared between the control and the treatment

groups. All assessments and surveys have been previously established and

needed no further validation tests.

Descriptive Characteristics of Participants

This study took place in a small suburban school district in New York State. The participants were all ninth-grade students who were required to take the Computer Applications 9 course in which the Digital Citizenship and Cyber Safety curriculum was taught. This one-semester course runs concurrently with a Freshman Seminar course that is also required. Students are randomly placed in either the Freshman Seminar course or the Computer Applications 9 course first semester and then they switch the second semester. There were a total of 102 participants, 51 girls and 51 boys. The control group contained 25 girls and 26 boys; the treatment group contained 26 girls and 25 boys. Students in both the treatment group and the control group were administered the Panhandle Area Educational Consortium Student Technology Survey to establish that both groups had similar backgrounds both demographically and with respect to technology use (Appendix E).

Research Questions and Associated Hypotheses

This study set out to answer the following research questions and test the associated hypotheses:

1. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on student achievement?

H_0 = There is no statistically significant difference between the achievement of the treatment group from the control group.

H_1 = There is a statistically significant difference between the achievement of the treatment group from the control group.

2. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on higher order thinking skills?

H_0 = There is no statistically significant difference between the critical thinking skills of the treatment group from the control group.

H_1 = There is a statistically significant difference between the critical thinking skills of the treatment group from the control group.

3. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on test motivation?

H_0 = There is no statistically significant difference between the motivation of the treatment group from the control group.

H_1 = There is a statistically significant difference between the motivation of the treatment group from the control group.

Analysis of Data

This section will present an analysis of the data for each research question and present findings to either accept or reject the null hypothesis for each.

1. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on student achievement?

To test this hypothesis, an independent samples t-Test was used to assess the equality of the variances and equalities of the means between the treatment and control groups. The means for the academic achievement posttest for the treatment group was 76.51 for the treatment group and 79.47 for the control group on a scale of 0-100 as shown in Table 1.

Table 1

Academic Posttest Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Academic Post	Treatment	51	76.51	9.388	1.316
	Control	51	79.47	7.880	1.103

Levene's Test for Equality of the variances had an F-score of .869 with a significance of .353, indicating there is no statistically significant difference between the groups' variances as shown in Table 2.

Table 2

Academic Posttest Levene's Test for Equality of the Variances

	F	Sig.
Academic Post	.869	.353

Likewise, the t-Test for the equality of the means had a t-value of -1.724 and a

significance (two-tailed) of .088, revealing no statistically significant difference

between the groups' means as shown in Table 3.

Table 3

Academic Posttest Independent Samples T-Test

	t	df	Sig. (two-tailed)	Mean Diff.	Std. Error Diff.	Lower	Upper
						95% Confidence Interval of the Difference	
Cornell_Post Equal var. assumed	-1.724	100	.088	-2.961	1.717	-6.368	.477
Equal var. not assumed	-1.724	97.04	.088	-2.961	1.717	-6.369	.448

The result supports the acceptance of the null hypothesis. The treatment

intervention is an equally effective means of delivering the unit content taught.

   2. What impact does the integration of a VWLE into a unit designed to

meet the federally mandated e-rate requirement to teach Internet safety and digital

citizenship have on higher order thinking skills?

   To test this hypothesis, an independent samples t-Test was used again to

assess the equality of the variances and equalities of the means between the

treatment and control groups. The means for the Cornell Critical Thinking

posttest for the treatment group was 24.922 for the treatment group and 26.431 for

the control group on a scale of 0-50 as shown in Table 4.

Table 4

Cornell Posttest Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Cornell Post	Treatment	51	24.922	11.9144	1.6684
	Control	51	26.431	9.9262	1.3900

Levene's Test for Equality of the variances had an F-score of .597 with a

significance of .442, indicating there is no statistically significant difference

between the groups' variances as shown in Table 5.

Table 5

Cornell Posttest Levene's Test for Equality of the Variances

	F	Sig.
Cornell_Post	.597	.442

Likewise, the t-Test for the equality of the means had a t-value of -.695 and a

significance (two-tailed) of .488, revealing no statistically significant difference

between the groups' means as shown in Table 6.

Table 6

Cornell Posttest Independent Samples T-Test

						95% Confidence Interval of the Difference	
						t-test for Equality of Means	
	t	df	Sig. (two-tailed)	Mean Diff.	Std. Error Diff.	Lower	Upper
Cornell_Post Equal var. assumed	-.695	100	.488	-1.5098	2.1715	-5.8180	2.7984
Equal var. not assumed	-.695	96.8	.489	-1.5098	2.1715	-5.8197	2.8001

The result supports the acceptance of the null hypothesis. The treatment was equally as effective at developing critical thinking skills as the control group.

3. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on student motivation?

To test this hypothesis, an independent samples t-Test was used to assess the equality of the variances and equalities of the means between the treatment and control groups. The means for the motivation survey for the treatment group was 10.16 for the treatment group and 9.85 for the control group on a scale of -20 to 20 as shown in Table 7.

Table 7

Motivation Survey Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Motivation Survey	Treatment	51	10.16	5.278	.739
	Control	51	9.86	6.299	.882

Levene's Test for Equality of the variances had an F-score of .591 with a

significance of .444, indicating there is no statistically significant difference

between the groups' variances as shown in Table 8.

Table 8

Motivation Survey Levene's Test for Equality of the Variances

	F	Sig.
Motivation Survey	.591	.444

Likewise, the t-Test for the equality of the means had a t-value of .256 and a

significance (two-tailed) of .799, revealing no statistically significant difference

between the groups' means as shown in Table 9.

Table 9

Motivation Survey Independent Samples T-Test

						95% Confidence Interval of the Difference	
			Sig. (two-tailed)	Mean Diff.	Std. Error Diff.		
	t	df				Lower	Upper
Motivation Survey							
Equal var. assumed	.256	100	.799	-1.5098	.294	-1.989	2.577
	.256	97.02	.799	-1.5098	.294	-1.990	2.578
Equal var. not assumed							

The result supports the acceptance of the null hypothesis. The two groups were equally motivated to do well on the academic achievement posttest.

Correlation Analyses

The variables were then correlated to determine if there are any bivariate relationships among them as shown in Table 10.

Table 10

Correlations Among Dependent Variables and Gender[a]

		Motivation	Academic Post	Cornell Post	Gender
Motivation	Pearson Correlation	1	.331[**]	.191	-.182
	Sig. (2-tailed)		.001	.055	.067
	Sum of Squares and Cross-products	3378.990	1694.010	1218.324	-53.500
	Covariance	33.445	16.772	12.063	-.530
Academic Post	Pearson Correlation	.331[**]	1	.607[**]	-.195[*]
	Sig. (2-tailed)	.001		.000	.050
	Sum of Squares and Cross-products	1694.010	7744.990	5875.676	-86.500
	Covariance	16.772	76.683	58.175	-.856
Cornell Post	Pearson Correlation	.191	.607[**]	1	-.125
	Sig. (2-tailed)	.055	.000		.210
	Sum of Squares and Cross-products	1218.324	5875.676	12082.324	-69.500
	Covariance	12.063	58.175	119.627	-.688
Gender	Pearson Correlation	-.182	-.195[*]	-.125	1
	Sig. (2-tailed)	.067	.050	.210	
	Sum of Squares and Cross-products	-53.500	-86.500	-69.500	25.500
	Covariance	-.530	-.856	-.688	.252

[a]n = 102
* $p < .05$, **$p < .01$

The analysis showed a correlation between motivation and the academic posttest with r = .331, Sig. (one-tailed) = .000. However, since there was no statistically significant difference in the means of the motivation between the two groups, it is not possible to establish the VWLE as a factor in motivating the students to do well on the unit test. Scores on the Cornell Critical Thinking posttest were also highly correlated with scores on the academic posttest with r = .607, Sig (one-tailed) = .000, indicating that students with higher critical thinking skills

performed better on the academic test than those with lower critical thinking skills. Again, however, since there was no statistically significant difference in the means of the Cornell Critical Thinking posttest scores between the two groups and no statistically significant difference between the means of the academic posttest of the two groups, it is not possible to establish the VWLE as a factor in this correlational relationship.

Summary of Data

This study investigated whether or not the integration of the virtual world learning environment (VWLE), Grand Central Grid, into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship has a positive impact on student achievement, higher order thinking skills, and student motivation. This study was conducted in a small suburban New York high school involving 102 ninth-grade students, 51 in each of the treatment and control groups, with 50% of the students of each gender in each group. Students were randomly assigned to either the control or treatment groups. Pretests and posttests on academic content knowledge and critical thinking skills were administered and a self-motivation survey was given as measurement tools to answer the research questions. Levene's tests and independent samples t-Tests were used to assess the equality of the variances and equalities of the means between the treatment and control groups. A correlational analysis was conducted to find any relationships among the variables. For the three research questions,

the data supported the acceptance of the null hypothesis. The data showed that the virtual world learning environment was as effective as the traditional classroom with respect to student achievement, higher order thinking skills, and motivation. The correlational analyses showed relationships between motivation and academic achievement on the posttest and between the critical thinking posttest and academic achievement posttest. The means for each of these tests did not show any statistically significant difference between the two groups; therefore, it is not possible to attribute the correlation to the different learning environments.

Students' Work Inworld

One inworld activity the students in the treatment group engaged in was a role-playing game. Students paired up and were given fictional character roles. The purpose of the game was to give the students practice interacting safely with online strangers. The object of the game was two-fold. With their partner as stranger, the students had to simultaneously try to elicit the stranger's character identity while at the same time creatively avoiding answering those same questions from their partner. An example of this is from one pair of students, whose characters are Stephanie and Amanda22. A portion of their chat log is:

Amanda22: hi how are you

Stephanie: good, how are you?

Amanda22: good what are you doing

Stephanie nothing much

Amanda222: that's good what is your name

Stephanie: Stephanie, what is yours?

Amanda22: Amanda how old are you

Stephanie: uhm old enough I guess

Amanda22: why can't you tell me your exact age im just wondering

Stephanie: I'd rather not

Amanda: anyways are you from earth or mars

Stephanie: I'm pretty sure I'm from earth

Amanda22: o okay have we ever met

Stephanie: Doubt it

Amanda22: What heritage are you

Stephanie: Well I live in America

Amanda22: me too what do you like to do in your free time

Stephanie: Just hang with some friends, how about you?

Amanda22: the same and I like to meet other ppl I don't know

Stephanie: Oh that's cool

Amanda22: yup so hows are your parents? do you have any sibblings?

Stephanie: they're good and yeah

Amanda 22: what are their names

Stephanie: I'd rather not share that, but they're nice

Amanda22: why don't you want to share that with me? do you think im

going to tell anyone that information

Stephanie: I just don't know who you are, and I don't know you too well.

Another activity that was done inworld by the treatment group was the

creation of their public service announcements. These movies created inworld,

machinimas, were recorded using screen capture software. Screen shots from
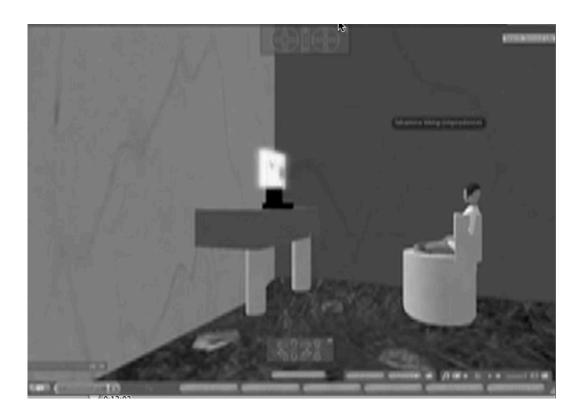
these videos follow:

Figure 1: Screenshot from public service announcement TMI

Figure 2: Screenshot 1 from public service announcement Showing
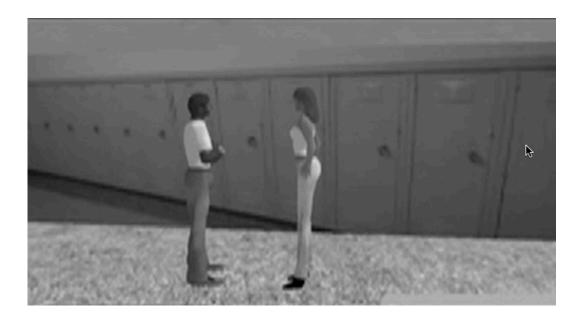

Figure 3: Screenshot 2 from public service announcement Showing

CHAPTER V

FINDINGS, CONCLUSIONS, AND IMPLICATIONS

<u>Introduction</u>

This study was designed to address three research questions. This chapter will give a summary of this study, discuss the findings of the study, draw conclusions, discuss implications, and make recommendations for future research.

<u>Summary of the Study</u>

This researcher investigated whether or not the integration of the virtual world learning environment (VWLE), Grand Central Grid, into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship, has a positive impact on student achievement, higher order thinking skills, and student motivation. This study focused on the following research questions:

1. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on student achievement?

2. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on higher order thinking skills?

3. What impact does the integration of a VWLE into a unit designed to meet the federally mandated e-rate requirement to teach Internet safety and digital citizenship have on test motivation?

This action research study took place in the researcher's own classroom in a small suburban school district in New York. The subjects were 102 ninth-grade students, 51 in the control group and 51 in the treatment group. The students were assigned to the groups by randomized class scheduling for this required course. Letters explaining the study as well as permission slips to participate in the data collection were distributed and collected from the students and their parents. The Panhandle Consortium Technology Survey was given to all students prior to each group's participation in the study to establish the equality of the groups' technology background going into the study. The four-section Cornell Test of Critical Thinking was divided into two parts, and given as pretests and posttests for higher order thinking skills, and pre and post academic content tests were given to assess achievement. A self-motivation survey was given to measure motivation to do well on the post unit test. Data collected from each group were analyzed using Excel and SPSS. Two tailed t-tests for the means of each of the posttest scores as well as the motivation survey were calculated for

each group. Correlational relationships between independent and dependent variables were calculated.

Findings

The means of the posttest for each of the groups' academic tests, critical thinking tests, and motivation survey were calculated. In each case the t-test for the equality of the means revealed no statistically significant difference between the groups' means on the different assessments. The integration of the virtual world was found to be as effective as traditional class methodologies and provides an alternate means of delivery of the content. It is important to note, however, that the motivation measurement used was for motivation to do well on the unit test, not on motivation to learn the curriculum.

Correlational analysis between the variables revealed two statistically significant relationships. A strong correlational relationship existed between motivation and academic posttest scores. However, since there was no statistically significant relationship between the means of the two groups' scores, the relationship cannot be attributed to the integration of the virtual world. Likewise, a strong correlational relationship existed between the Cornell Test of Critical Thinking tests and the academic posttests. Again, however, since no statistically significant relationship was found between the means of the two groups' scores, the relationship cannot be attributed to the integration of the virtual world.

<u>Conclusions</u>

Although the differences in the results of the achievement, higher order thinking skills, and motivation assessments between the two groups were not statistically significant, they are consistent with other research on K-12 online learning (Figlio, Rush, & Yin, 2010; Harvey-Woodall, 2009; O'Dwyer, Carey, & Klieman, 2007).

There are several possible explanations as to why the two groups' results were not statistically different across the board. One significant possibility is the desensitization to the digital medium. Teens today spend 10.75 hours per day, including multitasking with media. According to the Pew Research Group's Pew Internet & American Life Project (Lenhart, Purcell, Smith, & Zickuhr, 2010), 93% of youths age 8-17 access the Internet. More than 73% of teens have profiles on social networking sites, and 38% of the online teens are sharing content, such as photos, videos, artwork, or stories. Eighty percent of all teens have a console gaming system, and 51% have a portable gaming system. However, only eight percent of teens go into virtual worlds, suggesting they are not stimulating enough environments to capture their attention away from the social networking and game playing sites.

Another possibility as to why the virtual world did not show increased scores on the posttests and surveys is the inherent problems that accompany virtual worlds, such as system requirements, learning curves, and technical

failures (Wiecha, Heyden, Sternthal, & Merialdi, 2010). The software requires downloading and significant system requirements for bandwidth, video cards, and processing power. Students in the treatment group frequently had to download and reconfigure the software to access the correct grid. In addition, the learning curve for navigation and interaction in a virtual world is steep and the concentration needed for content learning can be lost in the process of learning to navigate the virtual environment. Students spent two weeks of class time learning how to walk, fly, set up their avatars, and build. Finally, the likelihood of technical problems and failures is high, and, in fact, did occur regularly during the study. The server crashed on an average of one time per week, with downtime being approximately one hour, and lag or latency on Grand Central Grid was common. These problems can individually and collectively have an impact on the learning process.

Not measured as part of the study, but important to note, are this researcher's informal observations during the study. Students in the treatment group appeared to be more engaged, meaning they were not only focused on the task, but also committed to successful completion of the assignments. This was demonstrated by the enthusiasm with which they interacted with each other when working on an assignment and the quality of work that was produced. Students were on task, and interested in the subject. They looked forward to coming to class and were more immersed in the content since they were interacting with it in both the real and virtual worlds. Increased interactions between students who

typically did not talk with each other were noticed. Students engaged in conversations related to the topic that were not heard in the control group.

These informal observations are congruent with current research. In a study to measure user attitude toward using Second Life© and to explain the different types of motivational determinants, such as intrinsic and extrinsic, of Second Life© use showed that users' extrinsic and intrinsic motivations are significantly associated with their motivation to use Second Life©. The experience was enjoyable, intrinsically rewarding, and eventually increased the intention of use (Shin, 2009). A project called 3-D Worlds, for 60 autistic students from 6 high schools in New York City has three goals: a) applying functional living skills, b) increasing communication, and c) expanding social skills. The project uses Second Life© where the district designed a space for the students to communicate and develop social and practical living skills (Stroud, 2009). To develop their social skills, the students meet weekly for a community day to interact with one another. Students communicated with other students they did not know, some using text-based chatting, but most using voice communication.

Implications

President Barack Obama's fiscal year 2012 budget request for the Department of Education calls for a) $372 million for the Expanding Educational Options programs, which will support districts implementing various educational

options for students, including online learning; b) $835 million for the Effective Teaching and Learning for a Complete Education programs, which will support states and districts to identify how best to meet the academic needs of their students and teachers through innovative uses of technology; and c) $2.5 billion for Effective Teachers and Leaders formula grants, which will support professional development for teachers to use technology effectively in the classroom (Obama, 2011). Billions of dollars are being spent on innovative uses of technology and online learning programs, and it is important that the dollars are spent where they will have the most impact on the greatest number of students.

The integration of Grand Central Grid into the Internet safety and digital citizenship unit was found to be equally as effective at increasing academic achievement, higher order thinking skills, and motivation to do well on the test as not integrating it and is a viable alternative. If these are the only areas of concern for a school district, then investment dollars might be better spent on other areas of technology integration and associated professional development where the technology has a greater impact on these factors. However, if a school district is also concerned about motivation, engagement, interest, and/or social development, then there is a large body of evidence that virtual worlds can meet that need, and investing in those environments would be money well spent (Sheehy, 2007; Shin, 2009; Stroud, 2009).

Further study into the integration of virtual worlds into K-12 curricula should be done on the core curricula subject areas of math, science, English, and social studies. It is important to see how well virtual world technology improves these essential areas on which schools are typically rated. The accessibility to successful alternate teaching environments would be very helpful to schools, especially those with lower achieving or unmotivated students. Longitudinal studies should also be conducted to determine how well the students retain information after the integration of a virtual world into the curricula compared to traditional classroom teaching.

Another recommendation for future research would be to incorporate student feedback surveys, interviews, and observations. While this study provided a factual quantitative analysis of the impact integrating virtual worlds into a curriculum has on a student achievement, higher order thinking skills, and test motivation, there are many other facets of student learning and growth that cannot be summed up quantitatively, such as interest, engagement, social skill development, immersion in the content, and perception of learning.

Finally, qualitative studies measuring the relationship between a student and his/her avatar and social skill development would be beneficial to teachers, guidance counselors, and school psychologists. Anecdotal evidence strongly suggests positive social skill development in virtual worlds, especially for special

needs students. Stronger evidence of this could be a catalyst for incorporating

virtual worlds into students' programs.

BIBLIOGAPHY

About Global Kids. (2011).   Retrieved May 15, 2011, from
http://www.globalkids.org/#/about-global-kids

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning,
teaching and assessing: A revision of Bloom's taxonomy of educational
objectives* (Complete ed.). New York: Longman.

Bandura, A. (1977). *Social learning theory*. New York: General Learning Press.

Barron, A. E., Dawson, K., & Yendol-Hoppey, D. (2009). Peer coaching and
technology integration: An evaluation of the Microsoft peer coaching
program. *Mentoring & Tutoring: Partnership in Learning, 17*(1), 83-102.

Beisser, S. R. (2005). An Examination of Gender Differences in Elementary
Constructionist Classrooms Using Lego/Logo Instruction.. *Computers in
the Schools, 22*(3/4), 7-19.

Bell, M. (2001). Online role-play: Anonymity, engagement and risk. *Education
Media International, 38*(4), 251-260.

Beyer, B. K. (1988). *Developing thinking skills program*. Boston: Allyn & Bacon.

Bielefeldt, T. (2005). Computers and student learning: Interpreting the
multivariate analysis of PISA 2000. *Journal of Research on Technology in
Education, 37*(4), 339-347.

Bissell, A. N., & Lemons, P. P. (2006). A new method for assessing critical
thinking in the classroom. *BioScience, 56*(1), 66-72.

Blaik-Hourani, R. (2011). Constructivism and Revitalizing Social Studies. [Case
Study]. *Society for History Education, 44*, 227-249.

Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R.
(1956). *Taxonomy of educational objectives - The classification of
educational goals, handbook I - cognitive domain*. New York: David
McKay.

Bonk, C. J., & Reynolds, T. H. (1996). Learner-centered web instruction for higher order thinking, teamwork, and apprenticeship. In B. H. Kahn (Ed.), *Web-Based Instruction* (pp. 167-178). Englewood Cliffs, NJ: Educational Technology Publications.

Boster, F. J., Meyer, G. S., Roberto, A. J., & Inge, C. C. (2002). *A report on the effect of the unitedstreaming tm application on educational performance*: Cometrika, Inc., Baseline Research LLC, Longwood University.

Boster, F. J., Meyer, G. S., Roberto, A. J., Lindsey, L., Smith, R., Strom, R., et al. (2004). *A report on the effect of the unitedstreaming tm application on educational erformance: The 2004 Los Angeles Unified School District mathematics evaluation*: Cometrika, Inc., Baseline Research, LLC, Longwood University.

Bradshaw, A. C., Bishop, J. L., Gens, L. S., Miller, S. L., & Rogers, M. A. (2002). The relationship of the world wide web to thinking skills. *Education Media International, 39*(3/4), 275-284.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Bruckman, A. S. (1997). *MOOSE crossing: Construction, community, and learning in a networked virtual world for kids.* Unpublished Dissertation, Massachusettes Institute of Technology, Cambridge.

Burkhardt, J. M., Kinnie, J., & Cournoyer, C. M. (2008). Information Literacy Successes Compared: Online vs. Face to Face. *Journal of Library Administration, 48*(3/4), 379-389.

Campbell, M. L., & Melching, L. C. (2009). Small group computer-assisted instruction with SMART Board technology: An investigation of observational and incidental learning of nontarget information. *Remedial and Special Education, 30*(1), 47-57.

The CEO Forum technology and readiness report: Key building blocks for student achievement in the 21st century. (2001). CEO Forum on Education and Technology.

Cheal, C. (2007). Second Life: Hype or hyperlearning? *On the Horizon, 15*(4), 204-210.

Childress, M. D., & Braswell, R. (2006). Using massively multiplayer online role-playing games for online learning. *Distance Education, 27*(2), 187-196.

Coleman-Martin, M. B., Heller, K. W., Cihak, D. F., & Irvine, K. L. (2005). Using computer-assisted instruction and the nonverbal reading approach to teach word identification. *Focus on Autism and Other Developmental Disabilities, 20*(2), 80-90.

Coley, R., Cradler, J., & Engle, P. (1997). *Computers and classrooms: The status of technology in U.S. schools*. Princeton, NJ: Educational Testing Service, Policy Invromation Center.

Darvin, J. (2006). Real-world cognition doesn't end when the bell rings: Literacy instruction strategies derived from situated cognition research. [Article]. *Journal of Adolescent & Adult Literacy, 49*(5), 398-407.

De Freitas, S., & Yapp, C. (2005). *Personalizing learning in the 21st century*. Stafford, UK: Network Education Press.

Ennis, R. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership, 43*(2), 45-48.

Eshach, H. (2010). An Analysis of Conceptual Flow Patterns and Structures in the Physics Classroom. *International Journal of Science Education, 32*(4), 451-477.

Esteves, M., Fonseca, B., Morgado, L., & Martins, P. (2009). Using Second Life for problem based learning in computer science programming. *Journal of Virtual Worlds Research, 2*(1), 4-25.

Field, J. (2007). Looking outwards, not inwards. *ELT Journal, 61*(1), 30-38.

Figlio, D. N., Rush, M., & Yin, L. (2010). Is it live or is it internet? Experimental estimates of the effects of online instruction on student learning. National Bureau of Economic Research.

Fry, S. W., & Gosky, R. (2007). Supporting social stuies reading comprehension with an electronic pop-up dictionary. *Journal of Research on Technology in Education, 40*(2), 127-139.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *The American Journal of Distance Education, 15*(1), 7-23.

Global Kids' Online Leadership Program. (2011).   Retrieved May 15, 2011, from http://www.olpglobalkids.org/virtual_worlds/

Gomez, M. L., Schieble, M., Curwood, J. S., & Hassett, D. (2010). Technology, learning and instruction: distributed cognition in the secondary English classroom. *Literacy, 44*(1), 20-27.

Hackbarth, S. (1996). Web-based learning activities for children. In B. H. Kahn (Ed.), *Web-based instruction* (pp. 191-212). Englewood Cliffs, NJ: Educational Technology Publications.

Harvey-Woodall, A. (2009). Integrating technology into the classroom: How does it impact student achievement. Jackson State University.

Haste, H. (2009). What is 'competence' and how should education incorporate new technology's tools to generate 'competent civic agents'. [Article]. *Curriculum Journal, 20*(3), 207-223.

Heinmann, M., Nelson, K., Thus, T., & Gillberg, C. (1995). Increasing reading and communication skills in children with autism through an interactive multimedia computer program. *Journal of Autism and Developmental Disorders, 25*(5), 459-480.

Honey, M., Culp, K. M., & Karrigg, F. (1999). *Perspectives on technology and education research: Lessons from the past and present*. New York: Center for Children and Technology.

Hopson, M. H., Simms, R. L., & Knezek, G. A. (2001). Using a technology-enriched environment to improve higher-order thinking skills. *Journal of Research on Technology in Education, 34*(2), 109-119.

Hudson, K., & Degast-Kennedy, K. (2009). Canadian border simulation at Loyalist College. *Journal of Virtual Worlds Research, 2*(1), 4-11.

Internet safety policies and CIPA: An e-rate primer for schools and libraries. (n.d.).   Retrieved June 6, 2010, from http://www.e-ratecentral.com/CIPA/cipa_policy_primer.pdf

ISTE. (2007). National Educational Technology Standards for Students (NET-S).

Jennings, N., & Collins, C. (2007). Virtual or virtually u: Educational institutions in Second Life. *International Journal of Scoial Sciences, 2*(3), 180-186.

Ketelhut, D. J., Nelson, B. C., Clarke, J., & Dede, C. (2010). A multi-user virtual environment for building and assessing higher order inquiry skills in science. *British Journal of Educational Technology, 41*(1), 56-68.

Kim, Y., & Baylor, A. (2006). A Social-Cognitive Framework for Pedagogical Agents as Learning Companions. [Article]. *Educational Technology Research & Development, 54*(6), 569-596.

Kingsley, K. V., & Boone, R. (2008). Effects of multimedia software on achievement of middle school students in an American history class. *Journal of Research on Technology in Education, 41*(2), 203-221.

Lamb, A., & Johnson, L. (2009). The potential, the pitfalls, and the promise of multi-user virtual environments: Getting a second life. *Teacher Librarian, 36*(4), 68-72.

Lave, J. (1993). Situated learning in communities of practice. In L. B. Resnick, J. M. Levine, & S.D.Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 63-84). Washington, DC: American Psychological Association.

Lebens, M., Graff, M., & Mayer, P. (2009). Access, attitudes and the digital divide: children's attitudes towards computers in a technology-rich environment. [Article]. *Educational Media International, 46*(3), 255-266.

Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010). *Social media & Internet use among teens and young adults*: Pew Research Center.

Lim, K. Y. T. (2009). The six learnings of Second LIfe: A framework for designing curricular interventions inworld. *Journal of Virtual Worlds Research, 2*(1), 3-11.

Marsh, J. (2011). Young children's literacy practices in a virtual world: Establishing an online interaction order. *Reading Research Quarterly, 46*(2), 101-118.

Martin, W., Strother, S., Beglau, M., Bates, L., Reitzes, T., & Culp, K. M. (2010). Connecting Instructional Technology Professional Development to Teacher and Student Outcomes. [Article]. *Journal of Research on Technology in Education, 43*(1), 53-74.

Martindale, T., Pearson, C., Curda, L. K., & Pilcher, J. (2005). Effects of an online instructional application on reading and mathematics standardized test scores. *Journal of Research on Technology in Education, 37*(4), 349-360.

Matzen, N., & Edmunds, J. (2007). Technology as a catalyst for change: The role of professional development. *Journal of Research on Technology in Education, 39*(4), 417-430.

Maushak, J. J., & Ou, C. (2007). Using synchronous communication to facilitate graduate students' online collaboration. *The Quarterly Review of Distance Education, 8*(2), 161-169.

McMahon, G. (2009). Critical Thinking and ICT Integration in a Western Australian Secondary School. [Article]. *Journal of Educational Technology & Society, 12*(4), 269-281.

Meyer, K. A. (2003). The role of time and higher order thinking. *Journal of Asynchronous Learning Networks, 7*(3), 55-65.

Mills, G. E. (2011). *Action research: A guide for the teacher researcher* (Fourth ed.). Boston: Pearson Education, Inc.

Mouza, C. (2008). Learning with Laptops: Implementation and outcomes in an urban, under-privileged school. *Journal of Research on Technology in Education, 40*(4), 447-472.

Neo, M., & Neo, T.-K. (2009). Engaging students in multimedia-mediated Constructivist learning – Students' perceptions. *Educational Technology & Society, 12*(2), 254-266.

The New York State District Report Card, Valhalla Union Free School District. (2010). New York State.

Ng, W., & Nicholas, H. (2007). Conceptualising the use of online technologies for gifted secondary students. *Roeper Review, 29*(3), 190-196.

Nicholas, H., & Ng, W. (2009). Engaging secondary school students in extended and open learning supported by online technologies. *Journal of Research on Technology in Education, 41*(3), 305-328.

No Child Left Behind Act of 2002. (2002). Retrieved July 28, 2010 from http://www2.ed.gov/policy/elsec/leg/esea02/107-110.pdf

O'Dwyer, L. M., Carey, R., & Klieman, G. (2007). A study of the effectiveness of the Louisiana algebra I online course. *Journal of Research on Technology in Education, 39*(3), 289-306.

Obama, B. (2011). *President's FY 2012 budget request for the U.S. Department of Education*. Retrieved April 26, 2011 from http://www2.ed.gov/about/overview/budget/budget12/index.html?src=ct.

Page, M. S. (2002). Technology-enriched classrooms: Effects on Students of low socioeconomic status. *Journal of Research on Technology in Education, 34*(4), 389-409.

Papert, S. (1991). Situating constructionism. In I. Harel & S. Papert (Eds.), *Constructionism: Research Reports and Essays* (pp. 1-12). Norwood, NJ: Ablex.

Picciano, A. G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal for Asynchronous learning networks, 6*(1), 21-40.

Pogrow, S. (1996). Using computers and other visual technology to combine process and content. In A. Costa & R. Liebman (Eds.), *When process is content: Toward renaissance learning*. Thousand Oaks, CA: Corwin Press.

Protecting Children in the 21st Century Act(2007).

Putnam, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher, 29*(1), 4-15.

Qiyun, W., Huay Lit, W., & Jianhua, Z. (2009). Investigating critical thinking and knowledge construction in an interactive learning environment. [Article]. *Interactive Learning Environments, 17*(1), 95-104.

Rockman, S., & Sloan, K. R. (1995). *Assessing the growth: The buddy project evaluation*. San Francisco: Authors.

Salmon, G. (1993). *Distributed cognition: Psychological and educational considerations*. Cambridge, UK: Cambridge University Press.

Sanchez, J. (2009). Barriers to student learning in Second Life. *Library Technology Reports, February/March*, 29-34.

Seymour, N. E., Gallagher, A. G., Roma, S. A., O'Brien, M. K., Bansal, V. K., Anderson, D. K., et al. (2002). Virtual reality training improves operating room performance: Results of a randomized double-blinded study. *Annals of Surgery, 236*(4), 458-464.

Sheehy, P. (2007). *Virtual simulations: Another dimension of learning.* Paper presented at the LHRIC Tech Expo 2007, Briarcliff, New York.

Shin, D. H. (2009). The evaluation of user experience of the virtual world in relation to extrinsic and intrinsic motivation. *International Journal of Human-Computer Interaction, 25*(6), 530-553.

Sims, R. (2009). Rethinking (e)learning: A manifesto for connected generations. *Distance Education, 20*(2), 152-164.

SimTeach. (2011).   Retrieved February 26, 2011, from http://www.simteach.com/wiki/index.php?title=Institutions_and_Organizations_in_SL#UNIVERSITIES.2C_COLLEGES_.26_SCHOOLS

Stroud, S. (2009). A new way forward. [Article]. *T H E Journal, 36*(10), 18-22.

Summers, J., Waigandt, A., & Whittaker, T. (2005). A Comparison of Student Achievement and Satisfaction in an Online Versus a Traditional Face-to-Face Statistics Class. *Innovative Higher Education, 29*(3), 233-250.

Suthers, D. D., Vatrapu, R., Medina, R., Joseph, S., & Dwyer, N. (2008). Beyond threaded discussion: Representational guidance in asynchronous collaborative learning environments. *Computers & Education, 50*(4), 1103-1127.

Thelk, A. D., Sundre, D. L., Horst, S. J., & Finney, S. J. (2009). Motivation Matters: Using the Student Opinion Scale to Make Valid Inferences About Student Performance. *JGE: The Journal of General Education, 58*(3), 129-151.

Thirunarayanan, M. O., & Perez-Prado, A. (2002). Comparing web-based and classroom-based learning: A quantitative study. *Journal of Research on Technology in Education, 34*(2), 131-137.

Universal Service Administrative Company. (2010).   Retrieved July 28, 2010, from http://www.usac.org/sl/about/overview-program.aspx

Vogel, J. J., Greenwood-Ericksen, A., Cannon-Bowers, J., & Bowers, C. A. (2006). Using virtual reality with and without gaming attributes for academic achievement. *Journal for Research on Technology in Education, 39*(1), 105-118.

Wagner, C. (2008). Teaching tip: Learning experience with virtual worlds. *Journal of Information Systems Education, 19*(3), 263-266.

Weinreich, D. M., & Tompkins, C. J. (2006). Learning objectives and gerontology. *Educational Gerontology, 32*(9), 785-799.

Wenger, E. (1998). *Communities of practice: Learning, meaning and identity.* New York: Cambridge University Press.

West-Burnham, J. (2005). Understanding personalization. In J. West-Burnham & M. Coates (Eds.), *Personalizing Learning*. Stafford, UK: Network Educational Press.

Wiecha, J., Heyden, R., Sternthal, E., & Merialdi, M. (2010). Learning in a virtual world: Experience with using Second Life for medical education. *Journal of Medical Internet Research, 12*(1), e1.

Williams, C., Wright, B., Callighan, G., & Coughlan, B. (2002). Do children with autism learn to read more readily by computer assisted instruction or traditional book methods? *Autism, 6*, 71-91.

Wishart, J. J., Oades, C. E., & Morris, M. (2007). Using online role play to teach internet safety awareness. *Computers & Education, 48*, 40-473.

Wittwer, J., & Senkbeil, M. (2008). Is students' computer use at home related to their mathematical performance at school? *Computers & Education, 50*(4), 1558-1571.

Zohar, A., & Dori, Y. J. (2003). Higher order thinking skills and low-achieving students: Are they mutually exclusive? *The Journal of the Learning Sciences, 12*(2), 145-181.

APPENDIX A

TABLE 1

USES OF SECOND LIFE©

IGI GLOBAL

Organization	Application	Source
1. Replicating Reality – Utilizing Alternative Space for Existing Activities		
Appalachian State University and Clemson University	3-D virtual world created to improve online learning for master's degree students.	"ASU Partners", 2008
Ball State University – Middletown Island	Intellagirl conducts freshman English-composition class.	Foster, 2007b
Duke University's Fuqua School of Business	Partnering with ProtonMedia to create 3-D spaces for education or "telepresence portal."	"Bringing Virtual Worlds," 2008
INSEAD - France and Singapore	School/library is open-air building with auditorium seating 36. Clickable computer screens provide access to other web pages and library offers hot tea. Research lab provides notecards to describe research and request consent. Public space/beach provides clickable kiosks to obtain more information about INSEAD, space for reflecting and conversing, bar with drinks available, and listening to radio.	Jennings & Collins, 2007
Princeton University	Created island that includes lecture hall, art museum, and performance location.	Graves, 2008
2. Developing Novel Space – Conducting Activities Unique to Virtual World		
Immersive Education project - Boston College, Harvard University, Amherst College, Columbia University, Massachusetts Institute of Technology, Sweden's Royal Institute of Technology, Japan's University of Aizu, the Israeli Association of Grid Technologies, National Aeronautics and Space Administration (NASA), Sun Microsystems, the City of Boston, and the New Media Consortium	Created tours inside Egyptian tomb, created interactive lessons (Croquet and Project Wonderland), developed park and replica of Boston's subway system to tour city's neighborhoods, developed Restaurant Game to help waiters/waitresses acquire skills/training through simulations of restaurant experiences.	Foster, 2007a
Indiana University	Created a Virtual Solar System project for astronomy undergraduate course.	Barab et al., 2000
Lehigh Carbon Community College and adjunct at DeSales University (professor at both)	Professor created Literature Alive – provides guided tours of famous literary locations (e.g., Dante's Inferno).	Foster, 2007b
Vassar College – Vassar Island	Re-creation of Sistine Chapel – visitors can fly to ceiling or view tapestries designed for the walls.	Foster, 2007b

Table 1. continued

3. Replicating Reality and Developing Novel Space		
Boise State University	EDTech island utilized for teaching educational games and providing students testing area (building own objects), includes information center, and condominium.	Goral, 2008
Bowling Green State, Ohio	Use virtual campus for teaching, research, office hours (space pods situated into mountain sides), exhibiting art and music, and presentations by guest speakers. In process of creating a writing center ran by graduate students.	Goral, 2008
Bradley University	Students have conducted analyses of avatar fans of musicians that conduct performances in Second Life, as well as other topics such as online hackers.	Foster, 2007b
Georgia Institute of Technology	Augmented Reality lab created software to associate actual physical spaces with virtual – creating ability to combine video feeds from the real world with Second Life avatars.	Goral, 2008
Johnson & Wales University	Created a Virtual Morocco in conjunction with Ministry of Tourism of Morocco. Includes monuments and opportunities to learn about Moroccan culture. Students created and developed plans and prototypes, and worked with individuals from other countries on project. Virtual BLAST (Balloon-borne Large-Aperture Submillimeter Telescope) brought attention to scientific ballooning projects by flying over the Second Life main grid and stopping to visit various educational and scientific locations. Entrepreneurship students create business plans and develop prototypes in Second Life.	Mason , 2007
Massachusetts Institute of Technology	75% of island dedicated to student projects, remainder replicates physical campus (including outdoor theater area). Avatars can address a crowd with a megaphone and determine average viewpoint by avatars moving to right or left of line on platform. Sponsored contest for students to design dormitories.	Foster, 2007b
Montclair State University	Use mountain sides for displaying syllabus and spheres for deadlines, Literature Alive spots include Willow Springs and encountering evil in Young Goodman Brown, and provide sun bathing area as well as covered deck near lake.	Foster, 2007b

Table 1. continued

Ohio University or Ohio University Without Boundaries	Entry way provides historical information and historic replicas of campus (along with Standards and Privacy Statement). Locations include Welcome Center (video display of learning intiatives), Art and Music Center, Classroom and Meeting Center (with seating capacity of 25), Learning Center (displaying e-learning activities), Student Center (coffee shop, stage which includes microphone, pool tables, kiosk publicizing real-world entertainment activities, student video lounge, vending machines, and reading space), Featured Games (simulation of fast food restaurant – avatar selects food to learn nutritional value), Stocker Center and Sandbox (building objects by permission). Collaborated with The Princeton Review for SAT preparation.	Jennings & Collins, 2007; Goral, 2008
Simon Fraser University	Professor produced films for posting on YouTube and created cartoons for first-year calculus students.	Conway, 2007

APPENDIX B

PARENT AND STUDENT CONSENT FORMS

TREATMENT GROUP

<u>Parent/Guardian Consent for Child's Participation in Educational Study</u>

Dear Parent/Guardian,

Your child's teacher, Mrs. Amy Billig is conducting an educational research study devoted to the meaningful integration of educational technology. This study, entitled ***<u>Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation,</u>*** is being conducted by in an effort to establish the effectiveness of integrating a virtual world learning environment as an educational technology tool into the curriculum and help improve your child's academic achievement (grades), higher order thinking skills (problem solving and evaluating situations) and motivation. This is a technology that your child's teacher has been trained in using, and other research indicates there is much promise for success at the secondary level. Amy Billig is a doctoral candidate at Pace University and a faculty member at Valhalla High School,

During the Digital Citizenship and Internet Safety unit during the fall, your child will be learning the first part of the unit in the classroom and the second part of the unit in a virtual world called Grand Central Grid. For both parts of the study, s/he will be asked to complete the following:
1. a student technology survey to establish prior computer experiences of each student. (15 min)
2. a pre-test for critical thinking skills (40 min)
3. a post-test for critical thinking skills (40 min)
4. a pre-test for academic content knowledge (30 min)
5. a post-test for academic content knowledge (30 min)
6. Student self-motivation survey (10 min)

The end of unit academic test will be the state standards based exam typically given at the end of a unit of study to measure academic achievement. The survey and critical thinking tests will not count toward the students' grades. Additionally, observations will be made to determine levels of engagement, effort, interest, attention, and persistence. The data collection portion of this study will begin October 2010 and will be completed no later than December 2010.

To protect your child, all students will be given a unique identification number. The list will be kept in a secured locked cabinet. The questionnaires and tests will only contain the unique identifier to protect the confidentiality of your child's responses.

Your child's participation in this research study is voluntary. There are no known risks involved in this study beyond the normal classroom setting they encounter on a daily basis. Non-participation will not affect grades or academic standing in any way. Your child may withdraw from the study at any time without penalty or loss of benefits. Should you or your child not wish to participate, s/he will simply remain in class for the same instruction but not be asked to take the student technology survey or the pre- or post-critical thinking tests. S/he will still be responsible for the end of unit academic test. I will be available to answer any questions your child may have.

This study is part of my doctoral dissertation in progress at Pace University. Pace University Institutional Review Board (IRB) and the Valhalla Union Free School District, former Superintendent Dr. Ramos-Kelly, and Principal Mr. Thomas, and Assistant Principal Mrs. Aguilar have approved this solicitation of participants for the project.

 The Institutional Review Board (IRB) at Pace University has approved the solicitation of subjects for this study. If you have any questions or concerns, please contact the Office of Sponsored Research at 212-346-1273. You can also contact the dissertation advisor Dr. Gregory Ramsay at gramsay@pace.edu.

In addition, your child will be asked to sign an assent form acknowledging the purpose of the study, the expectations of the student, and the right to withdraw from the study at any time without penalty or loss of benefits. You should discuss this with them to be sure they understand.

Please sign and return the attached informed consent form to me by Friday October 15, 2010. Return only the signed permission slip. You should keep this page for your records. I welcome your questions or comments at any point in time. I can be contacted at abillig@valhallaschools.org .

Amy Billig, MAT
Computer Science/Mathematics
Valhalla High School
300 Columbus Avenue
Valhalla, NY 10595

***Consent form attached

Parent/Guardian Consent for Participation in Educational Research Study

Child's Name:_____

Parent/Guardian Name:_____

I have read the information provided to me regarding the research study
entitled, *Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation,* and give my permission for my child,

 _____,

to be a participant in the study during the time period from October 2010 to December 2010.

_____   _____
          Parent/Guardian signature   Date

** Please return this signed form (ONLY THIS PAGE) by Friday October 15, 2010

Student-Participant Assent for Educational Research Study

Dear Student,

Your teacher, Mrs. Billig, is conducting an educational research study that can show how using a 3-D virtual world learning environment called Grand Central Grid can help improve your academic achievement (grades), higher order thinking skills (problem solving and evaluating situations) and motivation. The study is entitled, ***Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation***. Mrs. Amy Billig is a doctoral candidate at Pace University and your teacher at Valhalla High School.

During the Digital Citizenship and Internet Safety unit during the fall, you will be learning the first part of the unit in the classroom and the second part of the unit in a virtual world called Grand Central Grid. For both parts of the study, you will be asked to complete the following:

1. a student technology survey to establish prior computer experiences of each student. (15 min)
2. a pre-test for critical thinking skills (40 min)
3. a post-test for critical thinking skills (40 min)
4. a pre-test for academic content knowledge (30 min)
5. a post-test for academic content knowledge (30 min)
6. Student self-motivation survey (40 min)

The end of unit academic test will be the test your teacher would normally give. The survey and critical thinking tests will *not* count toward your grade. The information you provide will be used to determine how effective using a virtual environment was for that unit. The data collection for this study will begin October 2010 and will be completed no later than December 2010.

To protect your privacy, all students will be given a unique identification number. The list will be kept in a secured locked cabinet. The questionnaires and tests will only contain the unique identifier to protect the confidentiality of your responses.

Your participation in this study is voluntary and if you decide you do not want to participate, you will still attend class but will not be asked to complete the survey or the pre- and post-critical thinking tests. You are still

responsible for taking the end of unit tests. There are no negative consequences for choosing to not participate in the study. Everyone who is going to participate must start at the same time. You cannot decide to be a participant after we have already begun. You may withdraw from the study at any time without penalty or loss of benefits. This study will be completed by January 2011. There are no known risks involved in this study beyond the normal classroom setting you encounter on a daily basis.

This study is part of my doctoral dissertation in progress at Pace University. Pace University Institutional Review Board (IRB), former Superintendent Dr. Ramos-Kelly, Principal Mr. Thomas, and Assistant Principal Mrs. Aguilar have approved this solicitation of participants for the project.

The Institutional Review Board (IRB) at Pace University has approved the solicitation of subjects for this study. If you have any questions or concerns, please contact the Office of Sponsored Research at 212-346-1273. You can also contact the dissertation advisor Dr. Gregory Ramsay at gramsay@pace.edu.

In addition to your assent, I have requested that your parents/guardians give permission as well. Please discuss this with them, and be sure to return yours and your parents'/guardians' consent forms to your teacher by Friday October 15, 2010. You must return BOTH consent forms in order to be a participant. Return only the signed permission slip. You should keep this page for your records. If you have *any* questions about the study, you may email me at abillig@valhallaschools.org . Thank you for your willingness to help me with my doctoral dissertation study!

Sincerely,

Mrs. Billig, MAT
Computer Science/Mathematics
Valhalla High School
300 Columbus Avenue
Valhalla, NY 10595

***Consent form Attached

Student Assent for Participation in Educational Research Study

Student's Name: _____

Parent/Guardian Name:

_____

I have read the information provided to me regarding Amy Billig's research study entitled, _Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation_, and I agree to be a participant in the described study during a specific unit of study during the period from October 2010 through December 2010.

_____
| **Student Signature**   **Date**

** Please return ONLY THIS PAGE by Friday October 15, 2010.

APPENDIX C

PARENT AND STUDENT CONSENT FORMS

CONTROL GROUP

Parent/Guardian Consent for Child's Participation in Educational Study

Dear Parent/Guardian,

Your child's teacher, Mrs. Amy Billig is conducting an educational research study devoted to the meaningful integration of educational technology. This study, entitled ***Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation,*** is being conducted by in an effort to establish the effectiveness of integrating a virtual world learning environment as an educational technology tool into the curriculum and help improve your child's academic achievement (grades), higher order thinking skills (problem solving and evaluating situations) and motivation. This is a technology that your child's teacher has been trained in using, and other research indicates there is much promise for success at the secondary level. Amy Billig is a doctoral candidate at Pace University and a faculty member at Valhalla High School,

During the Digital Citizenship and Internet Safety unit during the fall, your child will be asked to complete the following:
1. a student technology survey to establish prior computer experiences of each student. (15 min)
2. a pre-test for critical thinking skills (40 min)
3. a post-test for critical thinking skills (40 min)
4. a pre-test for academic content knowledge (30 min)
5. a post-test for academic content knowledge (30 min)
6. Student self-motivation survey (10 min)

The end of unit academic test will be the state standards based exam typically given at the end of a unit of study to measure academic achievement.   The survey and critical thinking tests will not count toward the students' grades. Additionally, observations will be made to determine levels of engagement, effort, interest, attention, and persistence. The data collection portion of this study will begin February 2011 and will be completed no later than April 2011.

To protect your child, all students will be given a unique identification number. The list will be kept in a secured locked cabinet. The questionnaires and tests will only contain the unique identifier to protect the confidentiality of your child's responses.

Your child's participation in this research study is voluntary. There are no known risks involved in this study beyond the normal classroom setting they encounter on a daily basis. Non-participation will not affect grades or academic standing in any way. Your child may withdraw from the study at any time without penalty or loss of benefits. Should you or your child not wish to participate, s/he will simply remain in class for the same instruction but not be asked to take the student technology survey or the pre- or post-critical thinking tests. S/he will still be responsible for the end of unit academic test. I will be available to answer any questions your child may have.

This study is part of my doctoral dissertation in progress at Pace University. Pace University Institutional Review Board (IRB) and the Valhalla Union Free School District, former Superintendent Dr. Ramos-Kelly, and Principal Mr. Thomas, and Assistant Principal Mrs. Aguilar have approved this solicitation of participants for the project.

 The Institutional Review Board (IRB) at Pace University has approved the solicitation of subjects for this study. If you have any questions or concerns, please contact the Office of Sponsored Research at 212-346-1273. You can also contact the dissertation advisor Dr. Gregory Ramsay at gramsay@pace.edu.

In addition, your child will be asked to sign an assent form acknowledging the purpose of the study, the expectations of the student, and the right to withdraw from the study at any time without penalty or loss of benefits. You should discuss this with them to be sure they understand.

Please sign and return the attached informed consent form to me by Friday February 11, 2011. Return only the signed permission slip. You should keep this page for your records. I welcome your questions or comments at any point in time. I can be contacted at abillig@valhallaschools.org .

Amy Billig, MAT
Computer Science/Mathematics
Valhalla High School
300 Columbus Avenue
Valhalla, NY 10595

***Consent form attached

Parent/Guardian Consent for Participation in Educational Research Study

Child's Name:_____

Parent/Guardian Name:_____

I have read the information provided to me regarding the research study
entitled, *Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation,* and give my permission for my child,

 _____,

to be a participant in the study during the time period from February 2011 through April 2011.

_____   _____
          Parent/Guardian signature   Date

** Please return this signed form (ONLY THIS PAGE) by Friday February 11, 2011.

Student-Participant Assent for Educational Research Study

Dear Student,

Your teacher, Mrs. Billig, is conducting an educational research study that can show how using a 3-D virtual world learning environment called Grand Central Grid can help improve your academic achievement (grades), higher order thinking skills (problem solving and evaluating situations) and motivation. The study is entitled, ***Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation***. Mrs. Amy Billig is a doctoral candidate at Pace University and your teacher at Valhalla High School.

During the Digital Citizenship and Internet Safety unit during the spring, you will be asked to complete the following:
1. a student technology survey to establish prior computer experiences of each student. (15 min)
2. a pre-test for critical thinking skills (40 min)
3. a post-test for critical thinking skills (40 min)
4. a pre-test for academic content knowledge (30 min)
5. a post-test for academic content knowledge (30 min)
6. Student self-motivation survey (40 min)

The end of unit academic test will be the test your teacher would normally give. The survey and critical thinking tests will *not* count toward your grade. The information you provide will be used to determine how effective using a virtual environment was for that unit. The data collection for this study will begin February 2011 and will be completed no later than April 2011.

To protect your privacy, all students will be given a unique identification number. The list will be kept in a secured locked cabinet. The questionnaires and tests will only contain the unique identifier to protect the confidentiality of your responses.

Your participation in this study is voluntary and if you decide you do not want to participate, you will still attend class but will not be asked to complete the survey or the pre- and post-critical thinking tests. You are still responsible for taking the end of unit tests. There are no negative

consequences for choosing to not participate in the study. Everyone who is going to participate must start at the same time. You cannot decide to be a participant after we have already begun. You may withdraw from the study at any time without penalty or loss of benefits. This study will be completed by January 2011. There are no known risks involved in this study beyond the normal classroom setting you encounter on a daily basis.

This study is part of my doctoral dissertation in progress at Pace University. Pace University Institutional Review Board (IRB), former Superintendent Dr. Ramos-Kelly, Principal Mr. Thomas, and Assistant Principal Mrs. Aguilar have approved this solicitation of participants for the project.

The Institutional Review Board (IRB) at Pace University has approved the solicitation of subjects for this study. If you have any questions or concerns, please contact the Office of Sponsored Research at 212-346-1273. You can also contact the dissertation advisor Dr. Gregory Ramsay at gramsay@pace.edu.

In addition to your assent, I have requested that your parents/guardians give permission as well. Please discuss this with them, and be sure to return yours and your parents'/guardians' consent forms to your teacher by Friday February 11, 2011. You must return BOTH consent forms in order to be a participant. Return only the signed permission slip. You should keep this page for your records. If you have *any* questions about the study, you may email me at abillig@valhallaschools.org . Thank you for your willingness to help me with my doctoral dissertation study!

Sincerely,

Mrs. Billig, MAT
Computer Science/Mathematics
Valhalla High School
300 Columbus Avenue
Valhalla, NY 10595

***Consent form Attached

Student Assent for Participation in Educational Research Study

Student's Name: _____

Parent/Guardian Name:

_____

I have read the information provided to me regarding Amy Billig's research study entitled, *Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Digital Citizenship and Internet Safety Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation*, and I agree to be a participant in the described study during a specific unit of study during the period from February 2011 through April 2011.

_____
_

Student Signature   **Date**

** Please return ONLY THIS PAGE by Friday February 11, 2011.

APPENDIX D

NIH CERTIFICATE

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Amy Billig** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 07/28/2009

Certification Number: 261079

APPENDIX E

STUDENT TECHNOLOGY USE SURVEY RESULTS

TREATMENT AND CONTROL GROUPS

STUDENT TECHNOLOGY SURVEY RESULTS – TREATMENT GROUP

QUEST-ION #	QUESTION	RESPONSES	PER B	PER D	PER E	Total	Percent
1	Gender						
		Female	10	10	6	26	51%
		Male	7	7	11	25	49%
2	Ethnicity					0	0%
		African-American	0	0	0	0	0%
		Asian-American	0	3	0	3	6%
		Hispanic	4	2	5	11	22%
		Native-American	0	0	0	0	0%
		White, non-Hispanic	9	9	8	26	51%
		Multi-ethnic	2	2	2	6	12%
		Other	3	1	2	6	12%
3	Grade					0	0%
		9				0	0%
4	Do you have a computer at home?					0	0%
		yes	17	17	17	51	100%
		no	0	0	0	0	0%
	if yes, does it have					0	0%
		CD-ROM	0	0	0	0	0%
		Internet Connection	7	0	1	8	16%
		Both	12	17	15	44	86%
5	Avg time per week on computer in school					0	0%
		Little or none	0	0	0	0	0%
		Less than 15	0	0	0	0	0%
		15-30	1	0	0	1	2%
		30-60	0	0	0	0	0%
		60-90	1	0	0	1	2%
		over 90	15	17	17	49	96%
6	Classes you used					0	0%

	computers for this year						
		ELA	12	16	15	43	84%
		History/Sstudies	7	14	15	36	71%
		Music/Art	3	5	7	15	29%
		Science	7	13	7	27	53%
		Business Education	0	0	0	0	0%
		ESL	1	0	1	2	4%
		Phys Ed/Health	0	2	1	3	6%
		Math	1	2	4	7	14%
7	Places where you used a computer						0%
		Regular classroom	1	5	1	7	14%
		School media center/library	14	11	9	34	67%
		Own home	16	16	16	48	94%
		After-School program	3	3	3	9	18%
		Computer lab - teacher assigns use	16	14	15	45	88%
		Computer lab - I choose when to use	2	2	3	7	14%
		Community center or public library	3	2	1	6	12%
8	I use tech to learn basic skills in math, reading or spelling					0	0%
		Never	10	8	5	23	45%
		Sometimes	7	9	11	27	53%
		Always	0	0	1	1	2%
9	I have trouble understanding text, numbers or					0	0%

graphs when they are shown on a computer

		Never	14	12	14	40	78%
		Sometimes	3	5	3	11	22%
		Always	0	0	0	0	0%
10	I communicate with others using technology					0	0%
		Never	4	0	1	5	10%
		Sometimes	5	2	5	12	24%
		Always	8	15	11	34	67%
11	I know which technology, software and online services to pick to help me solve problems					0	0%
		Never	4	3	1	8	16%
		Sometimes	10	6	10	26	51%
		Always	3	9	4	16	31%
12	I use technology to find the information I need					0	0%
		Never	1	0	2	3	6%
		Sometimes	7	3	4	14	27%
		Always	9	14	11	34	67%
13	I use pictures and graphs in my computer work to better explain my ideas					0	0%
		Never	1	3	4	8	16%
		Sometimes	13	6	10	29	57%
		Always	3	6	3	12	24%
14	Technology helps me understand how the					0	0%

things we learn in school relate to RL situations

		Never	7	2	3	12	24%
		Sometimes	8	15	13	36	71%
		Always	0	0	1	1	2%
15	I use computers to find information from sources that are like printed books					0	0%
		Never	1	2	2	5	10%
		Sometimes	15	7	13	35	69%
		Always	1	8	2	11	22%
16	I use technology to find information that is not in our school library or school books					0	0%
		Never	6	2	2	10	20%
		Sometimes	6	10	10	26	51%
		Always	5	5	5	15	29%
17	I use technology to solve short problems					0	0%
		Never	4	2	4	10	20%
		Sometimes	9	6	10	25	49%
		Always	4	9	3	16	31%
18	I use technology to solve more complex RL problems					0	0%
		Never	8	5	3	16	31%
		Sometimes	6	6	6	18	35%
		Always	3	6	7	16	31%
19	I work in a team with others students when I use					0	0%

technology

		Never	6	8	6	20	39%
		Sometimes	11	9	9	29	57%
		Always	0	0	2	2	4%
20	I use computer probrams to predict how things in the real world might change					0	0%
		Never	11	13	10	34	67%
		Sometimes	6	4	7	17	33%
		Always	0	0	1	1	2%
21	Use a computer to search for information on a CD-ROM					0	0%
		Can't/Never did this	6	4	1	11	22%
		Can do with help	3	6	3	12	24%
		Can do without help	7	7	13	27	53%
22	Send and receive messages on a computer chat room or bulletin board					0	0%
		Can't/Never did this	2	0	1	3	6%
		Can do with help	1	1	1	3	6%
		Can do without help	14	16	15	45	88%
23	Develop Web pages for the Internet					0	0%
		Can't/Never did this	6	1	4	11	22%
		Can do with help	10	12	9	31	61%
		Can do without help	1	4	4	9	18%

24	Use a word processing program					0	0%
	Can't/Never did this	1	1	1	3	6%
	Can do with help	3	1	1	5	10%
	Can do without help	13	16	15	44	86%
25	Use a spreadsheet program					0	0%
	Can't/Never did this	9	7	11	27	53%
	Can do with help	7	6	4	17	33%
	Can do without help	1	4	1	6	12%
26	Use a presentation program					0	0%
	Can't/Never did this	1	0	0	1	2%
	Can do with help	1	0	2	3	6%
	Can do without help	15	17	15	47	92%
27	Send and receive e-mail messages					0	0%
	Can't/Never did this	0	0	0	0	0%
	Can do with help	2	0	0	2	4%
	Can do without help	15	17	17	49	96%
28	Search the Web to find material for class assignments					0	0%
	Can't/Never did this	1	0	0	1	2%
	Can do with help	0	0	1	1	2%
	Can do without help	16	17	16	49	96%

29	Conduct electronic information searches on the WWW					0	0%
		Can't/Never did this	3	2	1	6	12%
		Can do with help	5	1	1	7	14%
		Can do without help	9	14	15	38	75%
30	Use simulation or story-based learning programs					0	0%
		Can't/Never did this	5	5	4	14	27%
		Can do with help	6	3	3	12	24%
		Can do without help	6	9	10	25	49%
31	Develop multimedia presentations on a computer					0	0%
		Can't/Never did this	2	0	2	4	8%
		Can do with help	7	6	8	21	41%
		Can do without help	8	11	7	26	51%
32	Use skill building programs to learn things such as math facts, spelling and typing skills					0	0%
		Can't/Never did this	4	0	0	4	8%
		Can do with help	1	2	1	4	8%
		Can do without help	12	15	16	43	84%
33	How would you rate your overall ability					0	0%

		to use technology?					
		I can use technology without assistance whenever I need to	4	4	12	20	39%
		I need minimal assistance when using technology	13	13	5	31	61%
		I need a lot of assistance when using technology	0	0	0	0	0%
		I can not use technology without assistance	0	0	0	0	0%
34	Do you know if your school has an Internet Use Policy					0	0%
		Yes	15	16	16	47	92%
		No	2	1	1	4	8%
35	Have you ever signed an Internet Use Policy for your school?					0	0%
		Yes	9	16	14	39	76%
		No	8	1	3	12	24%
36	Have your parents been asked to sign and Internet Use Policy for your school?					0	0%
		Yes	9	16	11	36	71%
		No	7	1	6	14	27%
37	Do more than half your teachers use technology in their					0	0%

classroom
instruction?

Yes	15	17	16	48	94%
No	2	0	1	3	6%

STUDENT TECHNOLOGY SURVEY RESULTS – CONTROL GROUP

QUEST -ION #	QUESTION	RESPONSES	PER B	PER D	PER E	Total	Percent
1	Gender						
		Female	10	9	7	26	50%
		Male	9	7	10	26	50%
2	Ethnicity					0	0%
		African-American	0	2	0	2	4%
		Asian-American	0	1	0	1	2%
		Hispanic	5	0	3	8	15%
		Native-American	0	0	0	0	0%
		White, non-Hispanic	10	10	12	32	62%
		Multi-ethnic	4	1	1	6	12%
		Other	0	2	1	3	6%
3	Grade					0	0%
		9	19	16	17	52	100%
4	Do you have a computer at home?					0	0%
		yes	19	16	16	51	98%
		no	0	0	1	1	2%
	if yes, does it have					0	0%
		CD-ROM	19	13	14	46	88%
		Internet Connection	19	16	16	51	98%
		Both	16	14	15	45	87%
5	Avg time per week on computer in school					0	0%
		Little or none	0	0	0	0	0%
		Less than 15	0	0	1	1	2%
		15-30	0	0	0	0	0%
		30-60	0	0	1	1	2%
		60-90	1	0	0	1	2%
		over 90	18	16	15	49	94%
6	Classes you used computers for this year					0	0%
		ELA	18	9	13	40	77%

		History/Sstudies	14	9	10	33	63%
		Music/Art	5	4	4	13	25%
		Science	16	9	10	35	67%
		Business Education	0	0	0	0	0%
		ESL	0	0	1	1	2%
		Phys Ed/Health	1	1	1	3	6%
		Math	4	2	1	7	13%
7	Places where you used a computer					0	0%
		Regular classroom	3	9	7	19	37%
		School media center/library	12	18	17	47	90%
		Own home	17	12	14	43	83%
		After-School program	5	6	4	15	29%
		Computer lab - teacher assigns use	15	11	14	40	77%
		Computer lab - I choose when to use	6	2	2	10	19%
		Community center or public library	2	4	0	6	12%
8	I use tech to learn basic skills in math, reading or spelling					0	0%
		Never	7	3	5	15	29%
		Sometimes	10	12	11	33	63%
		Always	2	1	1	4	8%
9	I have trouble understanding text, numbers or graphs when they are shown on a computer					0	0%
		Never	12	12	15	39	75%
		Sometimes	5	3	2	10	19%
		Always	2	1	0	3	6%

10	I communicate with others using technology					0	0%
		Never	0	0	0	0	0%
		Sometimes	6	2	5	13	25%
		Always	13	14	12	39	75%
11	I know which technology, software and online services to pick to help me solve problems					0	0%
		Never	3	0	0	3	6%
		Sometimes	11	12	11	34	65%
		Always	5	4	6	15	29%
12	I use technology to find the information I need					0	0%
		Never	1	0	0	1	2%
		Sometimes	8	2	2	12	23%
		Always	10	14	15	39	75%
13	I use pictures and graphs in my computer work to better explain my ideas					0	0%
		Never	5	1	1	7	13%
		Sometimes	12	11	12	35	67%
		Always	2	4	4	10	19%
14	Technology helps me understand how the things we learn in school relate to RL situations					0	0%
		Never	6	3	4	13	25%
		Sometimes	13	9	13	35	67%
		Always	0	4	0	4	8%

15	I use computers to find information from sources that are like printed books				0	0%
		Never	3	2	0	5	10%
		Sometimes	12	10	10	32	62%
		Always	4	4	7	15	29%
16	I use technology to find information that is not in our school library or school books				0	0%
		Never	1	1	1	3	6%
		Sometimes	10	8	11	29	56%
		Always	7	8	5	20	38%
17	I use technology to solve short problems				0	0%
		Never	6	2	0	8	15%
		Sometimes	12	9	10	31	60%
		Always	1	5	7	13	25%
18	I use technology to solve more complex RL problems				0	0%
		Never	5	3	1	9	17%
		Sometimes	10	6	7	23	44%
		Always	4	7	9	20	38%
19	I work in a team with other students when I use technology				0	0%
		Never	5	4	2	11	21%
		Sometimes	14	12	14	40	77%
		Always	0	0	1	1	2%
20	I use computer programs to predict how				0	0%

#	Item	Response				Total	%
	things in the real world might change						
		Never	15	10	11	36	69%
		Sometimes	4	5	4	13	25%
		Always	0	1	2	3	6%
21	Use a computer to search for information on a CD-ROM					0	0%
		Can't/Never did this	8	3	4	15	29%
		Can do with help	6	4	5	15	29%
		Can do without help	5	9	8	22	42%
22	Send and receive messages on a computer chat room or bulletin board					0	0%
		Can't/Never did this	2	0	0	2	4%
		Can do with help	0	0	1	1	2%
		Can do without help	17	16	16	49	94%
23	Develop Web pages for the Internet					0	0%
		Can't/Never did this	8	5	5	18	35%
		Can do with help	8	6	10	24	46%
		Can do without help	3	5	2	10	19%
24	Use a word processing program					0	0%
		Can't/Never did this	3	0	1	4	8%
		Can do with help	5	1	1	7	13%
		Can do without help	11	15	15	41	79%

25	Use a spreadsheet program					0	0%
		Can't/Never did this	12	3	6	21	40%
		Can do with help	3	6	7	16	31%
		Can do without help	4	7	4	15	29%
26	Use a presentation program					0	0%
		Can't/Never did this	2	0	0	2	4%
		Can do with help	5	2	2	9	17%
		Can do without help	12	14	15	41	79%
27	Send and receive e-mail messages					0	0%
		Can't/Never did this	0	0	0	0	0%
		Can do with help	0	0	0	0	0%
		Can do without help	19	16	17	52	100%
28	Search the Web to find material for class assignments					0	0%
		Can't/Never did this	0	0	0	0	0%
		Can do with help	0	1	0	1	2%
		Can do without help	19	15	17	51	98%
29	Conduct electronic information searches on the WWW					0	0%
		Can't/Never did this	1	0	1	2	4%
		Can do with help	6	3	2	11	21%
		Can do without help	12	14	13	39	75%

30	Use simulation or story-based learning programs					0	0%
		Can't/Never did this	6	5	4	15	29%
		Can do with help	5	2	4	11	21%
		Can do without help	8	9	9	26	50%
31	Develop multimedia presentations on a computer					0	0%
		Can't/Never did this	1	1	0	2	4%
		Can do with help	6	5	6	17	33%
		Can do without help	12	10	11	33	63%
32	Use skill building programs to learn things such as math facts, spelling and typing skills					0	0%
		Can't/Never did this	3	2	3	8	15%
		Can do with help	0	3	4	7	13%
		Can do without help	16	11	10	37	71%
33	How would you rate your overall ability to use technology?					0	0%
		I can use technology without assistance whenever I need to	6	5	6	17	33%
		I need minimal assistance	13	11	11	35	67%

		when using technology				
	I need a lot of assistance when using technology		0	0	0	0	0%
	I can not use technology without assistance		0	0	0	0	0%
34	Do you know if your school has an Internet Use Policy					0	0%
		Yes	18	16	16	50	96%
		No	1	0	1	2	4%
35	Have you ever signed an Internet Use Policy for your school?					0	0%
		Yes	16	15	14	45	87%
		No	3	1	3	7	13%
36	Have your parents been asked to sign and Internet Use Policy for your school?					0	0%
		Yes	15	14	14	43	83%
		No	4	2	3	9	17%
37	Do more than half your teachers use technology in their classroom instruction?					0	0%
		Yes	14	16	17	47	90%
		No	5	0	0	5	10%

APPENDIX F

PERMISSION TO CONDUCT STUDY

PRINCIPAL

Consent to Conduct Research Study

I, Angela Aguilar, Acting Principal of Valhalla High School, give permission to Amy Fox Billig to conduct her doctoral research study entitled ***Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade Technology Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation*** during the period from October 2010 through December 2010.

I will allow Amy to collect background data from district's student information system. Amy will distribute both student and parent/guardian permission slips, including letters explaining the study and collect the permission slips. Parents/guardians and students should keep the letter of explanation.

I agree to allow three sections of 9th grade high school technology classes to participate and allow the following surveys and tests to be administered to ALL students participating in the study regardless of which group they are in.
1. a student technology survey to establish prior computer experiences of each student.
2. a pre-test for critical thinking skills
3. a post-test for critical thinking skills
4. a pre-test for academic content knowledge
5. a post-test for academic content knowledge.
6. Student self-motivation survey

The pre- and post- end of unit academic test will be the state standards based exam typically given at the end of a unit of study to measure academic achievement.   The survey and critical thinking tests will not count toward the students' grades. Additionally, observations will be made to determine levels of engagement, effort, interest, attention, and persistence.

To protect the children, I agree to the following security measures. All students will be given a unique identification number. The list will be kept in a secured locked cabinet. The questionnaires and tests will only contain the unique identifier to protect the confidentiality of the students' responses.

I understand that student participation in this research study is voluntary and that there are no known risks involved in this study beyond the normal classroom setting they encounter on a daily basis. Non-participation will not

affect grades or academic standing in any way. Should the parent/guardian or the child not wish to participate, the student will simply remain in class for the same instruction but not be asked to take the student technology survey, the self-motivation survey, or the pre- or post- critical thinking tests. S/he will still be responsible for the end of unit academic test.

I am aware that this study is part of Amy Fox Billig's doctoral dissertation in progress at Pace University and that Pace University Institutional Review Board (IRB) has approved this solicitation of participants and methodology for the project. If I have any questions or concerns, I know I can contact the Office of Sponsored Research at Pace University at 212-346-1273 or dissertation advisor, Dr. Gregory Ramsay at gramsay@pace.edu. A copy of this letter is being provided for the Principal's records.

_____   _9/22/10___
Signature   Date

APPENDIX G

PERMISSION TO CONDUCT STUDY

SUPERINTENDENT

Consent to Conduct Research Study

I, Jonathon Thomas, Acting Superintendent of Valhalla Union Free School District, give permission to Amy Fox Billig to conduct her doctoral research study entitled ***Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade Technology Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation*** during the period from October 2010 through December 2010.

I will allow Amy to collect background data from district's student information system. Amy will distribute both student and parent/guardian permission slips, including letters explaining the study and collect the permission slips. Parents/guardians and students should keep the letter of explanation.

I agree to allow three sections of 9th grade high school technology classes to participate and allow the following surveys and tests to be administered to ALL students participating in the study regardless of which group they are in.

1. a student technology survey to establish prior computer experiences of each student.
2. a pre-test for critical thinking skills
3. a post-test for critical thinking skills
4. a pre-test for academic content knowledge
5. a post-test for academic content knowledge.
6. Student self-motivation survey

The pre- and post- end of unit academic test will be the state standards based exam typically given at the end of a unit of study to measure academic achievement. The survey and critical thinking tests will not count toward the students' grades. Additionally, observations will be made to determine levels of engagement, effort, interest, attention, and persistence.

To protect the children, I agree to the following security measures. All students will be given a unique identification number. The list will be kept in a secured locked cabinet. The questionnaires and tests will only contain the unique identifier to protect the confidentiality of the students' responses.

I understand that student participation in this research study is voluntary and that there are no known risks involved in this study beyond the normal

classroom setting they encounter on a daily basis. Non-participation will not affect grades or academic standing in any way. Should the parent/guardian or the child not wish to participate, the student will simply remain in class for the same instruction but not be asked to take the student technology survey, the self-motivation survey, or the pre- or post- critical thinking tests. S/he will still be responsible for the end of unit academic test.

I am aware that this study is part of Amy Fox Billig's doctoral dissertation in progress at Pace University and that Pace University Institutional Review Board (IRB) has approved this solicitation of participants and methodology for the project. If I have any questions or concerns, I know I can contact the Office of Sponsored Research at Pace University at 212-346-1273 or dissertation advisor, Dr. Gregory Ramsay at gramsay@pace.edu. A copy of this letter is being provided for the Superintendent's records.

_____   _____
Signature   Date

APPENDIX H

PERMISSION TO REPRINT TABLE

IGI GLOBAL, INC.

Dear Amy, your request for permission to reprint IGI Global copyrighted materials has been forwarded to me for response. IGI Global is pleased to grant you the use of Table 1 as outlined below. Please be sure to site the copyright holder as IGI Global and add the words "Reprinted with permission of the publisher." Thanks and good luck with your dissertation.

Jan Travers

(Ms) Jan Travers

Vice President

IGI Global - Disseminator of Knowledge Since 1988

701 E Chocolate Avenue

Hershey Pennsylvania 17033-1240, USA

Tel: 717.533-8845 x112; Fax: 717.533-8661

E-mail: jtravers@igi-global.com

www.igi-global.com

APPENDIX I

IRB APPROVAL LETTER

PACE UNIVERSITY INSTITUTIONAL REVIEW BOARD (IRB)
NOTIFICATION OF STUDY REVISION APPROVAL

Date: September 29, 2010   IRB Code #: 09-60

Amy Billig
Teacher/DPS Candidate
103 Holbrooke Road
White Plains, NY 10605

Dear Amy:

Please be advised that the revisions/renewal (i.e. instrumentation, participant site, consent/assent forms) you submitted for your original proposal titled, "Investigating the Impact of Integrating a Virtual World Learning Environment into the 9th Grade State Mandated Social Studies Curriculum on Student Achievement, Higher Order Thinking Skills, and Student Motivation" (originally titled: The Lessons of Life: Investigating the Impact of Integrating the Second Life Virtual World into State Mandated Curricula at the Middle School Level, has been approved by the Institutional Review Board. The approval period for you project is September 29, 2010 September 28, 2011. After that date, and annually thereafter, if the proposal continues to enroll subjects, the IRB is required to review its implementation. Your method of data collection and assurance of confidentiality are consistent with minimal to low risk, make this an expedited review.

Please advise Pace University Institutional Review Board when participants are first enrolled. A final report to the IRB should be submitted within 60 days of the conclusion of the research. A form for this purpose is available from the Office of Sponsored Research and Economic Development and can be obtained at that time.

Please remember your obligation to notify the IRB of any deviation from your proposal, however slight, since any change requires IRB review and approval. In addition, please notify the IRB of the occurrence of any adverse outcomes or effects, whether or not anticipated. If interim data suggest that it may be ethically problematic to continue the research because of risks to participants, the IRB must be advised.

Thank you for your continuing cooperation, and best of luck with your research.

Sincerely,

Brian Evans, Ed.D.
Co-Chair
Institutional Review Board

Copy: Office of Sponsored Research and Economic Development