THE EFFECTS OF TECHNOLOGY INSTRUCTION ON THE ACADEMIC ACHIEVEMENT OF FIFTH GRADE STUDENTS

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree of

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ABSTRACT

A digital native is an individual born between 1981 and 2001, and children born after 2001 are called millennials. Educators are expected to meet the needs of today's technologically savvy students. Some researchers assert that an academic 'moral panic' is taking place that lacks the empirical and theoretical knowledge to support the claims that education needs to change to meet the needs of digital natives and millennials. The problem is that considering that the majority of students today are digital natives are educators meeting the learning needs of their students. This research study focused on the use of instructional technology and how it effects student achievement for fifth grade science and math instruction. Using the 2010 and 2011 math and science CRCT test scores, the SPSS statistical software was employed to run an independent sample *t* test to measure the mean difference between the experimental and control groups. The results found that the use of technological instruction in this instance did not increase student academic achievement.

Descriptors: Digital Native, Digital Immigrant, Millennials, Nonconformist, Whiteboard, PowerPoint, Instructional Technology, e-learning, Web 1.0, and Web 2.0

Dedication

Thank you God for your love, guidance, and the blessings you have given my family. I dedicate this dissertation to my loving husband Michael who has been my rock throughout this process. I am thankful for your support and encouragement. To my wonderful children Lauren and Greg, I am proud and honored to be your mother. You are both my inspiration and motivation to strive to be the best I can be. To my parents, Sam and Gilda Cortina, who instilled in me the importance of education.

This dissertation is also dedicated to the memory of the late Dr. Jill A. Jones. You were an amazing teacher and role model. You understood me; we shared the same story. You were in my heart throughout this process.

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LIST OF ABBREVIATIONS

Criterion Referenced Competency Test (CRCT)

Georgia Performance Standards (GPS)

Source, Evidence, Explaination, and Knowledge (SEEK)

Statistical Package for the Social Sciences (SPSS)

Virtual Lecture Hall (VLH)

CHAPTER ONE: INTRODUCTION

Background

Digital natives, the net-generation, the digital-generation, and millenniums are all labels to identify today's learners. Marc Prensky (2001) created the term digital native in his work *Digital Natives, Digital Immigrants* to describe the generation of learners growing up interacting with digital technology. Marc Prensky (2001), educational author, noted that the average college student has spent less than 5,000 hours of his/her life reading, yet he/she has spent over 10,000 hours playing video games and 20,000 hours watching television. The National School Board Association (2007) reported teens engage in social networking almost as much as they watch television. Marc Prensky (2001) stated, "Our students have changed radically. Today's students are no longer the people our educational system was designed to teach" (p.1). Media entrepreneur Rupert Murdock (2005) agreed with Prensky when he stated that today's generation and future generations will "never know a world without ubiquitous broadband Internet access." Referring to himself as a digital immigrant he continued, "We may never become true digital natives, but we can and must begin to assimilate to their culture and way of thinking" (Murdock, 2005, p. 1).

Researchers Pucel and Stertz (2005), Lu and Gordon (2009), Wiley et al. (2009), Eysink et al. (2009), Ward, Moule and Lockyer (2009), Cilesiz (2009), and Crowe (2004) all recognized the need for sound empirical research to determine whether the traditional or the technological educational methods meet the needs of today's digital natives. Bennett, Maton, and Kervin (2008) characterized today's generation as "optimistic, team-oriented achievers who are talented with technology" (p. 776). Technology advocates

Prensky (2001), Sprenger (2010), Tapscott (2009), Bennett et al. (2008), and Pucel and Stertz (2005) asserted that not only have our students changed but the skills and knowledge they need to possess for their future has changed as well. The Partnership for 21st Century Skills identifies the skills students need to attain. They asserted that students need to be creators, innovators, critical thinkers, problem solvers, communicators, and collaborators.

The National School Boards Association (2007) included leadership skills and technological proficiency as essential 21st century learning tools. The International Society for Technology in Education (ISTE) (2009) identified the National Educational Technology Standards (NETS-A and NETS-S) and Performance Indicators for administrators and students. The NETS-A included providing a visionary leadership, digital-age learning culture, excellence in professional practice, systemic improvement, and digital citizenship. The NETS-S called for teachers to facilitate and inspire student learning and creativity, design and develop digital-age learning experiences and assessments, model digital-age work and learning, promote and model digital citizenship and responsibility, and engage in professional growth and leadership (ISTE NETS, 2010).

No longer should our students sit passively in the classroom while their teacher lectures. Tapscott (2009) explained that educators must prepare today's students for change; by the time students are seniors in college 50% of what they learned freshman year will no longer be relevant. Speaking of an earlier generation John Dewey stated, "If we teach today's students as we taught yesterday's we rob them of tomorrow" (Agnello, White, & Fryer, 2006). His statement summed up the importance of technology instruction in education today. Researchers Ian Jukes and Anita Dosja (2004) and Marilee Sprenger (2010) described the learning preferences of digital natives. The authors

described them as multi-taskers due to their ability to process sounds and videos before processing text. Digital natives want information quickly from numerous sources and networks. The authors reinforced Dewey, Piaget, Vygotsky, and Bruner who claimed that students have to construct their knowledge. Jukes and Dosja's (2004) learning pyramid illustrated educators' perceptions regarding students learning as they found that: students retain five percent of what they hear, ten percent of what they read, 30% from demonstration, 50% of what they discuss, 75% of what they practice, and 90% of what they apply and teach others. Sprenger (2010) explained that individuals' brains will not retain 99% of the information they receive. Consider the vast amount of information that bombards an individual in a single day.

The National School Boards Association (2007) found that 96 % of students with Internet access engage in some aspect of social networking. Their study found that 60% of the students use social networking to discuss educational topics, and 50% use it for schoolwork. Students used social networking to: post messages, share music, videos and photos, blog, design websites, and create content. Davis (2008) explained that the nonconformist is a new label that has emerged for the learner who creates and designs content using technology. The nonconformist is creative, inquisitive, a leader, and innovative challenging the rules and limits. The nonconformists are the leaders in producing and editing online content. Social networking could be a great educational tool; however, as Sprenger (2010) noted most school systems prohibit access to social networking sites. Presnky (2001), Murdock (2005), and Tapscott (2009) believed the traditional lecture and listen classroom is losing today's learners especially the nonconformist.

Are the advocates for incorporating technology in education correct? Author

Marilee Sprenger (2010) reported that current brain research indicates that technology has changed the way our students' brains are developing. Does education need to change? Will incorporating technology into instruction enhance or inhibit student learning? Does the use of personal technology enhance or inhibit instruction? The question arises, is technology the way for educators to meet the needs and reach the digital natives of today in their classrooms? Are digital immigrant teachers capable of teaching digital native students? As school systems across the national are implementing 21st century classrooms, funds are being used to support the technological initiative. The call for increased technology is not being implemented at the same rate and pace throughout the country. Once technology is made available access to the Internet and the use of Web 2.0 tools is still often limited or completely restricted.

The majority of existing research in the area of instructional technology covers Web 1.0 tools such as presentation method software as seen by Bartsch and Cobern (2003), Leonard, Slykhuis, and Wiebe (2007), Ricer, Filak, and Short (2005), Apperson, Laws, and Scepansky (2004), Sugahara and Boland (2006), Burke and James (2008), Parette, Hourcade, Boechman, and Blum (2008), and Jennifer Clark's (2008) research studies. Today's Web 2.0 tools engage the user in interactive activities. Pucel and Stertz (2005), Lu and Gordon (2009), Wiley et al. (2009), Eysink et al. (2009), Ward et al. (2009), Cilesiz (2009), Crowe (2004), Yu, She and Lee (2010), and Wijekumar, Hitchcock, Turner, Lei, and Peck (2009) have all performed research studies relating to the use of Web 2.0 tools. Technological advances seem to outpace the research to determine their effectiveness. Web 3.0 tools are now on the horizon.

Further research examining the implementation of instructional technology in the classroom and its effect on student achievement needs to be performed. Educators will

benefit from research that determines how instructional technology affects student achievement and learn ways to implement sound teaching strategies. The research will provide building administrators with the information to support their faculty and students to provide professional development to improve instruction. School superintendents and their staff will have the research to support the expenditure of funds to have the greatest positive impact on teaching, instruction, and student achievement.

Problem Statement

Presnky (2008), Tapscott (2009) and Sprenger (2010) claimed that technology has changed the way today's students learn. The implementation and access to technology varies greatly among school systems. The problem was that the lack of access to and use of technology in education is placing our students at a disadvantage and not meeting the educational needs of today's digital natives.

Purpose Statement

The purpose of the study was to discover if and how integrating technology into instruction improved student academic achievement. The study took place in a suburban public school district in the Southeast about 30 miles from a metropolitan city. The participants were fifth grade math and science students. The majority of research literature addresses Web 1.0 technology. However, there was limited research focusing on Web 2.0 interactive technologies. This study strove to contribute to the literature regarding the integration of Web 2.0 technologies in classroom instruction.

Significance of the Study

The results of the study have the potential to influence the appropriation of state education agencies and school systems' funds in the areas of professional development and technology instruction. In addition to the utilization of funds, the results could

influence state standards, curriculum guides, and the inclusion of instructional technology. Positive results from the study will lead school districts that prohibit access to Web 2.0 tools to rethink their present technology policies.

If the study finds there was not a statistically significant relationship between technology and student achievement, educators still need to identify ways to tie instruction to the constant changing technologies available to today's learners. It is the responsibility of educators to prepare students for the world outside of school including technological use.

Research Questions and Hypotheses

Research Question 1

What is the difference between the 2011 Math CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in math?

Research Question 2

What is the difference between the 2011 Science CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in science?

Research Null Hypotheses

H1: There will not be a statistically significant difference between the 2011Math CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0 technologies.

H2: There will not be a statistically significant difference between the 2011Science CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0

technologies.

Identification of Terms

Brain Pop – educational website that offers Flash based movies in most content areas for students in grades kindergarten through 12 (BrainPop Educators, 2011).

Classroom Response System (CRS) –student handheld interactive response system providing teachers with immediate feedback regarding student learning.

Digital Native – refers to a person born after 1980. The participants in the study were digital natives (Prensky, 2001).

Digital Immigrant – refers to a person born prior to 1980. The teacher in the study was a digital immigrant (Prensky, 2001).

E-learning – "learning that is facilitated and supported via information and communications technology (ICT)" (TS& Logistics Group. (2011).

Instructional Technology – "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (AECT, 2001).

Millennial – refers to a person born between 1982 to 1995 (*Urban Dictionary*).

Nonconformist – refers to a person who uses technology creatively, inquisitively, is a leader, and innovative challenging the rules and limits. The nonconformists are the leaders in producing and editing online content (Davis, 2008).

PowerPoint – presentation software used for instructional purposes (TechTerms.com).

Web 1.0 – is the first generation of the World Wide Web characterized by static websites (PC Digital Magazine, 2011).

Web 2.0 – is the second generation of the World Wide Web. The applications are

interactive with the use of blogs and many social networking tools (PC Digital Magazine, 2011).

Whiteboard – a non-electronic variation of the traditional blackboard and can be written on with colored erasable markers. (The use of the word whiteboard does not refer to a Smart Board.) (SearchNetworking.com, 2011).

21st Century Classroom Learning Environment –classroom equipped with a DLP (digital light processing) projector, screen, speakers, voice amplification, Pixie Wall Controller, and Mobi Interactive Pad providing a world of information available at the touch of a finger on the Internet and other media (Cleary, 2009).

Research Plan

The study was a non-equivalent control group design intentionally using random assignment, a pre-test, and post-test. The pre-tests were the 2010 Math CRCT scores and 2010 Science CRCT scores. The post-tests were the 2011 Math CRCT scores and the 2011 Science CRCT scores. The control group received the whiteboard/lecture method of instruction. The experimental group received technological methods of instruction, including the use of the 21st century classroom learning environment, online tests and assessments, online learning games, BrainPOP, PowerPoint presentations, and online videos. Random allocation determined the control group which received the whiteboard/lecture method of instruction for the subject math. The control group for math was the experimental group receiving technological instruction for the subject science. The random selection determined the control group and experimental group for the other class. The control group for math instruction was the experimental group for science instruction, and the control group for science instruction was the experimental group for math instruction. The purpose of giving each class exposure to both methods of

instruction was to not place the students at a disadvantage if one method of instruction was deemed statistically to impact student achievement.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Bartsch and Cobern (2003), Leonard et al. (2007), Ricer et al. (2005), Apperson et al. (2004), Sugahara and Boland (2006), Burke and James (2005), Parette et al. (2008), Clark (2008), Yu et al. (2010), and Wijekumar et al. (2009) were all researchers who have sought sound empirical data to determine the effects of technological instruction on student academic performance. One of the most used methods of instruction was the use of PowerPoint. Several researchers studied the impact of the use of PowerPoint on student academic performance. Researchers Slykhuis, Wiebe, and Len (2005) employed eye tracking technology to determine the most effective use of PowerPoint instruction. Web-based learning was another area educational researchers Wiley et al. (2009) and Pucel and Stertz (2005) have deemed important to study. Most of the research deals with the static Web 1.0 technologies.

As Ward et al. (2009) recognized, the research has not kept pace with the swiftly changing technological innovations of the interactive Web 2.0 tools. Cramer, Collins, Snider, and Fawcett's (2007) researched the virtual lecture hall environment. These educational researchers have compared the use of traditional methods of instruction to the technological methods of instruction. Student educational computer use in social and leisure environments has been studied. Bartsch and Cobern (2003), Hansen and Williams (2008), D'Angelo and Wooley (2007), and Cramer et al. (2007) sought to identify students' preferences and perceptions of educational methods of instruction.

Theoretical Framework

Educational learning theories have their value and can be applied to instructive

settings. In a classroom situation it would be difficult to assert that only one learning method should be implemented. The constructivist learning theory seems to fit well with instructional technology. Jerome Bruner, constructivist theorist, asserted that students learn by engaging in the learning and constructing their knowledge through their experiences. Students' learning builds from prior knowledge and understanding, while building new ideas and concepts through engaging in learning activities.

> Bruner highlighted three principles of constructivism:
>
> Instruction must be concerned with the experiences and context that make the student willing and able to learn (readiness), 2. Instruction must be structured so that it can be easily grasped by the student (spiral organization), and 3. Instruction should be designed to facilitate extrapolation and or fill in the gaps (going beyond the information given) (Bruner, 2010, p. 1).

The active process of engaging in an activity adds to an individual's learning. Technology instruction utilizing Web 2.0 tools fits well with the constructivist learning theory. The interactive technological tools allow students to move at their own pace. The students also have the ability to discover and seek more information and knowledge as soon as they are ready.

Bruner was not the only theorist to purport a constructive learning theory. Dewey, Piaget, and Vygotsky have all added to the guiding principles of constructivism. Dewey's theory was developed prior to technological instruction, yet he saw that education and the curriculum would constantly need to be revamped to meet the needs and interests of the students and society. He wanted students to be engaged in the learning "using scientific method to intelligently solve problems rather than transmitting bodies of information" (Gutek, 2005, p. 348). He advocated for collaborative and hands

on learning "using inquiry methods; and the need for process-based learning activities" (Gutek, 2005, p. 348). Dewey was calling for a constructivist learning method of instruction. Constructivism engaged students in the learning process hoping to make the attainment of knowledge more meaningful.

Overview

Leonard et al. (2007), Parette et al. (2008), Jennifer Clark (2008), Xiaoqing Guo, Dobson, and Petrina (2008), and Wiley et al. (2009) recognized the need for sound empirical research to determine whether the traditional or the technological educational methods meet the needs of today's digital learners. Bennett et al. (2008) characterized today's generation as "optimistic, team-oriented achievers who are talented with technology" (p. 776). Are educational author and technology proponent Marc Prensky and media entrepreneur Robert Murdoch correct? Does education need to change? Will incorporating technology into instruction enhance or inhibit student learning? Does the use of personal technology enhance or inhibit instruction? Hansen and Williams (2008), Cramer et al. (2007), Sugahara and Boland (2006), Lu and Gordon (2009),Yu, She and Lee (2010), and Wijekumar et al. (2009) performed research in the areas of comparing traditional classroom instruction with more modern methods such as the use of PowerPoint, web-based learning, the virtual lecture hall, web-based reading programs, evaluating computer use in public access areas, and assessing students' perceptions and preferences for instructional methods.

Digital Immigrants and Digital Natives

Digital natives appear to be technologically savvy with their use of Twitter, Facebook, the Internet, cell phones, and a great deal more. Kvavik, Caruso & Morgan (2004) found that today's generation of learners own technological devices; however,

their use level was at a skill lower than expected. They found only 21% of the digital generation "engaged in creating their own content and multimedia for the Web," (Bennett et al., 2008, p. 778). Jing (2009) conducted his research with preservice teachers who qualified as digital natives. He concluded that the teachers were savvy with the basic technological operations and social communication. He determined that their technology proficiency was limited by both the narrow scope and the lack of depth of their technology activities.

Researchers Kennedy, Judd, Churchward, Gray, and Krause (2008) reinforced these findings with the conclusions from their study with over 2,000 first year students at a university in Australia. After the initial social technologies, the individuals' range of ability varies greatly. Kvavik et al. (2004), Bennett et al. (2008), and Jing's (2009) research indicated that there is not a universal skill level among digital natives. Technology in the classroom is being researched now, yet it is still considered an untapped area in educational research.

Xiaoqing Guo et al. (2008) found that no differences exist between digital natives and digital immigrants. Their research included over 2,000 pre-service teachers in Canada and the United States from 2001 to 2004. The researchers asserted that "the digital divide thought to exist between 'native' and 'immigrant' users may be misleading, distracting education researchers from more careful consideration of the diversity of ICT (information and communication technology) users and the nuances of their ICT competencies" (Xiaoqing Guo et al., 2008, p. 235). The researchers concluded that Prensky's assertion about digital natives was exaggerated; nevertheless they acknowledge that education needs to appeal to the students growing up in the fast paced world of technology. The authors' conclusions went against the prevailing thought concerning the

importance of using technology in the classroom. The authors recognized the digital divide might not be that wide; today's students are social networking savvy but not necessary technologically savvy.

Kvavik et al. (2004) asserted that the difference between digital natives and digital immigrants was the same as the differences among the digital native generation. Cognitive differences needed to be taken into consideration in this debate. Students use home computers differently than school computers. Students experience frustration with the limitations of school computer use due to restraints placed on school computers to protect students from inappropriate material. Contrary to Xiaoqing Guo et al.'s (2008) assertion, research does need to distinguish and identify the technological levels of digital natives so that educators can address their individual learning styles and needs. The problem was meeting the educational needs of today's digital natives. One powerful instructional tool that students respond well to was the use of the PowerPoint presentation method of instruction.

Traditional Classroom Instruction and Modern Instruction

Using traditional and modern educational methods**,** Hansen and Williams (2008) performed a study comparing cross-cultural psychology classes. The 101 subjects for the study were from a predominately white, southern college. The subjects ranged in age from 18 to 21. Archival data was used for the 56 students in the traditional class. Forty-eight students were in the modern class. A several year span existed between the traditional and modern classes. Hansen and Williams (2008) did not provide the actual number of years between the two studies. Both classes were expected to purchase four to five books and take three exams throughout the semester. The traditional class used text books. The modern class used one text book and three paperback novels written by

minority authors. The modern class visited each other's homes, participated in a restaurant experiment, and engaged in role playing. The students received instruction through lectures, textbooks and novels, video clips and multicultural experiences (Hansen & Williams, p. 201). The traditional class received instruction through lectures and textbook readings.

Subsequent analysis conducted by Hansen and Williams (2008) found significant differences between the classes on their exams. The modern class performed better on exam two, and the traditional class performed better on exam three. The requirements for the modern class were to hand in a PowerPoint/video presentation along with taking exam three which may account for not performing as well as the traditional class. The traditional class only had to take the exam. Both classes completed a course evaluation. The majority of the traditional class subjects claimed that they did not purchase nor read all the assignments for the course. Therefore there was little class discussion and more lecture time. The modern class stated that they enjoyed discussing their readings, conversing with each other, and choosing their video presentations. Although they expressed a heavier workload, on the course evaluations the students in the modern class's experiences were more positive than the traditional classes.

The biggest flaw with Hansen and Williams' (2008) research study was the time span between the classes being compared. The results would have been more accurate if there were two classes participating in the study at the same time with one class receiving the traditional method of instruction and the other class receiving the modern methods of instruction. The authors attributed the comments on the evaluations of the modern class concerning the workload to be a result of the stress and anxiety placed on them because they had to hand in a video presentation as well as prepare for the exam. Another

influence on the study results could have been the timing of the evaluations. Had the evaluations taken place at a different point in the semester the students may not have felt as stressed by the workload and the results may have been different.

The results of the study did not meet the expectations of the researchers. The modern class was perceived as more engaged and involved in learning throughout the course, yet the assessments did not indicate that they learned more than the traditional class. The study leaves many unanswered questions that could be addressed by further research. One area of further research could be to understand why the modern class was more engaged in the learning and discover what aspects of the class made learning appealing.

Pucel and Stertz (2005) also performed a research study comparing web-based instruction to traditional classroom instruction. Their study looked at student satisfaction and academic achievement for in-service teacher education courses for career and technical education teachers. The researchers noted that in the career and technical education field many educators are first trained in their career fields and once they become teachers they receive teacher education training. Many people in the field of career and technical education lack the traditional teacher education instruction before becoming educators. The University of Minnesota offered in-service instruction to teachers in career and technical education courses on the web and in the traditional classroom environment. The teachers taught at the high school level and at technical and career colleges. The purpose of the study was to identify a model for web-based instruction courses and to determine if the web instruction demonstrated similar results to traditional course instruction (Pucel & Stertz, 2005).

The two courses compared in the study were the History and Philosophy of

Career and Technical Education and Instructional Methods for Business and Industry (Pucel & Stertz, 2005). The two experienced Ph.D. instructors, who taught the courses in the study, expressed an interested in web-based learning and both had taught the courses in a traditional classroom environment. They worked together to design the online courses. The traditional and web-based courses had the same assignments, objectives, and grading criteria. The researchers recruited two doctoral candidates to provide support for the course development. One candidate's expertise was in the course content, and the other candidate's proficiency was in developing web-based instruction.

The traditional courses took place in the summer and fall. Offered in the spring and following summer session were the two web-based courses. Students did not engage in the traditional classroom instruction and web-based instruction at the same time. For all the courses student satisfaction surveys and grades were gathered at the end of the semester. Pucel and Stertz (2005) did note that not all students answered the student satisfaction questionnaires.

The results of the Purcel and Stertz'(2005) study found that students in the History and Philosophy of Career and Technical Education expressed that they basically spent the same amount of time outside of class in both the traditional and web-based courses. Eighty-two percent of the students in the web-based Instructional Methods for Business and Industry course articulated that they spent more time outside of class than the students in the traditional class. The satisfaction survey indicated that the students felt both courses were equal in rigor and challenge.

The Instructional Methods for Business and Industry course showed the widest disparity of student satisfaction. Ninety-two percent of the students who received traditional instruction were satisfied with the course. However, only 52 percent of the

students in the web-based course indicated their satisfaction (Pucel & Stertz 2005). These students shared that they would have preferred taking the methods course in the traditional classroom environment. The data indicated that there was no statistical significant difference in the student evaluations between the two methods of instruction. There was only a slight preference indicated for the traditional instructional method (Pucel & Stertz). Interestingly, the students in the web-based Instructional Methods for Business and Industry course expressed that they learned more than the traditional instruction students, yet more than one half of the students would have preferred the traditional method of instruction.

When Purcel and Stertz (2005) looked at student academic achievement, the results indicated a statistically significant difference in two areas for the web-based students scoring less than the traditional method students in the History and Philosophy of Career and Technical Education course. For the Instructional Methods for Business and Industry course the web-based students performed better in three of the four criteria evaluated than the students receiving traditional instruction. The students also performed significantly better for the final exam. The authors noted that on the presentation project portion of the course, the students receiving traditional instruction outperformed the web-based instruction students.

Purcel and Stertz (2005) made a good effort to make the learning environments as equal as possible. The study could have been improved if the same instructor taught both the traditional instruction and web-based course. Instructor teaching style could have influenced the students' preferences and performance in the courses. The researchers were thorough in their attempt to provide as equal as possible learning environments for their study. After the courses were developed by the instructors, the curriculum

coordinator also looked at the course material. The study could have been enhanced if the course offerings had taken place at the same time. The researchers made the assumption that the students from different semesters were equal. Students expressing a preference for traditional instruction in the philosophy course may have been the nature of the class even though the web-based students outperformed the traditional instruction class in all areas expect for one. Overall, the researchers did a fine job of trying to equalize the influencing factors of their study.

PowerPoint Instruction

Bartsch and Cobern (2003) conducted two studies which compared the use of overhead transparencies, basic PowerPoint and enhanced PowerPoint and their effect on learning. A clear conclusion was never reached in the study. The subjects stated that they preferred the PowerPoint presentations over the use of overhead transparencies. The participants also articulated that they believed they learned more when PowerPoint was incorporated into the instructional lesson. The researchers discovered unrelated presentation slides lead to decreased comprehension.

In their second study, Bartsch and Cobern (2003) focused on visual cues in the PowerPoint presentations and their effect on learning. The results determined that unrelated graphics negatively affect learning. The researchers failed to distinguish between graphics that were relevant to the topic and slides that only displayed relevant text. The low number of participants in the study limited its applicability. The authors asserted the study could be replicated with a larger group of participants. While no clear consensus was found between the three instructional methods, the students expressed a preference for the use of PowerPoint in instruction.

Ricer et al. (2005) studied the effectiveness of PowerPoint presentations

compared to overhead transparencies using medical school students as the subjects. The authors agree that PowerPoint is the expected presentation method to use for instruction. Yet the researchers claimed a lack of empirical evidence supporting this presentation method and its effectiveness. They sought to discover the answer to the following questions: "1. Subjective evaluation of the presentation? 2. Short-term retention of material? 3. Long-term retention of material?" (Ricer et al., 2005, p.108). The study took place over a one-year period with 12 to 14 participants per month for a total of 150 participants. The instructional media differed, but the content was identical each month. The media instruction included video clips, sound, animation, and graphics. The overhead transparencies were printed versions of the PowerPoint slides in an effort to maintain strict adherence to the content. The participants only had access to presentation notes during class time. The subjects completed a 13 question posttest at the end of each class "to evaluate knowledge of the material presented" (Ricer et al., 2005, p. 108). Subjects also completed a Likert type questionnaire evaluating subjectively the value of the presentation. One year later the students were asked to complete an identical posttest. The second posttest response was at 80% with 120 of subjects participating.

The results of the study did not find a significant difference between the PowerPoint presentation method and overhead transparency method of instruction. On the immediate posttest, the overhead transparency groups' average score was 11.01 questions answered correctly as to 10.91 answered correctly for the PowerPoint group. Subsequent analysis of the identical test one year later revealed 8.21 questions answered correctly for the PowerPoint group and 7.87 answered correctly for the transparency group. The results indicated that the method of presentation does not affect learning.

The quality and teaching appeal of the instructor may have been one reason that

the students did not express a difference when evaluating the class subjectively. Ricer et al. (2005) made a concerted effort to keep all variables equal throughout the comparison study. They could improve upon the study by further distinguishing between the types of slides incorporating graphics and sound. The research study could include the use of graphics and sounds that related to the topic and animations that did not relate to the topic. The study could also be repeated using two or more professors. The medical students in the study did not express a preference for the use of the PowerPoint method of instruction over the overhead transparency method of instruction. However, if one recognized and accepted the concept of digital natives, the use of the PowerPoint method of instruction will most likely have more appeal for students. The study determined that specific use of one type of presentation method does not affect learning, yet a further study could be to look at explicit details in the PowerPoint method of instruction to determine its effect on learning and retention.

Apperson et al. (2004) supported the use of the PowerPoint presentation method for instruction even though their research did not determine that its use improves students' academic achievement. They performed their research study at a small, state university in the Atlantic region of the country. The subjects were from five courses in four different disciplines. Five professors participated in the study. Each professor taught using the chalk and lecture method of instruction for the fall semester, and in the spring semester the professors used the PowerPoint presentation method of instruction. The study consisted of 95 participants in the PowerPoint classes, and 104 participants in the chalk and lecture classes. The researchers assessed the participants' perceptions and attitudes toward the use of the PowerPoint presentation method of instruction. They also assessed whether the use of the PowerPoint presentation method improved students'

grades. The subjects completed the university's standard end-of-course professor evaluation questionnaire. In addition, they completed a Likert type assessment on the impact of graphics in the PowerPoint presentation method of instruction, their attitudes and perceptions of the instruction method, instructor preparation, interest in the course, and their overall academic experience.

The results of Apperson et al.'s (2004) research overwhelmingly supported the use of the PowerPoint presentation method of instruction. Subjects articulated that the class was more organized making it easier to maintain focus; the instructor was interesting, class discussion was engaging, and participants believed their grasp of the material was enhanced. Subjects expressed an interest in taking the professor for another class when the PowerPoint presentation method of instruction was used. Subjects' grades did not improve using one method of instruction over the other. The researchers determined that using the PowerPoint presentation method of instruction engages students and is worthwhile even though grades were not affected.

Apperson et al. (2004) attempted to get a diversified group of participants for the study. One way the study could have been improved if the instructors taught one section using each method during the fall and spring semesters. The research could also be replicated with more participants. Another area for research could be to identify what aspects of the PowerPoint presentation method appeal and engage the students.

Sugahara and Boland (2006) stated there was conflicting research concerning the use of the PowerPoint presentation method of instruction and its affect on learning. The authors noted the prevailing belief in the early 1990s was that technology and PowerPoint did enhance learning. From their literature review the authors recognized that PowerPoint may not improve student grades, yet they have found that students prefer this method of

instruction and may engage students in the learning process. Their study started with 189 undergraduate participants in an introductory accounting class in a midsize Japanese university. The researchers asserted that the students' preference for the use of PowerPoint would not significantly affect their academic performance (Sugahara & Boland, 2006).

In Sugahara and Boland's (2006) study, the students were given a questionnaire to answer in week 14 of the semester. Of the original 189 participants, 132 participants were used for the study due to incomplete questionnaires. The participants were required to put their name and ID number on the questionnaire. A different professor administered the questionnaire during allotted class time. The questionnaire assessed the participants' perceptions using a four and five point Likert type scale. Instruction throughout the semester was administered using the PowerPoint presentation method of instruction. The students were provided a copy of the PowerPoint lecture notes prior to class. The results found that participants who expressed a preference for the PowerPoint presentation method of instruction earned lower final exam scores. Contrastingly, the students who did not prefer the use of PowerPoint did not score significantly better on their final exams. Students who take notes overwhelmingly preferred the PowerPoint presentation method of instruction and took advantage of the opportunity to download their lecture notes.

Sugahara and Boland (2006) asserted that unmotivated students may not learn as well when PowerPoint is used because the lecture notes were made available to them requiring minimal effort on their part. They also commented that when using PowerPoint students become unengaged and passive in class. The authors acknowledged that their results should not mean the elimination of the PowerPoint presentation method of instruction. They also acknowledged that their specific type of study was one of the first

performed in Japan, and the research study needs to be replicated in other environments. The results do tie to Burke and James' (2008) research that found the PowerPoint presentation method of instruction was not conducive to accounting courses. One major drawback of Sugahara and Boland's (2006) research study was the requiring of the participants to submit their name and ID number on the questionnaire jeopardizing the validity of the survey. Students may have been influenced to respond to the questionnaire in a manner they thought their professor expected of them.

Sugahara and Boland (2006) did not critique the PowerPoint slides in their study. Clark (2008) and Bartsch and Cobern's (2003) research determined that slides relevant to the topic at hand are more effective. Interestingly, the researchers felt that using PowerPoint leads to the students being passive in the class. Research has found that the correct use of PowerPoint can motivate and actively engage the learner. However, this may not be necessarily true in accounting classes. In this researcher's opinion, it would be interesting to replicate this study in other countries with similar level of students. Does the educational environment of students in Japan align with students from other countries? Are the expectations of students in Japan similar to the expectations of students from other countries?

PowerPoint has been found to be very effective for developing literacy skills for young children especially at-risk and special needs individuals. Parette et al. (2008) shared ways that PowerPoint aids instruction in particular "in the areas of phonological awareness, alphabetic principles, comprehension, concepts about print, and vocabulary development" (p. 233). PowerPoint allowed students to connect letters and words and their respective sounds. Pictures on a slide correlating to sounds and letters were another way students learn using PowerPoint. Young readers gained an understanding of the

relationship between printed words and language. There were various ways PowerPoint can be used interactively to teach and engage children.

Jennifer Clark (2008) asserted that student interest and engagement in classroom lectures can be achieved through the use of PowerPoint. Clark's research included 46 second and third-year history students whose professors employed various styles and methods of PowerPoint instruction in their classes. Using a qualitative questionnaire she assessed the students' input on the positive and negative elements of the PowerPoint presentation method of instruction in lecture classes. Clark did not define learning for the students, yet the respondents articulated that learning increased due to the use of PowerPoint in their classes. They expressed this by stating the information was easier to understand, more organized, the printed handout was reinforced by the visual presentation on the projection screen, and felt they were able to listen more intently.

The students believed that retention increased when printed handouts accompanied the PowerPoint presentation. Students preferred visual and audio stimuli in the presentations. The majority of the students preferred the slides that included movement too. Clark noted that the quality of the presentation and slides was determined by the professors and their creativity. She concluded that while the students like the visuals, colors, graphics, sounds, and movement they expect the slides to be relevant to the content and learning. Slides for the sake of ascetics had no educational value.

Clark (2008) believed it was most effective and "stimulation can be increased if PowerPoint is used to bridge the direct and constructivist teaching models" (p.39). Clark stressed the importance of students being provided with the PowerPoint notes before the class. The printed notes allow students to be more engaged in the lecture; in addition they can write their personal notes and comments on the handout, and are free to participate in

class discussion. Following these suggestions led to higher order thinking for the students with the instructor encouraging students to express and conceptualize not copy.

Clark (2008) emphasized that the students recognize that the professor and the content was the most important element in the course. The students' felt more engaged and interested when quality instructional PowerPoint was utilized. Clark shared great ideas to incorporate PowerPoint into instruction positively. Her research included only a small number of students. She was not looking for a correlation between PowerPoint and improved grades. She seemed to have accepted the current research that asserts that PowerPoint does not appear to affect grades. She wanted to understand what aspects of PowerPoint the students enjoy and relate to feeling that learning is enhanced. She gathered their qualitative responses and offers tips and suggestions. This research could be replicated with a larger population of participants.

Presentation software is readily available in the classroom, the boardroom, and throughout business and industry. Recognizing the wide use of PowerPoint, Deal (2005) claimed that audiences retain more information when presentation software includes the use of visual materials. He referenced two outdated studies to support his claim. The first was a combined study with 3M and the University of Pennsylvania's Wharton School in 1981 titled "*A Study of the Effects of the Use of Overhead Transparencies on Business Meetings*", and the second study was with 3M and the University of Minnesota in 1986 titled "*Persuasion and the Role of Visual Presentation Support*" The author "concluded that visual aids improve communication, effectiveness, improve the audience's perceptions of the presenter, and improve speakers' confidence" (Deal, p. 12). These two studies did not look at the effect of the PowerPoint presentation method of instruction on learning as has been the focus of the majority of research studies performed in this area.

Subsequent early PowerPoint research determined that the audience does perceive that the use of PowerPoint enhances learning; subjects positively viewed the instructor or presenter, and subjects did appreciate the use of relevant visual aids in the presentation. Deal (2005) emphasized what was good about PowerPoint as well as notes what can make a presentation ineffective and a "visual 'eyesore'" (p. 13). Deal explained that conceptual, factual, and procedural information can be displayed in the presentation. Teachers and students now have the ability to direct, produce, and edit their pictures and videos. Deal found to add creativity to the presentation use: "custom animation, hidden slides accessible through hyperlinks or action buttons, add narration, include video clips, embed Macromedia Flash movies, and create interactive games" (2005, p. 13). Deal shared ways to make the PowerPoint method of instruction interesting and appealing; however, he stresses that the goal is to lead students to become "technologically literate" (Deal, 2005, p. 16).

The use of the word literate was important as Kvavik et al. (2004), Bennett et al. (2008), Kennedy et al. (2008), and Xiaoqing Guo et al. (2008) have noted the technological level and ability of today's digital native varies greatly. These researchers all accentuated the importance of improving the technological level and expertise of our students to be able to employ knowledge creatively and critically.

PowerPoint Instruction and Gender

PowerPoint appeals to genders differently. Leonard et al. (2007) focused on the appeal of PowerPoint as it pertains to gender. They did not look at its effectiveness and impact on learning. Leonard et al. performed a research study looking at gender preferences and PowerPoint presentations for pre-service science teachers. Overwhelmingly, the female participants preferred the PowerPoint presentation method

of instruction even when the graphics were not related to the topic. The authors recognized that gender differences exist concerning color and visual stimulation. For example, males were sensitive to visual stimuli where women were more concerned with color and color compatibility. The authors asserted the need for educators to understand "how different populations of students respond to varying components of PowerPoint was a vital piece of the educational puzzle that researchers of instructional technology need to continue to explore" (Leonard et al., p.303). From this study more research could be performed to ascertain what aspects of PowerPoint appeal to both genders enabling professors to design more effective presentations.

Web-based Learning and PowerPoint

Koeber (2005) researched web-based learning and the use of the PowerPoint presentation method of instruction in sociology classes. His premise was that students would respond positively to the professor's use of technology and the students would become engaged in learning and favorably view the course. The researcher taught an introductory sociology class in the fall semester using PowerPoint multimedia presentations and Blackboard© at a mid-size state university in the Midwest. He taught two sections of the class using a lecture format. He used overhead transparency slides that were copied from the PowerPoint slides. The students took five, 40 multiple choice question exams throughout the semester. Students were provided with textbook information that could be accessed on the Internet and take optional quizzes.

In the spring semester, the professor taught two sections of the same course with all elements being the same except for the class met in a multimedia classroom, the transparency slides were replaced by PowerPoint slides keeping with the basic text of the transparencies used in the fall semester, and he used Blackboard© to construct a website

for the students. Koeber (2005) offered extra credit to students who registered on Blackboard©; he also only posted test grades on the site. Only two students out of 91 did not access Blackboard© throughout the semester. At the end of the course all students were asked to answer the university's Likert type scale questionnaire assessing the course and instructor.

Koeber (2005) found that there was not a significant statistical difference in students' grades from either semester. The spring semester showed a significant statistical difference in the overall quality of the course, a higher workload, and students felt the course was easier compared to the feedback from the fall semester students. The results showed that the use of technology and PowerPoint does not affect student grades. However, the use of technology and PowerPoint was viewed favorably by students and increases students' perceptions of teaching effectiveness. The results aligned with Sugahara and Boland's (2006) findings.

Koeber replicated his experiment from the fall to spring semester. He found that grades are not affected by the use of technology in classroom instruction when using PowerPoint and Blackboard©. He did find, as other researchers have, that students' perception of learning and enjoyment for the class increases with the use of technology. I think Koeber could improve upon his research by discovering what aspects of Blackboard© and PowerPoint engage and interest students. He could focus his research on making the class more students centered than teacher centered.

Ricer et al. (2005), Bartsch and Cobern (2003), and Sugahara and Boland (2006) are advocates and educational researchers who believe that the use of the PowerPoint method of instruction does enhance learning and engage students. These supporters focused on the methods and aspects of the design of the PowerPoint presentation to

augment learning and interest the students in the learning process. Focus on the capabilities of the presentation software to utilize it to meet educational goals of the professor for the specific course.

Web-Based Reading Instruction

Two university professors studied whether a technology web-based summer reading program would positively impact students' reading behaviors. They also sought to ascertain what aspects of the program were of value to be replicated in future programs. Lu and Gordon (2009) performed their study at a high school in New England. In the summer reading program 288 students from three ability groups participated along with 11 English teachers and the school librarian. The school in the study homogeneously grouped their students. The three groups represented in the study were high achieving, average achieving, and low achieving students.

Lu and Gordon (2009) surveyed the student participants and interviewed the teacher participants. The researchers used close ended questions to identify age, gender, grade level of the participants. The other questions from the survey were open ended in an attempt to have the participants answer honestly and candidly about their reading attitudes and behaviors. The researchers had a 52% rate of return on the questionnaires. Originally 550 surveys were dispersed with 288 respondents replying.

Lu and Gordon (2009) did not identify access to computers and the Internet as a factor influencing the outcomes of the study. Students who reported not having computer access in their homes utilized public resources and still participated in the summer reading program. The researchers found that the reading level of the participants was the most significant factor influencing reading behavior. Computer and Internet access was considered a non-issue concerning reading behavior.

Lu and Gordon (2009) emphasized an important element of the summer reading program is the variety of selections that were not grade specific. The lists were posted online. The lists were also available at the school library and bookstores in the community. Computers and Internet access was available at the public library in town for the students without the necessary resources in their homes. While the participants claimed to use the Internet to peruse the reading lists only nine percent of the students used the "Get Books" feature online. The "Get Books" feature allows individuals to purchase and download the book immediately to their computer or electronic book. The participants preferred purchasing or borrowing the books they selected to read. The participants did not favor using the online catalogue as well. Only 18 participants used online sources to purchase their reading material.

Another significant element of the program that the researchers shared was the web-based project choices including an assortment of language, art, and computer based options (Lu & Gordon, 2009). The participants' reaction to the projects did not include a preference for or against the web-based choices. The students expressed positive feedback concerning the web-based summer reading program. The ability to browse and select from a variety of choices was deemed favorable by the participants.

In the teacher interviews, Lu and Gordon (2009) found a split among participants as to the value of offering the summer reading program web-based. The teachers felt that the web-based choices led to confusion for the participants. They believed that the participants' reading behaviors were not influenced by the web-based choices. A few teachers articulated that the web-based reading program could positively impact the unmotivated reader. They also saw the value in the web-based program encouraging critical and independent thinking skills.

Lu and Gordon (2009) did not indicate how the students were selected to participate in the summer reading program. They did identify that three reading levels participated. Was the program voluntary? Was the programmed offered for students needing remediation? Knowing why the participants were in the summer reading program would lead to a greater understanding of the results of the study. The participants did not seem to embrace the online aspects of the summer reading program. It would be interesting to learn why the participants who are digital natives did not use the interactive technological features of the program more. The participants did not use the online capability to download the books or participate in the blogging projects. These were all features that align with what critics like Prensky (2008), Murdock (2005), and Tapscott (2009) claimed that today's digital natives' desire, yet the participants in this study did not utilize their technological options. The results tied to what Kvavik et al. (2004), Kennedy et al. (2008), and Bennett et al. (2008) highlight about the differences among our digital natives.

Eye-Tacking Technology

Slykhuis et al. (2005) researched the visual aspects of a presentation slide that increase understanding and retention for the learner. Fifteen pre-service teachers in an introductory science education course participated in the study. The research questions for the study were: Is there a difference in how students attend to photographs either with or without audio narration? Do students rarely attend to the photograph regardless of the level of its classification (Slykhuis et al., 2005, p. 512)? The researchers chose to use Pozzer and Roth's (2003, as cited in Slykhuis et al., 2005) four classifications of photographs: decorative, illustrative, explanatory and complementary. Decorative photographs provided aesthetics only, illustrative photographs did not add new or

additional information, and explanatory photographs provided a caption explaining the photograph. Complementary photographs were the most beneficial for the student. These photographs offered new or additional information that was not present in the text.

Slykhuis et al. (2005) used eye-tracking technology to evaluate the percentage of the time each subject spent looking at the photograph in relation to the amount of time spent viewing the entire slide. The results indicated that the subjects spent significantly more time viewing the complementary photographs. The results also showed the subjects' initial and subsequent focus was on the complementary slide whereas on a decorative slide the focus was for a shorter time span and not until other aspects of the slide have been viewed. The participants looked at all the slides; however the complementary slides received more focus and attention. When the PowerPoint presentation was accompanied with an audio narration the subjects spent more time viewing those slides than slides without audio enhancement. When audio narration was used there was little distinction between the four types of photographs and subject attention to the slide.

While it seemed that the results of Slykhuis et al.'s (2005) research were what would be expected, educators often do not construct PowerPoint presentations in the most effective manner for the learner. The results of the research study provided valuable information for the educators who use PowerPoint. Leonard et al. (2007) found that females prefer slides with color and graphics even when they do not relate to the topic or subject matter. However, armed with this information educators can still appeal to their female learners by using color and graphics that are complementary in nature. The research study was performed on only 15 participants that were pre-service science education teachers. The study should be duplicated with more participants in varied

fields. The results of Slykhuis et al.'s (2005) research study provided a sound basis for application and use by educators and all users of PowerPoint presentation applications.

The Web and Student Learning

Wiley et al. (2009) sought to evaluate college students' ability to disseminate science information posted on the Internet. The researchers performed two experiments to gain an understanding of how students process information when using the web. They assessed students' methods of search, selection, evaluation, comparison, and integration of specific scientific content (Wiley et al., 2009).

Wiley et al.'s (2009) research study was conducted at two state universities that shared similar student demographics and academic entrance requirements. The participants from the study were pulled from students enrolled in introductory psychology courses. The possible participants took a pretest on volcanic eruptions. There were 110 participants in the study selected from a group of 1,650 possible students. The participants were in their freshman or sophomore year of college and their average age was 19. The participants were divided into four different methodology conditions all involving the Internet. The four conditions were: employing the Dual-Purkinje eye tracker; a think aloud task; a head-mounted eye tracker and think aloud task; and the absence of both eye tracking technology and a think aloud task. Ninety other participants in the study comprised the non-reading comparison group that would not participate in the inquiry activity (Wiley et al., 2009).

Wiley et al. (2009) directed the participants to explain the eruption of Mt. St. Helens. The participants were provided with seven Internet sources related to volcanic eruptions. The researchers replicated the appearance of a "typical" Google search. The search results were ordered and presented in two different ways. Half the participants

were given the first order of results, and the other half of the participants received the second ordering of search results. All participants received exposure to the same seven results just the ordering was different. Some of the search sites provided inaccurate or incomplete information. The participants could not gather all the necessary information to complete the assignment through one Internet site. As part of the assessment procedures the participants were asked to rank the seven Internet sites and explain their selection evaluating the reliability of the sources.

Wiley et al. (2009) assessed the students' knowledge after researching the topic through an essay and test. Half of the students were directed to write an argumentative essay and the other half wrote a descriptive essay. The authors devised a four part evaluation rubric. The first level of the rubric was labeled Type O. Earning a Type O meant the participant's essay was mostly inaccurate information without covering the topic. Type 1 demonstrated an understanding of only one aspect of the assignment. Type 2 and 3 confirmed the participants understanding of the concepts with Type 3 showing the highest mastery level. The test assessment was a 30 question recognition test. To determine if the participants were able to apply their new knowledge, the researchers edited one participant's essay and asked the rest of the participants to evaluate the essay for accuracy using the evaluation rubric. The edited essay contained inaccurate information. The non-reading group did not participate in the Internet inquiry aspect of the study. The non-reading group also wrote an essay on Mt. St. Helens.

Wiley et al. (2009) then compared the results of the reading group with the non-reading group. The results demonstrated that the Internet inquiry group performed better than the non-reading group. The inquiry group scored higher on the Type 1 and 2 evaluation tool than the non-reading group. The results indicated that more of the

participants who were expected to write the argumentative essay scored in the Type 3 range. These participants spent more time rereading the reliable Internet sources. While the inquiry group scored higher than the non-reading group the results still demonstrated that the participants did not gain a thorough knowledge and understanding of the assignment. The researchers concluded that for experiment one the participants did not know how to disseminate accurate and reliable information from inaccurate and unreliable information on the Internet.

Taking the information learned in experiment one, Wiley et al. (2009) performed a second experiment at the same two institutions with 56 participants from the original student pool. For this part of the study, half of the participants first received instruction on evaluating reliable and accurate Internet sites. Prior to experiment two, 79% of the participants indicated that they had never received instruction for evaluating Internet sites. The researchers identified four areas that they felt students need to understand when researching on the Internet. The four areas are: source, evidence, explanation, and knowledge (SEEK) (Wiley et al., 2009). Half of the participants received SEEK instruction and the other half did not.

Following the format of experiment one, the experiment two participants were asked to evaluate the Atkins low carbohydrate diet to determine its health benefits or risks (Wiley et al., 2009). Again Internet sites were provided offering information on the topic. The participants were asked to rank the Internet sites. All participants were able to identify the most reliable and credible web site of the group of Internet sites. The findings did indicate that the participants who received the SEEK instruction far surpassed their counterparts in the identifying the most reliable and accurate sources.

Wiley et al. (2009) then performed experiment one with both groups of

participants from experiment two. All procedures from experiment one were followed for the second group of participants. One goal of the researchers was to determine if the SEEK instruction the participants received for the Atkins low carbohydrate diet task would transfer to the Mt. St. Helens task. For the essay portion of the Mt. St. Helens experiment the students' essays for those who did not receive the SEEK instruction scored Type 1 on the evaluation rubric. The SEEK groups' essays were mostly assigned a Type 3. The navigation patterns of the SEEK groups was significantly different from the navigation patterns of the non-SEEK instruction group. The results determined that the SEEK instruction was effective for improving comprehension when searching the Internet (Wiley et al., 2009). The results also indicated that the SEEK instruction did transfer to other Internet searching tasks.

With the call to integrate technology in instruction it is important for students to learn how to use the Internet and technology effectively. As Kvavik et al. (2004), Kennedy et al. (2008), and Bennett et al. (2008) have all noted, being a savvy, social networker, digital native does not necessarily correlate to knowing how to use technology for learning and comprehension. The results found that the SEEK instruction improved the participants' navigation patterns, ability to decipher between credible and inaccurate information, and that the SEEK skills transferred to other tasks.

Wiley et al. (2009) controlled the information provided on the Internet. They replicated a typical Google search for all participants while providing the same seven Internet sites. The only difference being the ordering of the sites on the results page. This aspect of the study allowed for a good comparison between the reading and instruction group with the non-reading and non-instruction group. One of the most important results of this research study notes that students need instruction to use technology effectively

and efficiently. Wiley et al.'s (2009) research highlights that educators cannot assume that because their students have grown up using technology that they know the best way to incorporate technology in an educational context. The results of Wiley et al.'s (2009) study indicated that today's students need guidance and instruction in the educational use of technology.

Researchers Eysink et al. (2009) used multimedia learning environments to determine which learning model was the most effective for student learning and performance. The researchers' studied four active learning instructional methods. Following the constructivist learning method, Eysink et al. (2009) asserted that the most meaningful learning takes place when the students become active stakeholders in the learning process. The four learning approaches for the study were: hypermedia learning, observational learning, self-explanation-based learning, and inquiry learning. With hypermedia learning the student told how something works, for observational learning the student showed how something works, for self-explanation-based learning the student explained how something works, and for inquiry learning the student investigated how something works (Eysink et al., 2009, p. 1108). All the instructional methods were taught in computer based learning environments. The researchers chose the computer based learning environment to avoid the influence of teacher effect if individual instructors taught the concepts. Mathematics was the content area and probability theory was the concept taught.

Eysink et al.'s (2009) non-equivalent control group design consisted of four studies in two countries. Two studies were performed in Germany in the German language, and the other two studies were performed in the Netherlands in Dutch. Of the 624 participants in the study, 318 were male, 303 were female, and three participants did

not state their gender. The participants were in grades 10 and 11. In Germany and the Netherlands grades 10 and 11 are the highest secondary grade levels. The research procedures were identical for all four studies. There were 196 participants for the hypermedia learning method, 138 participants for the observational learning method, 169 participants for the self-explanation-based learning method, and 121 participants for the inquiry learning method (Eysink et al., 2009, p. 1118). Following the curriculum the participants engaged in specifically designed random probability exercises. The participants answered a characteristics questionnaire, took a pretest, and posttest. All posttest items mirrored similar questions from the pretest. The concepts covered on the tests were conceptual, procedural, intuitive, and situational.

In Eysink et al.'s (2009) study the participants received an introduction to probability theory in four different computer based learning environments using each instructional method. The data was collected, combined, and analyzed from all four studies. The researchers analyzed the effectiveness of the instructional methods which encompassed academic performance and cognitive effort. They also analyzed efficiency of learning which looked at how long it took for the participants to reach specific levels of understanding. The researchers employed pair wise comparisons using the Bonferroni procedure. The results showed that in almost all categories the self-explanation based learning method was significantly higher than the other three learning methods.

An exception occurred in the conceptual knowledge and situational knowledge categories where there was not a significant difference between the self-explanation based learning method and the inquiry learning method. However, the self-based explanation based learning method was significantly higher than the other two methods in the same category. An interesting result of the study identified that the participants who

engaged in the self-explanation based learning method needed more time to complete the tasks than the participants in the other three learning methods. Inquiry learning was the found to be the next most effective instructional method. Hypermedia learning and observational learning methods received the lowest scores.

The results of the study found that students who actively participate in their learning process gain the most benefits. When given the time necessary to engage in self-explanation based learning the student will attain the highest levels of conceptual knowledge, intuitive knowledge, procedural knowledge, and situational knowledge (Eysink et al., 2009, p. 1142). Self-explanation based learning has many positive attributes, yet with the advent of No Child Left Behind and all the other constraints on educators is it the instructional method to employ? In this researcher's opinion, the method Eysink et al. (2009) used was inefficient and time consuming which did not help with the testing and limitations placed on education in America today. The most practical solution when designing instructional methods would be to take the best aspects of each instructional method.

Two noticeable questions arise from the research study. Were the high school students in the study experienced enough to be self-learners? Is probability theory a concept that students can grasp on their own without the assistance and guidance of a teacher? The concept of the study was good, yet mathematics is a content area that many students struggle to learn. A different content area may have served better for this research study. Even though the participants in the study were in their last two years of high school have they developed the necessary skills to be independent learners? Another drawback of the research study was the comparison of the different instructional methods. Eysink et al. (2009) explained that even when the same assessment method was

employed there were many disadvantages to comparing new instructional methods to traditional methods (p. 1109).

On a positive note, this researcher feels that the study did show that self-explanation based learning can be tied to technological instruction. The study's results can aid instructional designers when developing curriculum to include technological instruction. Another concern was does the knowledge learned in this research study transfer to students in the United States. Are the educational systems from Germany and the Netherlands similar to the educational system in America? The researchers did not address the comparison between the three countries in their study. The study was a good start for future research to address instructional methods using technological instruction.

Wijekumar et al. (2009) with the Regional Educational Laboratory (REL) Mid-Atlantic sought to identify an instructional method that increases elementary students' math achievement. The researchers determined that fourth grade is a pivotal year for math instruction. Their research indicated that other countries begin to surpass American students in math at this point. In 2005, in the Mid-Atlantic region, 693 schools were using the Odyssey Math software program; although little research existed to support its significance for improving math achievement. Developed by CompassLearning, Odyssey Math is a computer based math curriculum for K-12 students. The web-based program includes learning activities, math tools, and assessments (Wijekumar et al., p. 2). The Odyssey Math technological program can be used as the sole math curriculum or a supplement to the school's existing math curriculum. The researchers chose to use the Odyssey Math program as a supplement to the existing math curriculum.

The schools in the Mid-Atlantic Region were offered free use of the Odyssey Math software program for participation in the research study. Thirty-two elementary

schools from the Mid-Atlantic Region volunteered to participate in the study. The final participating schools were: 23 from Pennsylvania, eight from New Jersey and one from Delaware. The study included 122 teachers and 2,637 students (Wijekumar et al., 2009, p. ix). Random assignment determined the control and experimental groups for each school participating in the study. Due to the random assignment, the researchers determined that there was not a statistically significant difference in the "socioeconomic status, percentage of English language learner students, racial/ethnic minority students, gender, and teacher participation in professional development of the study's participants and teachers" (Wijekumar et al., 2009, p. ix).

The researchers sought to discover if the experimental group, the students who received the Odyssey Math technological instruction, would have higher math achievement scores than the control group on the TerraNova CTBS Basic Battery assessments. They also investigated the effect of the Odyssey Math program on the achievement of students by gender and those identified as high achieving and low achieving. The teachers in the experimental group were asked to employ the Odyssey Math program for 60 minutes per week. The math program's tracking system indicated that for the overall study the teachers used the Odyssey Math program for an average of 38 minutes per week. The researchers observed classroom instruction throughout the study.

The results found that there was not a statistically significant difference in fourth grade achievement on the TerraNova CTBS Basic Battery assessment when the Odyssey Math technological instructional method and the traditional math instruction were employed. The researchers did not find a statistically significant difference when looking at gender and high achieving and low achieving students. The researchers investigated

the difference between teacher professional training and still did not find a statistically significant difference. Wijekumar et al. (2009) emphasized that the results of their study relate to partial use of the Odyssey Math technological program and not full implementation. The researchers acknowledged that the participating schools volunteered for the study and emphasized that the results should not be generalized outside the Mid-Atlantic Region.

Yu et al. (2010) studied the effects of Web based instruction on seventh grade science students in Taiwan. The researcher investigated the effects of Web based instruction compared to traditional instruction had on student academic achievement in biology and on the students' problem solving skills. The researchers looked at the same questions as it pertained to identified high achievers and low achievers. The 156 participants were gathered from four different junior high schools. Seventy-eight students were put in the experimental group who received web based instruction. The remaining 78 students in the control group received traditional methods of instruction. The researchers then divided the participants into groups of high achievers and low achievers. Yu et al. classified the high achievers as the students that scored above average on the first biology assessment. The low achievers were the students who scored lower than average on the same assessment. There were 52 low achievers identified and 104 high achievers.

The students received six weeks of instruction in evolution. The same instructor taught all the participants in the study. The experimental group used computers and engaged in web instruction including PowerPoint, the Internet, interactive technologies, discussion boards, and web-based problem solving activities. The control group received instruction in the lecture format and textbooks served as the source of information. Oral

conversations were the only method of sharing and interaction for the control group. The experimental group used the computer as a tool to discover unknown science concepts; there were no restrictions for accessing the information. The control group used paper and pencil as they ascertained the science concepts; the control group was required to follow a sequence while discovering the science concepts.

The students were given a pre-test, post-test, and retention assessment. The results found that the experimental group scored higher on the post-test and retention assessment. When the researchers ran the MANCOVA using the pretest score as a covariate they did not find a statistically significant difference in the end assessments when compared to the pretest. The researchers concluded that the instructional method did not influence student academic achievement. The results did find that the high achievers outscored the low achievers. However, when the pretest score was used as the covariate they did not find a consistent statistically significance in the mean post assessments. For the problem solving aspect of the study, the control group outscored the experimental group in all categories on the post-test. Yet, after five months the retention assessment was administered and the experimental group outperformed the control group in all categories. The researchers determined that the web instructional method was statistically significant in the areas of problem solving and retention.

Yu et al. (2010) expressed that the research literature did not support their findings concerning problem solving and retention. They indicated that the experimental group was required to follow a rigorous three step method to solve problems. The same method was not required for the control group. They believe that when the participants took the post-test they did not have enough time to process the information and gain the benefits from the learning process. That is why they reasoned that after five months the

retention assessment showed that there was a statistically significant difference for the experimental group; the students had time to gain the benefits from the instructional method. The researchers thought the Web based instruction would motivate the low achieving students. They did not find that either method of instruction was better than the other to engage the low achievers. Yu et al. (2010) noted that the students identified as low achieving had lower mean assessment scores compared to their counterparts; however, they had higher mean scores than the high achieving students in the area of problem solving. While the researchers suggested that more research is needed, they believe that low achieving students will benefit from web instructional methods.

Virtual Lecture Hall

Cramer et al.'s (2007) research study, noted to be one of the largest, included 839 possible participants taking an introductory psychology class at a university in Ontario, Canada. The researchers believed that the Virtual Lecture Hall (VLH) would lead to increased student retention. The VLH was "an instructional computer-based platform for delivering Microsoft PowerPoint slides threaded with audio clips" (Cramer et al., 2007, p. 106). The purpose of the VLH tool was to provide a tool for students to review class lectures accessed via a website. The researchers recognized the changing dynamics of today's education with more classes being offered online and through distance learning. Their premise was that using the VLH pedagogical tool would lead to greater retention of material for students, increase student test scores, and increase student course satisfaction.

In the Cramer et al. (2007) study, 165 students chose to utilize the VLH learning tool. Students were not offered incentives for participation in the study. The participants were required to enter their name and student number on the website to access the class

lecture through VLH. The participants understood that their use on the website was being monitored for the purpose of the research study. After accessing VLH, students were asked to complete a five-point Likert scale survey stating their reactions to VLH. Respondents identified whether VLH increased their learning, their grades, and their preference to have VLH made available in other classes.

In the Cramer et al.'s (2007) study the students took the midterm exam after the first five weeks of the semester. The VLH tool was then made available to the students and the midterm exam was used as the baseline. VLH tool was obtainable for the students for the next five weeks prior to the next midterm type exam. The results found that when students viewed over 100 hours of PowerPoint presentations, in the form of VLH, their grades increased by 15% the second part of the semester. A positive correlation identified those students that viewed VLH recurrently scored significantly higher on their second exam. Student perceptions of the VLH tool were positive believing its use would increase their learning and test scores. Ninety-three percent of the participants commented that they would like to have the VLH pedagogical tool offered in their other courses.

In this researcher's opinion, Cramer et al. (2007) had the opportunity to include a large number of participants for their study. They could have possibly done a better job of recruiting participants without applying pressure to the students. The newness of the VLH tool may have been another reason students chose not to access the website. The research team could have provided various ways to demonstrate how to access the site and share the positive reasons for doing so. Present technology especially with Mac computers allows for students to access the class lecture if they take notes during the class. This may be another reason why students did not feel the need to utilize the VLH tool. However, the VLH tool was the only resource available for a student who missed

class. Additionally, students may have not accessed the VLH tool because today's digital natives appear to be less inclined to utilize all the teaching tools made available to them. It would be advisable to replicate this study with students from other majors. This study did not have the students critique what was positive and what was negative with the Virtual Lecture Hall teaching tool.

Web 2.0 Technology and Instruction

United Kingdom researchers Ward et al. (2009) studied incorporating Web 2.0 technologies in instruction in the health care curriculum at the university level. The authors noted that educational instruction has not kept pace with the latest technological trends including the use of Web 2.0 tools. They recognized that the Virtual Learning Environment (VLE), an interactive learning environment online, is limited in its capabilities as compared to the more current Web 2.0 tools. The researchers included social networking, web communities, wikis, blogs, web design and creation, information sharing, and collaboration as Web 2.0 tools (Ward et al., 2009).

The researchers initially used personal contacts to identify the participants for the study. They then utilized the Quality Assurance Agency for Higher Education Major Review of healthcare listings and the Nursing and Midwifery Admissions Service lists to enhance their participant list (Ward et al., 2009). Twenty-five universities in the United Kingdom were represented in the initial phase of the research study the survey portion. The Web 2.0 study was both quantitative and qualitative. The participants completed a survey adapted from the Managed Learning Environment Study Tool (Ward et al., 2009). Then the researchers met with survey respondents in a focus group format to gain a deeper more detail understanding of the participants' answers to the survey tool.

Ward et al. (2009) found that email, discussion boards, and CD-ROMS, DVDs

were the most prevalent used technological tools for instruction. Many Web 2.0 tools such as wikis, blogs, SMS Texting, mobile phones, and iPods were used in a very limited capacity if at all. The case study visits were productive in that the researchers were able to ascertain the reasons that the latest Web 2.0 tools were being neglected in instruction. The researchers discovered that E-learning is not a priority at the 25 universities in the study with the individuals who possess the purchasing authority. Therefore, the universities lacked the hardware to support increased technological instruction. The study also found that most of the faculty and staff lacked information technology (IT) skills and knowledge. This may have also been a factor influencing the lack of hardware support for instruction because the faculty and staff did not advocate for an increase in technology support for instruction.

Ward et al. (2009) found that the students were not interested in seeing social networking incorporated into instruction. The participants expressed the desire to keep their social networking tools such as Facebook separate from their education. They communicated the belief that social networking was for personal use only. A faculty member shared a concern that the students were unaware of the negative implications that could result from exposure to their social networking sites. The faculty member cited articles and news reports highlighting the negative consequences when an individual's social networking site becomes public.

Ward et al.'s (2009) method of identifying participants was not the most effective and could have led to influencing the results of the survey. By using personal contacts to identify the participants, the respondents may not have answered the survey in a completely impartial manner. Knowing the researchers may have influenced the participants' responses causing them answer the questions to align with the expectations

of the researchers purposely or unknowingly. The researchers also noted that when they used the Quality Assurance Agency for Higher Education Major Review of healthcare listings and the Nursing and Midwifery Admissions lists they found many duplicates from the three sources utilized to identify participants. The researchers noted that their sources did find many duplicates and that contact information was missing. Therefore, a participant for the study may have answered the survey more than once without the knowledge of the researchers.

The results of Ward et al.'s (2009) study identified that a majority of the faculty lacked the information technology skills and knowledge needed to incorporate Web 2.0 technologies in instruction. There needs to be professional development for instructors to be able to keep pace with the technology skills, expectations, and desires of their students. The faculty and staff's lack of information technology knowledge and understanding may be a factor preventing the universities from purchasing the proper equipment to support the more advanced methods of technological instruction. The lack of technological support leads to frustration for the faculty and staff who have embraced technology and desire to implement more interactive Web 2.0 tools in their classroom instruction. Ward, Moule, and Lockyer noted the needs of the universities seem to override the learning needs of the students. They express that the potential of using the innovative pedagogical tools available is being ignored by the majority of faculty and universities.

Modeling Technology in Instruction

Professor Alicia Crowe (2004) researched the impact of modeling technology in instruction on social studies education students. The author noted that the social studies discipline had not kept pace with other disciplines in integrating technology into

instruction. Crowe integrated technology instruction in two courses she taught at a university in a social studies education course and a seminar course that education major students take before their 96 hour practicum. She taught both courses to the same group of 23 students. One student dropped the course after being called for active duty to serve in the military. The researcher's purpose was to model the use of technology in instruction and encourage student use of technology. The researcher employed the strategy of modeling different technological classroom instructional methods and required the students to complete a project implementing technology.

During the first course students were asked to complete a technology survey. The survey attempted to gain an understanding of the students' technology use comfort levels and their willingness to incorporate technology in their instruction as future teachers. Throughout the semester the professor documented the use of technology through lesson plans, journals, and student work. Crowe (2004) interviewed a student in the course. The student utilized technology frequently in the class, yet the subject expressed during the interview that she felt she lacked the knowledge and comfort to employ technology. The student interview occurred on two different occasions. After transcribing and evaluating the interviews, the professor decided to ascertain the perceptions of a second student.

The second interviewee had collaborated on class assignments with the first interview subject. He expressed a high comfort level using technology. The results of the interviews with the two students led to Crowe (2004) devising another student survey. The second questionnaire dealt the with the subjects' influences of technology. The second survey was administered at the end of the second course before the 96-hour practicum. After the second survey three more students participated in one on one interviews with the professor.

Crowe (2004) found that teacher modeling of technology strongly influences students' desire and motivation to employ similar instructional techniques. After the first course the researcher noted students employing technological strategies throughout their coursework. By the end of the second course students were using technology more frequently and comfortably. The professor observed students using PowerPoint and incorporating images, graphics, video clips, charts, graphs, and music into their presentations. She noted that even when technology was not required most of the students still chose to incorporate technology into their assignments. Students began using web sites to enhance their assignments. Some students created web sites for their future classes. The researcher highlighted the students' perceptions that the instructional method of incorporating technology strongly impacted their acceptance and utilization of technology themselves. Crowe shared she learned that professors must model instructional technology and doing so or failure to do so sends an important message to their students.

In this researcher's opinion, the researcher demonstrated the importance of modeling technology especially if future teachers are going to be expected to incorporate technology in their instruction. Similar to Ward et al. (2009), Crowe found technological instruction cannot proceed and be enhanced without the support and encouragement from the administration and faculty. Crowe (2004) did not identify the age group of her students. Most likely some of these students would have qualified as digital natives. It would have been important for her to note whether the students who felt more comfortable with using technology were digital natives or not. It would have been good to know if some of the students were digital immigrants. As Kvavik et al. (2004), Kennedy et al. (2008), Bennett et al. (2008) clarified, the varying levels of technological

expertise does exist between the digital natives. Crowe's research could have added to this information if the ages of the students had been identified.

Using her students for the study provides some drawbacks to the validity of the research. The question arises if the students were completely honest answering the two surveys. Did the students respond in a manner they perceived that their professor wanted them to? In the case of the student interviews the subjects may have been hesitant to be candid because their professor was interviewing them—the same professor who was responsible for their grade in the course. Crowe's (2004) intention for her research was good, and her results did show that modeling is important to increase student learning and incorporating technology in instruction. By being part of the study the researcher led the validity of the results to some speculation even though the study resulted in positive outcomes for the 22 students.

Students' Use of Computers in Social Settings

Cilesiz (2009) performed a phenomenological study to gain a better understanding of adolescents' computer use and experiences at Internet cafes. Adolescents spending leisure time at Internet cafes continues to increase. The author identified a void in the area of research looking at students' computer use in leisure situations. Cilesiz asserted the potential to understand significant educational implications can be identified by studying adolescents' social computer use at Internet cafes. The researcher's goal was to understand the adolescent experience and to apply his findings to an educational context. Cilesiz defined an Internet cafe as a public business allowing for social gathering that offers Internet capability to their patrons. Internet cafes are mostly social where groups can informally form. Cilesiz broke down the context of education and learning into three groups: computer use in formal learning environments; computer use in non-formal

learning environments; and computer use in informal learning environments.

Cilesiz (2009) performed his research in Turkey in a city with a population of 250,000 people. The city in the research study had approximately 180 Internet cafes. Cilesiz' recruited volunteers from two Internet cafes. The criterions used to select his subjects were students who visited the Internet cafes at least two times per week and adolescents who used the computers for educational tasks. The researcher interviewed his potential subjects asking how they used computers in this social setting for educational purposes. He did not provide the volunteers with an interpretation of computer educational use. Prior to the interviews, Cilesiz identified eight items as acceptable responses to his questions. Six subjects were selected to participate in the phenomenological study. The subjects were high school students who had parental consent to participate in the study. The participants agreed to engage in audio taped interviews.

The subjects participated in three open ended detailed interviews. The interviews lasted no longer than 90 minutes and took place in a public area. The interviews were transcribed verbatim and merged into one document (Cilesiz, 2009, p. 243). Cilesiz explained that he translated into English the comments and statements he determined to be significant. To increase validity he sought out peer review for his selections and translations. When analyzing the data the researcher interpreted meaning units, developed profiles called individual textural descriptions, he employed imaginative variation for interpretation, as well as comprising individual structural descriptions for each subject. Then the author integrated his results to identify similarities amongst his subjects.

To increase validity of the study the researcher was assisted by a fellow professor fluent in Turkish and English. First the peer reviewer analyzed Cilesiz's (2009) data

collection results to determine relevancy to the research study. Then the peer reviewer evaluated the Turkish to English translations to ensure accuracy. In keeping with the integrity and ethical requirements of a phenomenological study the researcher did not compensate his participants financially. He chose to make himself available to the participants for advice relating to the college admissions process and studying abroad (Cilesiz, 2009, p. 245).

Cilesiz's (2009) results tie to Kvavik et al. (2004), Bennett et al. (2008), Jing (2009), and Kennedy et al.'s (2008) results in that his subjects recognized that using technology for social purposes does not help them reach their full potential using technology to help them educationally and in their future careers. The six subjects have built an identity that defines them by their computer use. They expressed that they felt they were experts in using computers and accessing information. All six subjects indicated career choices that technology and computer use would be beneficial or required. The subjects all recognized the value of using computers educationally in their present and future lives.

Cilesiz (2009) reported the subjects felt the Internet cafes provided them the opportunity to interact with people who shared their interest in technology and computers. The subjects reported that their computer use at Internet cafes served as a compliment to their education at school. They could engage in more in-depth and enriching activities that they did not have time for during the school day. All subjects expressed that they liked the freedom they were allowed educationally at the Internet cafes; they were not limited by the constraints in place at school. The participants articulated that they were a minority when it came to adolescents' use of computers educationally in this environment.

As a professor at the Ohio State University, Cilesiz (2009) never explained why he chose Turkey to perform his research study. He did have to translate the subjects' responses into English. To help in this capacity, he employed a language expert to ensure that his translations from Turkish to English grasped the intended meaning of his interviews with his subjects. However, had this study been performed in Cilesiz's native language his understandings may have been more concrete. The opportunity for misunderstanding and miscommunication increased when more individuals were involved in the translations. The translator was not part of the actual interviews.

Cilesiz (2009) performed his research on a homogeneous group of subjects. It would be beneficial to replicate the study with a more diverse selection of subjects. One reason for the researcher's inability to gain access to a more diverse participant pool was the need for parental consent. There may very well be adolescents' who use computers at Internet cafes without their parents' knowledge. Do the results found in this research study correlate to student use of Internet cafes in the United States? Do adolescents in the United States frequent Internet cafes in the same ways adolescents do in Turkey? Do Internet cafes in Turkey mirror Internet cafes in America? These questions highlight that the information of this study may not be able to translate to other environments. What the study did show was that adolescents choose to use social and leisure activities to engage in educational activities. This information can be the basis for further research and the development of ways to engage students educationally outside of school.

Students' Perceptions of Technological Instruction

D'Angelo and Wooley (2007) research included three areas: the technologies students experience in the classroom; students' perceptions of technological learning environments; and do subpopulations of students view the effectiveness of technological

learning environments differently. The research study took place at a large midwestern university with students enrolled in criminal justice courses. Subjects were from four different courses and almost equally represented the freshman, sophomore, junior and senior classes. No incentive was offered for participation in the study. The racial breakdown of the subjects was "88% Caucasian, 6% African-American, 5% Latino, and 1% different racial/ethnic background" (D'Angelo & Wooley, p. 465).

D'Angelo and Wooley (2007) determined that 98% of the students had been exposed to technology in the classroom (p. 465). Consistent with other research performed by Bartsch and Cobern (2003) and Hansen and Williams (2008), the subjects' perceived that learning was enhanced when the PowerPoint presentation method of instruction was used in class. Participants felt that the PowerPoint presentation method of instruction was more effective then classes using the chalk and lecture method of instruction and classes using Blackboard© and online course activities. For the subpopulations, there was no difference in students' perception when comparing "gender, race, academic major, and college status" (D'Angelo & Wooley, 2007, p. 468).

In this researcher's opinion the research study should be replicated at other colleges and universities. It would be good to perform the study at schools that are noted for their technological use and those that lack the technological means. This study focused exclusively on students' perception and not learning. Another area where D'Angelo and Wooley (2007) could improve their study would be to identify the positive and negative aspects of PowerPoint as perceived by the students. The study should also be replicated at a more racially balanced institution.

Burke and James (2005) sought to discover students' perceptions of the effectiveness of PowerPoint instruction in college business courses. The authors wanted

to ascertain students' insights as to what makes PowerPoint presentations effective and determine the frequency of use by professors. The setting for the study was an urban university in the South. Data was collected over a two-week period starting with 230 participants. Some professors offered extra credit to students to encourage participation in the research study. Students were asked to answer only the Likert type questionnaire one time, as they may be enrolled in two or more classes participating in the study.

Burke and James (2005) found almost 33% of the faculty stated they never used PowerPoint presentations in class. Twenty-seven percent of the faculty claimed to utilize PowerPoint always and 14.3% claimed to use PowerPoint frequently. The student participants rated PowerPoint presentations effectiveness in their class. The results indicated that the subjects identified the most effective use of the PowerPoint instructional method was in their management courses followed by marketing and economics. Accounting was the one class that students did not deem PowerPoint as an effective teaching tool.

To gain a clear understanding of the students' perceptions Burke and James (2005) asked the subjects to articulate what they deemed as positive and what was negative about the faculty using the PowerPoint presentation method of instruction in class. The positive aspects of using PowerPoint instruction included organization and structure, graphics, pictures, and visuals. The negative aspects of PowerPoint as viewed by the subjects were related to the instructor not using the presentation software properly. This study distinguished the effectiveness of PowerPoint instruction by course content. PowerPoint was found not to be as effective for courses that emphasize mathematical or quantitative fundamentals where demonstration for working out problems is necessary.

Burke and James (2005) failed to use an accurate method to recruit subjects for

the study. Students had the option to participate with the enticement of extra credit or class participation points. There were various reasons as to whether the student would participate or not. There was no way to determine if a student answered more than one questionnaire in other business classes especially with the enticement of extra points. The research study did identify if the subjects viewed PowerPoint more positively in conceptual courses rather than the quantitative courses.

The researchers identified suggestions and tips that the subjects' felt make the use of the PowerPoint presentation method of instruction more effective:

- The font needs to be at least 28 point and a type of sans-serif. Arial, a sans-serif font, is also a font found to be effective for students with dyslexia.
- Retention increases by stressing key points on the slide.
- Slides should be limited to five bullets.
- Color, visuals, sounds, and graphics should all be relevant to the topic.
- Slide background and text should be in contrasting colors using no more than three colors.
- For ease of reading avoid the use of red.
- Do not bombard the students with too many slides. Use the slides to motivate and encourage student participation (Burke and James, 2005, pp. 249-250).

The results of this study did offer helpful tips for educators when designing future PowerPoint presentations for instruction.

Perceptions of Learning and Public Libraries

Shirley Biladeau (2009), along with the Idaho Commission for Libraries, performed a statewide study with participants from the ages of 12 to 25 to determine the perceptions of digital natives towards learning and public libraries. Results from the

Idaho study found that digital natives value education and learning. They perceived education as the way to "progress" or get ahead in life. They wanted exposure to opposing viewpoints, from the Internet and face to face interaction. They wanted learning to be presented in fun and innovative ways. They expressed that books and information obtained in a library is more credible than the Internet; nevertheless they prefer the ease of speed of the Internet. The study served to help public libraries adjust to meet the digital natives' need. The study also provided insight for educators as to how to reach the digital natives in the classroom.

Summary

Hansen and Williams (2008), Wiley et al. (2009), Eysink et al. (2009), and Lu and Gordon (2009), Apperson et al. (2004), and Sugahara and Boland (2006) found that the use of technological methods of instruction did not increase learning. Most research found that using technological instructional methods did not correlate to increased test scores. Presently, PowerPoint is the most widely used and researched method of instructional technology in education. However, the literature review overwhelmingly concluded that students perceive that the use of the PowerPoint method of instruction does increase learning. Koeber's (2005) study found that students perceived that the professors who utilized the PowerPoint method of instruction were more effective teachers. In addition, Clark's (2008) findings determined that the PowerPoint method was a nice supplement to the instruction, notes should be made available before class, and the professor should not read the notes to the class.

Instruction needs to incorporate technology effectively, and research needs to be performed to discover instructional methods supported by empirical evidence. Students want to be engaged in their learning; they want learning to be fun and creative.

Regardless if you accept Prensky's (2001) concept of the digital native, today's students have been exposed to the fast pace of information provided by technology and expect quick results to their questions. Researchers have identified positive aspects of PowerPoint and suggest ways to incorporate these techniques in classroom instruction. The need for more empirical evidence concerning technology, learning, and digital natives exists.

As Ward et al. (2009) asserted the gap in the literature was that little research had been performed studying the effects of Web 2.0 instructional technologies on student achievement. This research study looked at the difference between the whiteboard/lecture method of instruction and the technological method of instruction on student achievement. The Framework for 21st Century Learning calls for educators to focus on employing technology that develops learners that will think critically and be able to apply their knowledge creatively. Educators should continue to seek better ways to employ technological methods of instruction to engage and appeal to their students as well as develop an understanding of the new technologies that may enhance classroom instruction.

CHAPTER THREE: METHODOLOGY

Introduction

The purpose of the research study was to discover if integrating technology into instruction improves student academic achievement. The study was a non-equivalent control group design using random assignment. The study took place in a suburban public school district in the Southeast about 30 miles from a metropolitan city. The participants were fifth grade math and science students. Most research literature addresses Web 1.0 technology static and non-interactive instructional technology. While Lu and Gordon (2009), Wiley et al. (2009), Eysink et al. (2009), Ward et al. (2009), Cilesiz (2009), Crowe (2004), Yu et al. (2010), and Wijekumar, et al. (2009) have all performed research studies relating to the use of Web 2.0 tools there is still limited research focusing on Web 2.0 interactive technologies. This study strove to contribute to the literature regarding the integration of Web 2.0 technologies in classroom instruction.

Participants

The participants for the study were 51 fifth grade students. One group was comprised of 26 participants: 13 males and 13 females. The next group was 25 participants: 11 females and 14 males. Of the 25 participants in one class two students qualified for the Early Intervention Program (EIP) and a collaborative teacher worked with the classroom teacher. The two students in the EIP program were not classified as special education students. The fifth grade participants received math and science instruction from the same teacher. The two groups received their English and social studies instruction from another teacher. The average age for a fifth grade student is 10 to 11 years old. Nine to 12 years of age was the age range of students in the class. The

variation in the students' ages, 9–12 range, could be a result of either student retentions or student transfers; hence they have not fulfilled Georgia's fifth grade math and science curriculum requirements.

Setting/Demographics

The study was conducted in an elementary school in a small suburban public school district in the Southeast. The school district was 30 miles south of a metropolitan city. All other surrounding school districts were suburban. The school district in the study was a county school system. The school district had 22,073 students from pre-kindergarten through twelfth grade. The male to female population was close with 10,878 females and 11,995 males. The ethnic/racial breakdown for the student population in the district was as follows: (a) 4.4% Asian, b) 23.8% African-American, (c) 6.2% Hispanic, (d) 0.2% Native American, (e) 1.5% multiracial, and (f) 62% White. In the district, 13.8% of the students received free or reduced lunches the same percentage of students that were identified as gifted. Comparing the district to the ethnic/racial population for the state, the breakdown was as follows: (a) 2.7% Asian, (b) 38.3% African-American, (c) 8.5% Hispanic, (d) 0.1% Native American, and (e) 47.9% White. In the state 49.7% of the student population received free or reduced lunches and 7.2% of the students were identified as gifted.

The elementary school in the research study had a total student population of 501 students. The ethnic/racial breakdown for the student population in the research study was as follows: (a) 6% (28) Asian, (b) 2% (12) African American, (c) 5% (23) Hispanic, (d) 1% (9) multiracial, and (e) 86% (420) White. Students receiving free or reduced lunches were 6% (31) of the student population. Students identified as gifted were 22% (106) of the student population.

The school in the research study was known for the strong parental and community support it consistently receives. The Parent Teacher Organization was an active and supportive presence in the school. Parents volunteered on a daily basis assisting with the needs of the school community. Many of the parents are educated and have high expectations for academic achievement for their children. Zoom Prospector reported in 2011 that 41.50% of the population in the county where the research study was performed had earned a bachelor's degree or higher.

Research Design

The study was a non-equivalent control group design purposely using random assignment of treatment employing a pre-test and post-test. Random allocation limits bias by employing a double blind experiment so the statistician will not know which group received which treatment. Random assignment was employed to select the control group for math. A coin toss was the method of random assignment used to make the selection. Class A was heads and Class B was tails. The coin toss determined which class received the whiteboard/lecture method of instruction for math. The class that won the coin toss automatically received technological instruction for science. Therefore, the class that did not win the coin toss received technological instruction for math and whiteboard/lecture instruction for science. The reason for using this method, to select the control and experimental group, was to avoid putting either group of students at an educational disadvantage if one method of instruction was found to affect student achievement.

To allow for an unbiased comparison of treatments, Yates et al. (2008) explained that random assignment of treatments is important when the subjects are known to be similar. The randomization will average out the effects of the remaining factors that cannot be controlled. The participants have been placed into "equivalent' groups by non-

random assignment. The non-random placement leads to bias. However, the two comparison groups were of approximately equal "dimensions", and the random assignment of treatment to the groups mitigates some of the placement bias.

Using specific criteria, the principal and school counselor determined the non-random assignment of equivalent groups. The first criterion was to place an equal amount of gifted students in each class. Another criterion was to keep the gender evenly distributed between the two classes. Student behavior was the third criterion, and social issues were the fourth criterion that the principal and school counselor considered when placing the students. The principal did allow the parents to express their child's placement preferences with a valid explanation. There were no special education students in the two control groups. The method of assignment was intended to produce two "equivalent" classes. Criterion Referenced Competency Test (CRCT) scores were collected on the participants from the 2009-2010 school year in the areas of math and science to further aid in identifying the equivalency of the control and experimental groups.

Peck, Olsen, and Devore (2010) stated, "When the (independent) two-sample *t* test is used to compare two treatments when the individuals in the experiment are not randomly selected from the population, it is only an approximate test (the reported *p*-values are only approximate). However, this is still the most common way to analyze such data" (p. 592). An independent *t*-test is a strong test to use when the sample size is less than 30. Yates, Moore, and Starnes (2008) explained it is appropriate to use a *t* test when the sample size is at least 15. They emphasized that "the *t* procedures are quite robust against non-Normality of the population when there are no outliers, especially when the distribution is roughly symmetric" (Yates et. al, 2008, p. 655). Therefore, it is

necessary to graph the data to check its shape to verify normality.

The independent *t* test was an appropriate statistical measurement to employ when comparing the means of the control and experimental groups. The independent *t* test was utilized to test the hypotheses. Variables were the difference in the mean scores of both the control and experimental groups. The control group received the whiteboard/lecture method of instruction, and the experimental group received the technological methods of instruction. An independent *t* test was utilized to determine if a statistically significant difference existed between the mean 2011 Math CRCT score of the control group and the mean 2011 Math CRCT score of the experimental group. The independent *t* test was then utilized to determine if a statistically significant difference existed between the mean 2011Science CRCT score of the control group and the mean 2011Science CRCT score of the experimental group.

Peck et al. (2010) explained that:

> a confidence interval (*CI*) for a population characteristic is an interval of plausible values for the characteristic. It was constructed so a chosen degree of confidence, the value of the characteristic will be captured between the upper and lower endpoints of the interval. The confidence level associated with the confidence interval estimate is the success rate of the *method* used to construct the interval. (p. 483)

It was necessary to identify a value for the population characteristic. A two sample confidence interval test was run to find a value for the population characteristic.

Instrumentation

Two different instructional methods were the independent variables in this research study. One method was the whiteboard and lecture method of instruction, and

the other method was the implementation of instructional technologies including the 21st century classroom, classroom response system, online videos, online testing, online games, BrainPOP, and PowerPoint. SPSS (Statistical Package for the Social Sciences) statistical software was the measurement tool. The SPSS software program is one of the most widely used statistical analysis programs used for educational research. The University of Southern California Information Technology Services website stated, "SPSS is a powerful application that allows you to read almost any kind of data, analyze that data, and create reports and graphs from that data" (2010). The SPSS software program was an efficient and concise tool to measure the variables in the study.

The instrument to measure student achievement was the 2011 Math Criterion Referenced Competency Test (CRCT) and the 2011 Science CRCT scores. The Georgia Department of Education reported that "the CRCTs have a high degree of validity, because they serve their intended purpose which was to measure student mastery of the Georgia Performance Standards, the state's curriculum" (2010, p. 6). The 2011 Math CRCT and 2011 Science CRCT were valid and reliable. The development of the CRCT started with the state curriculum: the GPS. The CRCT assessments measured the performance of students from grades one through eight in the following content areas: math, science, reading, English language arts, and social studies. The Georgia Department of Education reported:

> The careful development from inception of the CRCT testing program and all steps in-between such as alignment with curriculum, creation of test and item specifications, multiple reviews by educators, careful form construction by content experts and psychometricians provide evidence that the CRCT are valid instruments. (2010, p. 6)

The Georgia Department of Education used the Cronbach's alpha reliability coefficient and the standard error of measurement (*SEM*) to assess the reliability of the CRCT. The Cronbach's alpha reliability coefficient for the math CRCT for fifth grade was .93, and .90 for the science CRCT for fifth grade. The raw score of the *SEM* for fifth grade math was 3.09 and 3.25 for fifth grade science (2010, p. 4-5). The reliability measurements proved that the CRCT was a reliable test. The teacher in the study used the questions from the math and science CRCT tests and the GPS to design his assessments (Georgia Department of Education, 2011).

Preliminary Procedures

The researcher communicated with the prospective teacher to discuss the details of this research study. The researcher chose to use this particular teacher because he embraces technology and comfortably incorporates its use in his instruction. He did not require additional training or professional development in technological instructional methods. Another positive reason for selecting the specific teacher for the study was that he taught the same students for math and science. Using the same group of participants with one instructor eliminated teacher effect influencing the outcome of the study. The researcher and fifth grade teacher discussed the particular aspects of the study. The researcher and fifth grade teacher discussed the terms whiteboard/lecture instruction and technological instruction. They came to a consensus on the definition of the terms. The whiteboard/lecture instruction was a teacher centered lecture method of instruction. Technological instruction included using the DLP projector, the classroom response system, the Mobi pad, several software programs such as Brain Pop, and the Internet. They discussed the various methods of instructional technology that would be employed throughout the study.

After gaining the teacher's consent to participate in this study, the researcher contacted the building principal. The researcher shared the details of the study with the principal and tentatively received her approval pending IRB approval. The building principal provided the researcher with written permission to perform the study at the elementary school (see Appendix B). The researcher also met with the Human Resources Director to discuss the study. The Human Resources Director offered her full support for the research study.

The pre-test for this study, the 2010 Math Criterion Referenced Competency Test math and the 2010 Science CRCT test scores, were collected on the participants. The researcher assumed that the GPS and CRCT exam questions were valid and reliable assessment tools as determined by the State of Georgia. The Georgia Department of Education reported that the CRCT were valid and reliable assessments that align with the GPS (2010, pg. 6).

Upon receiving the Human Resources Director and building principal's approval, the fifth grade math and science teacher began the research study at the beginning of the semester in January 2011. Random assignment was the method employed to select the control group for math. A coin toss was the method of random assignment used to make the selection. Class A was heads and Class B was tails. The class that won the coin toss received the whiteboard/lecture method of instruction for math. This class then received technological instruction for science. The class that received the whiteboard/lecture method of instruction for science received technological instruction for math. All subjects were exposed to both instructional methods.

For the experimental group, the fifth grade teacher incorporated 21st century technology in his instruction. Twenty-first century technology included a teacher

computer, speakers, voice amplification (a microphone the teacher wears around his neck), Pixie Wall Controller (control unit to change from computer to video and has access to the speakers), a Mobi pad (a hand-held interactive whiteboard), a mounted DLP projector connected to the Internet displayed on a large screen in the classroom, and a classroom response system (each student has an interactive remote control to simultaneously answer questions). The control group received whiteboard and lecture instruction from the teacher.

At the end of each unit, both the control group and experimental group took a teacher designed test or assessment. The teacher designed his assessments using test questions from the Georgia Performance Standards (GPS) and past Criterion Referenced Competency Tests (CRCT) in the subjects of math and science. He chose this method of assessment design to prepare his students for the CRCT exams given in the spring. The teacher assessed the students' learning throughout the entire semester.

Data Collection

Research Question 1

What is the difference between the 2011 Math CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in math? The 2011 Math CRCT tests were administered at the end of the semester. The principal, school counselor, teacher, researcher, and the statistician were the only individuals who had access to the 2010 and 2011 Math CRCT test scores. At the end of the semester, the teacher provided the researcher with the 2011 Math CRCT test scores for the participants. The researcher recorded the participants' 2010 Math CRCT scores in an Excel spreadsheet. Then the researcher recorded the participants' 2011 Math CRCT scores in an Excel Spreadsheet

matching the results with the 2010 Math CRCT results. Following IRB regulations, the participants' identity will remain confidential.

Research Question 2

What is the difference between the 2011 Science CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction including Web 2.0 technologies in science? The 2011 Science CRCT tests were administered to the participants at the end of the semester. The principal, school counselor, teacher, researcher, and the statistician were the only individuals who had access to the data. At the end of the semester, the teacher provided the researcher with the 2011 Science CRCT test scores for the participants. The researcher recorded the participants' 2010 Science CRCT scores in an Excel spreadsheet. Then the researcher recorded the participants' 2011 Science CRCT scores in an Excel Spreadsheet matching the results with the 2010 Science CRCT results. Following IRB regulations, the participants' identity will remain confidential.

Data Analysis Procedures

The researcher works at a high school and has a professional working relationship with the math department. An Advanced Placement Statistics Teacher at the researcher's school agreed to assist in the data analysis for this research project. They analyzed the data and ran the SPSS software program together. He has made himself available to consult with the statistical analysis.

The data were coded in an Excel spreadsheet for Class A and Class B. Once the all the data have been collected the SPSS Software program was used to run the statistical tests. The researcher saved the Excel spreadsheets on a flash drive. The flash drive only holds the spreadsheets and data analysis results; it was not storing any other information.

The flash drive was at the researcher's home in a personal filing cabinet. The researcher will store the flash drive for seven years, and then delete the information.

Research Question 1

What is the difference between the 2011 Math CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in math?

Null hypothesis 1. There will not be a statistically significant difference between the 2011 Math CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0 technologies.

Using the SPSS statistical software, an independent *t* test using the difference of means was employed. A mean score was calculated for the 2010 Math CRCT, the pre-test, for both the experimental and control groups. Then a mean score was calculated for the 2011 Math CRCT, the post-test, for the experimental and control groups. This independent *t*-test was utilized to determine whether or not a statistically significant difference in the means of the 2010 Math CRCT test scores between the experimental and control groups existed. The independent *t* test also was employed to determine whether or not a statistically significant difference in the means of the 2011 Math CRCT test scores between the experimental and control groups existed.

Research Question 2

What is the difference between the 2011 Science CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction including Web 2.0 technologies in science?

Null hypothesis 2. There will not be a statistically significant difference between the 2011Science CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0 technologies.

The identity of the participants has remained confidential. The SPSS statistical software was used to measure the difference between the experimental and control groups. A mean score was calculated for the 2010 Science CRCT for both the control and experimental groups. Then a mean score was calculated for the 2011 Science CRCT for the participants in the study. An independent *t* test was utilized to determine the mean difference between the control and experimental group. This independent *t* test was utilized to determine whether or not a statistically significant difference in the means of the 2010 Science CRCT test scores between the experimental and control groups existed. The independent *t* test also was employed to determine whether or not a statistically significant difference in the means of the 2011 Science CRCT test scores between the experimental and control groups existed.

CHAPTER FOUR: RESULTS

Introduction

This chapter includes the purpose of the study, the method of data analysis, the research questions, the null and alternative hypotheses, and the results of this study. This chapter also reports the results of the collected data and statistical analysis. The SPSS software program was used to run the statistical analysis. The dependent variables were the 2011 Math CRCT scores and the 2011 Science CRCT scores. The independent variables were two instructional methodologies: 21st the whiteboard/lecture method of instruction, and the technological instructional method including Web 2.0 technologies.

Overview of the Purpose of the Study

Educational researchers Prensky (2008), Tapscott (2009), and Sprenger (2010) claimed that technology has changed the way today's students learn. Educators are encouraged to incorporate technology in their classroom instruction. The 21st century learner has become one of the latest buzz words in education. The school system in the research study expended the funds to implement 21st century classrooms in all the schools in the district. The purpose of the study was to determine the effect of integrating technology into instruction and if it improved fifth grade students' academic achievement in math and science.

Method of Data Analysis

An independent *t*-test was the chosen method of data analysis. The SPSS software program was used to run the independent *t* test statistical analysis. Peck et al. (2010) stated, "Two samples are said to be *independent* if the selection of the individuals or objects that make up one of the samples has no bearing on the selection of individuals or

objects in the other sample" (p. 606). When comparing two groups' mean scores, the authors stated the independent *t* test is an appropriate and efficient statistical measurement to employ. In regard to this study, when comparing two groups an independent *t* test was the most appropriate way to test the hypothesis. Peck et al. (2010) stated the independent *t* test was an appropriate statistical measure for comparing treatments of means.

Results

The researcher determined that the independent *t* test should be the method of data analysis for this study. The independent *t* test should be employed when comparing two means and when the treatments have been randomly assigned. If the sample size is at least 15 and less than 30, it is necessary to graph the data to determine normality. If the graph shows normality, it is then appropriate to use the *t* test.

For this study, the researcher utilized the SPSS software to analyze the student data employing the independent *t* test to test the hypotheses. The SPSS program identified the *M* (mean), the *SD* (standard deviation), the *SEM* (standard error mean), the *t* value, the *p* value, the mean difference, and the *CI* (confidence interval) for the collected data. This study involved both fifth grade math and science classes. For the math classes in the study, the dependent variable was 2011Math CRCT scores. The independent variable was the implementation of instructional methodologies. The control group received the whiteboard/lecture method of instruction, and the experimental group received technological methods of instruction including Web 2.0 tools. Consistent with the math classes, for the science classes the dependent variable was 2011 Science CRCT scores. The independent variable was the implementation of instructional methodologies. The science control group received the whiteboard/lecture method of instruction. The

experimental group received technological methods of instruction including Web 2.0 tools. An independent *t* test was employed to determine if a statistically significant difference exists between the control group's mean 2011 Math CRCT score and the experimental group's mean 2011 Math CRCT score when technological instruction was employed and when whiteboard and lecture was the method of instruction.

Research Question 1

What is the difference between the 2011 Math CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in math? The control group (Table 1) was comprised of 25 participants: 14 males and 11 females. The control group (Class A) received the whiteboard/lecture method of instruction. The experimental group was comprised of 26 participants: 13 males and 13 females. The experimental group (Class B) received the technological instruction, including Web 2.0 tools. The variation in the students' ages, 9-12 range, could be a result of either student retentions or student transfers; hence they have not fulfilled Georgia's fifth grade math and science curriculum requirements.

Due to the sample size being less than 30, the data were graphed to check its shape for normality. Because the graph of the data (Figure 1) was quite symmetrical, the data can be interpreted as approximately normal. Consequently, the *t* test was a valid test to employ for comparing the data. Yates, Moore, and Starnes (2008) emphasized that " the *t* procedures are quite robust against non-Normality of the population when there are no outliers, especially when the distriubtion is roughly symmetric" (p. 655). Peck, Olsen, and Devore (2010) reinforced that an independent two sample *t* test should be used when

comparing two treatments that are randomly assigned and if the "treatment response distributions are approximately normal" (p. 592).

Table 1

Major Study Variable for Math Instruction

Variables	n
Control Group (Whiteboard and lecture instruction)	
Participants'	
Gender	25
Male	14
Female	11
Age	9–12
Experimental Group (Technological Instruction)	
Participants'	
Gender	26
Male	13
Female	13
Age	9–12

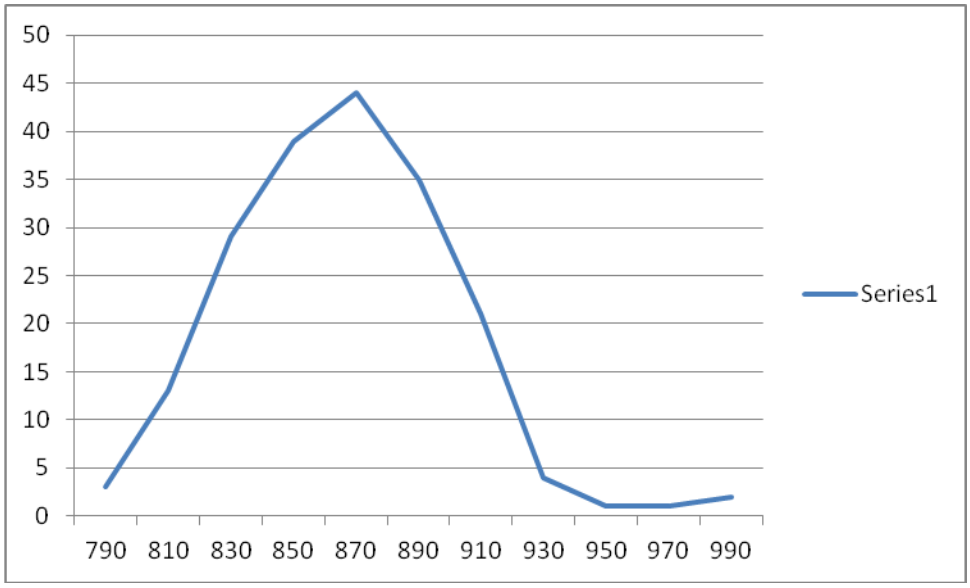

Figure 1: Distribution Graph of 2010 and 2011 Math and Science CRCT Scores

The SPSS statistical software program was used to employ an independent *t* test to compare the mean 2011 Math CRCT scores for the control and experimental groups. The *M* (mean) 2011 Math CRCT for Class A was 867.84 and 867.08 for Class B (Table 2). The independent *t* test identified t = .074 and p = .942. At a 95% confidence interval, the critical value of *t* was 2.000, and the *p* = .942 was higher than any standard significance level, and in particular the alpha level of .05 used with SPSS. Furthermore, *p* = .942 means that one should expect to achieve a result with similar differences approximately 94% of the time. Based on the data in Table 2, the researcher accepted the null hypothesis Ho which stated: there will not be a statistically significant difference between the 2011 Math CRCT scores of the students who received whiteboard/lecture instruction and the students who received technological instruction, including Web 2.0 technologies. In conclusion, there is not enough evidence to say there is a statistically significant difference between the mean 2011 Math CRCT scores for the control and experimental groups in the subject of math.

Table 2

Psychometric Properties Comparing Lecture and Technological Instruction in Math

Group	n	M	SD	t	p
Lecture Instruction	25	867.84	31.03	.074	.942
Technological Instruction	26	867.08	41.14	.074	.942

**significant at .05

Research Question 2

What is the difference between the 2011 Science CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in science? The control group for the math portion of the study became the experimental group for the science phase of the study. Likewise, the experimental group for the math portion of the study became the control group for the science segment of the study. The control group, Class B, (Table 3) was comprised of 26 participants: 13 males and 13 females. The control group received the whiteboard/lecture method of instruction. The experimental group (Class A) was comprised of 25 participants: 14 males and 11 females. The experimental group received the technological instruction, including Web 2.0 tools. The variation in the students' ages, 9-12 range, could be a result of either student retentions or student transfers; hence they have not fulfilled Georgia's fifth grade math and science curriculum requirements.

The number of the participants for the control group was 26, and the number of participants for the experimental group was 25. The sample size for both groups was less

than 30. It is necessary to graph the data when n < 30. The histogram (Figure 1) illustrates that the distribution of the data was normal. Therefore, the robust *t* test was an appropriate statistical measurement to use to test the hypothesis.

Table 3

Major Study Variable for Science Instruction

Variables	n
Control Group (Whiteboard and lecture instruction)	
Participants'	
Gender	26
Male	13
Female	13
Age	9-12
Experimental Group (Technological Instruction)	
Participants'	
Gender	25
Male	14
Female	11
Age	9-12

There was insufficient evidence to say there was a statistically significant difference between the mean 2011 Science CRCT scores for the control and experimental science classes. The summative assessments revealed that the *M* (mean) 2011Science CRCT score for Class B, the control group, was 873.28, and 871.00 for the experimental group, Class A (Table 4). The independent *t test* identified t = -.254 and p = .801. At a

95% confidence interval the critical value of *t* is 2.000 and *p* = .801 were higher than any standard significance level, and in particular the alpha level of .05 used with SPSS. Furthermore, the *p* = .801 means that one should expect to achieve a result with similar differences approximately 80% of the time. Due to this study's finding, the null hypothesis was accepted. The null hypothesis Ho stated: there will not be a statistically significant difference between the 2011 Science CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0 technologies.

Table 4

Psychometric Properties Comparing Whiteboard and Lecture Instruction to Technological Instruction in Science

Group	n	M	SD	t	p
Lecture Instruction	26	873.28	29.99	-.254	.801
Technological Instruction	25	871.00	33.50	-.254	.801

**significant at .05

CHAPTER FIVE: DISCUSSION

Introduction

This study sought to discover if integrating technology into instruction improved student academic achievement. Two different methods of instruction were employed for thisresearch study. The first method of instruction was the traditional lecture and whiteboard method. The second method of instruction was the use of technological instruction, including Web 2.0 technologies. Two classes of fifth grade math and science students were studied.

Summary

The study took place in a suburban public school district in the southeast about 30 miles from a metropolitan city. The participants were fifth grade math and science students. Fifty-one students participated in the non-equivalent control group design study. The control group received the whiteboard/lecture method of instruction. The experimental group received technological methods of instruction. There was a control and experimental group for math and science instruction. The control group was selected by random allocation. The data were analyzed using the SPSS statistical software to employ an independent *t*-test to measure the mean difference in the 2011 Math CRCT scores and the 2011 Science CRCT scores between the experimental and control groups

Restatement of the Problem and Purpose

The problem was that the lack of access to and use of technology in education is placing our students at a disadvantage and not meeting the educational needs of today's digital natives. The purpose of this study was to determine if integrating technological

instruction would improve fifth grade students' academic achievement in math and science.

Research Questions

Research Question 1

What is the difference between the 2011 Math CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in math? Based on the results of the independent *t* test, the researcher accepted the null hypothesis Ho: there will not be a statistically significant difference between the mean 2011Math CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0 technologies.

Research Question 2

What is the difference between the 2011 Science CRCT scores of students who received whiteboard and lecture instruction and students who received technological instruction, including Web 2.0 technologies in science? The results of the independent *t*-test found no significant difference in the mean 2011 Science CRCT scores between the control and experimental groups. Due to this study's findings, the researcher accepted the null hypothesis Ho: there will not be a statistically significant difference between the 2011 Science CRCT scores of the students who received whiteboard and lecture instruction and the students who received technological instruction, including Web 2.0 technologies.

Discussion of Results

Research Question 1

Similar to this research study's findings, the review of literature revealed that

technological instruction did not correlate to increased academic achievement. Hansen and Williams (2008), Wiley et al. (2009), Eysink et al. (2009), and Lu and Gordon (2009), and Sugahara and Boland (2006) all found implementing technological methods of instruction did not increase student learning. The results of this research study match the findings of these researchers. There was not a statistically significant difference in fifth grade students' mean 2011 Math CRCT scores when employing the whiteboard/lecture method of instruction compared to the technological methods of instruction. The control group for the math class scored only negligibly higher than the experimental group, with a .76% difference in the mean 2011 Math CRCT scores as seen in Table 2. The control group received the traditional whiteboard/lecture method of instruction.

The findings of the current research study are similar to Sugahara and Boland (2006) and Burke and James (2008) findings. Sugahara and Boland (2006) performed their research with accounting students. They looked at the effect of technological instruction, mainly PowerPoint, on academic achievement. The students who expressed a preference for the technological methods of learning scored significantly lower on their assessments than the students who preferred the traditional method of instruction. Burke and James (2005) also performed their study with accounting students. Their research focused on students' perceptions of the use of PowerPoint. They found that the students did not think that the use of this method of technology was effective for teaching accounting. Similar to Sugahara and Boland (2006), they found that the students who received the technological instruction had lower test scores than the students who received traditional instruction.

Presnky (2008), Tapscott (2009), and Sprenger (2010) asserted that technology

has changed the way students learn. Prensky (2001) and Murdock (2005) stressed that instruction must change to meet the needs of today's digital learners. Richardson's (2006) and Ferriter and Garry's (2010) books feature methods to integrate technology in instruction. The National School Boards Association (2007) and the International Society for Technology in Education (ISTE) (2009) have implemented technology performance standards for teachers and students. The school system in this research study has allocated funds to implement 21st century classrooms in order to increase technology in education.

CompassLearning, the creators of the Odyssey Math software program, asserted that using their program improves students' math academic achievement. After performing a review of the literature, the researcher did not agree with the claims of these authors. The current research did not demonstrate that technological methods of instruction increase student academic achievement. The researcher believes that technology must be integrated into instruction, but it is essential that researchers discover the instructional methods that do positively impact student learning.

Wijekumar et al. (2009) performed their study with fourth grade math students. They studied the effect of the Odyssey Math web-based instructional program compared to traditional methods of instruction on student academic achievement. Similarly, the current research study was performed with fifth grade math students who also received web-based technological instruction compared to the whiteboard/lecture method of instruction. Both studies found that the web-based technological instruction did not increase math students' academic achievement. The results of Wijekumar et al.'s study tied to the researcher's expectations for her research study as consistent with the review of literature.

Research Question 2

Similar to the review of literature, the results of this research study found there was not a statistically significant difference in the fifth grade students' mean 2011 Science CRCT scores when employing the whiteboard/lecture method of instruction compared to the technological methods of instruction. For the science classes, the control group scored marginally higher with a 2.28% difference in the mean 2011 Science CRCT scores shown in Table 4. The experimental group received the technological method of instruction including Web 2.0 technology.

Prior to the study, the researcher's expectations were the same for research questions one and two. Through the review of the literature, the researcher determined that neither of the two instructional methods would significantly impact student academic achievement as measured by the 2011 Math CRCT and 2011 Science CRCT scores. As Koeber (2005) and Clark (2008) determined, the researcher believed that most students prefer technological instruction. When the researcher was a classroom teacher, she observed the positive impact of incorporating technology into instruction. She did so when technology resources were limited and technological instruction was an untapped area for instruction. The teacher in this study shared that when he commenced the whiteboard/lecture method of instruction the students originally responded positively to the novelty of the instructional method. He stated that after a few weeks the novelty had worn off. By the end of the study, the teacher realized that the results of the study would not match his expectations.

The findings from the current research study are similar to Hansen and Williams (2008) and Ricer, Filak, and Short (2005) research studies' results. Hansen and Williams (2008) performed a study comparing whiteboard/lecture instruction to technological

instruction. The authors found their findings did not meet their expectations. They expected the students who received technological instruction to outperform those that received traditional instruction. There was not a significant difference between the two classes. On one assessment, the traditional class scored higher and on another assessment the technological class scored higher. There was not a clear delineation between the two classes. The students who received technological instruction indicated that they enjoyed their method of instruction more than the traditional class. Ricer, Filak, and Short (2005) performed their study in the field of science with medical students. They compared technological instruction with traditional instruction. Similar to this research study, the authors did not find a statistically significant difference between the assessment scores of the groups who received technological instruction and those that received traditional instruction.

Yu et al.'s (2010) findings tied to results of this research study. The researchers performed their study with seventh grade science students while this study's participants were fifth grade science students. Both studies compared the effects of web-based technological instruction and traditional methods of instruction on student academic achievement. In almost all areas as with the results of this study, Yu, et al. did not find that technological instruction increased science students' academic achievement. Yu et al. did find that after five months the students who received technological instruction displayed increased retention compared to their counterparts who received traditional instruction. Yu et al.'s findings concerning retention tie to Wiley et al. (2009) and Eysink et al.'s (2009) results. These researchers have found that it is essential to cultivate the aspects of technological instruction that do influence student academic achievement. Technological instruction can be effective and increase learning. Educators need

instruction to learn how to integrate technology. Wiley et al. (2009) determined that students need instruction and guidance as to how to use and evaluate the Internet to increase learning. The researchers found that students who received proper instruction on how to disseminate information from the Internet scored higher on assessments than those who did not receive the instruction. Only then will technological instruction be able to correlate to increased academic achievement.

The findings of Yu et al. (2010), Wiley et al. (2009), and Eysink et al. (2009) tie to the conceptual framework of the constructivist theory of learning. These researchers found that when the students were engaged in constructing the information they experienced success and increased retention of the material. Bruner, Dewey, Piaget, and Vygotsky were advocates of the constructive learning theory. Constructivism is when students actively participate in their learning and develop new information and knowledge from their prior experiences. In line with the constructive learning theory, the students in these studies learned methods to research and attain information on the Internet. They were permitted the freedom to explore the concepts and new material in a manner and pace to their choosing. The results of these studies did find that learning and achievement was successful when using technology.

Implications

The results of the current research study highlight the importance of sound empirical data to support educational initiatives. There is a call to implement technological instruction in education. There is a movement to provide technology in every classroom. In an effort to combat the cost of providing technology in every classroom, school systems are allowing and encouraging students to bring their own technology to school. What is missing from these initiatives is the empirical data

demonstrating that technology increases student academic achievement.

Educator professional development has to be at the forefront of the technological initiatives. Just because you equip a classroom with a 21st Century Classroom Learning Environment does not mean that 21st Century learning will take place. Putting technological equipment in a classroom without providing teacher training makes the equipment as useful and a slate tablet and piece of chalk. Educators need to learn how to provide meaningful instruction using technology.

The teacher in the current research study did implement technology in instruction correctly, yet the results of this study did not find a statistically significant difference between the two instructional methodologies. The teacher in the study has been nominated as the Teacher of Year for the present school year. He is an excellent teacher; he made sure his students achieved regardless of the instructional methodology. At the commencement of the study, he believed that the academic achievement of the experimental group would far surpass the academic achievement of the control group.

Yu et al. (2010), Wiley et al. (2009), and Eysink et al.'s (2009) have found ways to make technological instruction meaningful and to improve academic achievement. Technology cannot be thrown at the teachers or the students. For significant learning to take place instruction must be tied to the empirical data. The students in our classrooms will never know a world without technology. It is educators' responsibility to provide meaningful technological instruction and endow our students with the skills to be successful outside of school.

Assumptions and Limitations

Assumptions

The researcher made a few assumptions for this study. The researcher assumed the demographic data had been reported accurately. The school system supplied the demographic data for the research study. The researcher also assumed the teacher was consistent in employing instructional strategies with both the experimental and control groups. The researcher assumed the 2010 and 2011Georgia Math and Science Criterion Referenced Competency Tests were reliable and valid. The Georgia Department of Education reported that the Criterion Referenced Competency Tests are valid and reliable instruments (2010, p. 6).

Limitations

There were several limitations identified for this study. One limitation of this study was its the small sample size. While this study had 51 participants, 60 participants would have been ideal. The independent *t*-test was utilized after graphing the data which demonstrated that the scores were within the parameters for a normal distribution. The research study was performed in the county where the researcher worked. The school system in the study did not have class sizes of 30 or more students, especially in an elementary school. The teacher in the study was willing to provide instruction to match the parameters of the research study. The teacher was an avid technology user who embraced the study and did not require training for the experimental instructional methods**.**

A second limitation of this research study was the results of the investigation cannot be generalized beyond the population of this study or similar populations. The fifth grade students in the study were from a suburban public school district in the

southeast, 30 miles from a metropolitan city. The school district had 22,073 students from pre-kindergarten through 12th grade. The male to female population was close with 10,878 females and 11,995 males. The ethnic/racial breakdown for the student population in the district was as follows: 4.4% Asian students, 23.8% African-American students, 6.2% Hispanic students, 0.2% Native American students, 1.5% multiracial students, and 62% White students. In the district, 13.8% of the students received free or reduced lunches the same percentage of students that have been identified as gifted.

The active involvement of the parents and community was another reason this research study cannot be generalized beyond the population of this study or to similar populations. The school in this research study received tremendous parental and community support. The parents are educated and have high expectations for academic achievement for their children. Zoom Prospector reported in 2011 that 41.50% of the county's population, where the research study was performed, has earned a bachelor's degree or higher.

A further limitation of the study was that the measurement for student academic achievement was from the 2010 and 2011 Math Criterion Referenced Competency Tests (CRCT) and the 2010 and 2011 Science Criterion Referenced Competency Tests. The CRCT are designed to align with the Georgia Performance Standards designed by the Georgia Department of Education. Therefore, the results of this study may not be generalized outside the State of Georgia.

An additional limitation was that the study was designed to determine a relationship between methods of instruction and student academic achievement as measured by the 2011 Math CRCT and 2011 Science CRCT. Therefore, the study did not determine causality.

Selection bias can be a threat to the internal validity of the test because the school employed non-random assignment of students into "equivalent" groups. The two comparison groups were of approximately equal "dimensions." The random assignment of the treatment groups did mitigate some of the placement bias. The study was designed to determine if a relationship existed between methods of instruction and student academic achievement. The research study was performed only in the subject areas of math and science.

The maturation of the participants from the pre-test to the post-test was a limitation of the research study. Biological and psychological changes most likely occurred in the students from the end of the school year in 2010 when they took the pre-test to the next year when the 2011 Math and Science CRCTs were administered. Students could have performed better on the 2011 Math and Science CRCTs from various factors affecting their maturation.

The final limitation was that the race, gender, retention, or socio-economic status of the students was not identified in this research study. These factors could all possibly influence the results of the study.

Recommendations from the Limitations

To reinforce this study's findings, the study should be conducted at a school with analogous demographics to see if the results would reveal similar results. The school in the study received strong parental and community support. It would be beneficial to replicate the study in a similar school setting. It would also be valuable to perform the study with comparable communities in an urban as well a rural setting.

The race, gender, retention, or socio-economic status of the students was not identified in this research study. Recommendations for future research would be to

replicate the study with school populations of diverse ethnic, racial, and socioeconomic status than the population of the study. The study should be replicated in a school where true randomization of students exists. The study could also be replicated in other academic subject areas.

The Criterion Referenced Competency Tests align with the Georgia Performance Standards. So it would be good to replicate the study in other school systems in the State of Georgia. However, Georgia's standards do align with the national standards; consequently this study could be replicated in other states.

Recommendations for Further Research

There was a call for increased technology and technological instruction in the classroom. Yet, the literature review and this research study did not find that technological instruction consistently correlates to increased academic achievement. The students in this research study were in a technologically equipped classroom and received technological instruction that included using Web 2.0 tools. Future studies need to identify specific aspects of technological instruction and their effect on academic achievement. A possible study could be to compare the impact of the available Web 2.0 tools and their affect on academic achievement.

Today's learners are growing up in a digital age. They are comfortable with technology. D'Angelo and Wooley (2007), Hansen and Williams (2008), Koeber (2005), and Bartsch and Cobern's (2003), research determined that students prefer technological instruction over a lecture method of instruction even though the use of technology did not increase student academic achievement. Much of the research concerning students' preferences deals with the use of PowerPoint. Future research studies need to investigate students' preferences using Web 2.0 technology and its impact on academic achievement.

Research concerning educational technology needs to be performed in the areas of socioeconomic status, cultural, ethnic background, and gender. Research needs to address the digital native premise as well as the technology used for instruction.

Conclusion

To meet the needs of the generation of technologically savvy learners, many educators, authors, and researchers believed that technology must be an essential part of education. Like many school systems across the country, the county where the study was conducted has completed implementing the 21st century technology in every classroom in the school system. All classrooms have been equipped with a DLP projector, screen, speakers, voice amplification, Pixie Wall Controller, and Mobi Interactive Pad, providing a world of information available at the touch of a finger on the Internet and other media (Cleary, 2009). What does that mean? If technology is provided, will technological instruction take place? It is a start, and it is needed for technology instruction to occur. Yet, teachers must receive technological instruction training in order to create an effective 21st century classroom. School systems are making vast investments to provide technology in every classroom. School systems must be careful not to mandate the use of technological instruction without the research to support their directives.

The review of literature demonstrated that technological instruction did not correlate to increased academic achievement. This research study found that no statistically significant difference existed between the use of the whiteboard/lecture instruction and technological methods of instruction. Do educators know how to develop a meaningful lesson that integrates technology? The teacher in this study embraced technology and integrated it into instruction. However, the results of the study determined that neither the whiteboard/lecture method of instruction nor the technological method of

instruction affected student academic achievement. D'Angelo and Wooley (2007), Hansen and Williams (2008), and Koeber's (2005) research found that students prefer the use of technology in education. Educators need to continue to strive to find ways to meaningfully tie technology to instruction.

Technology is the future; it is essential that we find ways to connect instruction to meet the needs and future of today's digital learners. Researchers must continue to discover the best methods to improve instruction. The bottom line is that regardless of the technology available there is no substitute for a well prepared, engaging and charismatic instructor.

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