

HOW DO TEACHERS IN A MID-ATLANTIC SUBURBAN SCHOOL
DISTRICT USE TECHNOLOGY TO INTERACTIVELY
ENGAGE THEIR STUDENTS?

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ABSTRACT

Interactive whiteboards have become an emergent technology in K-12 education in the United States as well as other countries throughout the world (Johnson & Türel, 2012). There have been studies conducted on the perceived effectiveness of the SMART Board® (Beauchamp & Prakinson, 2005; Brown, 2004; Dolan, 2010; Erduran & Tataroğlu, 2010; Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Johnson & Türel, 2012; Jones, 2004; Manzo, 2010; Marzano & Haystead, 2009; Şad, 2012; Saltan & Arslan, 2009; Schachter, 2011; Smith, Higgins, Wall, & Miller, 2005; Türel, 2011; Wood & Ashfield, 2008). There has also been a study on the correlation between the SMART Board and student achievement (Marzano & Haystead, 2009).

The purpose of this qualitative case study was to observe the methods that teachers, who are above proficient with technology, use to integrate the SMART Board® into their daily lessons and interactively engage the students. A descriptive case study was conducted on four different teachers from four different elementary schools in a suburban mid-Atlantic school district in the United States. One teacher from grades second through fifth was observed. The use of multiple-cases helped strengthen the conclusions of the study (Yin, 2009).

The data was collected through pre-observation and post-observation interviews with the teachers, a triple-journal written by the researcher, a parent questionnaire, and a student questionnaire. All of this data contributed to the conclusion that these teachers were in fact above proficient users of the SMART Board®, who would fall into Rogers (2003) adopter categories of innovator and early adopter. They also adopted an

appropriation level where they have successfully integrated a new technology into all daily activities (Whitehead, Jensen, & Boschee, 2003).

The study found that the SMART Board® was perceived to be effective by the parents, teachers, and students from these schools in this one school district. 92% of the parents who responded to the parent questionnaire noted using a SMART Board® is beneficial to their child's education. All four teachers reflected in the post conference that the SMART Board® helped the students understand the concept of each observed lesson better than had they not used a SMART Board®. 81% of the students responded that they would remember these lessons better because the SMART Board® was used.

These four teachers demonstrated skillful pedagogy with integrating the SMART Board® into their daily lessons. They used many different media and many different methods to interactively engage their students with the content. A major question that arose from the research was the definition of interactive. Is physical interaction with the SMART Board® required to cognitively interact with the content of the lesson?

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CHAPTER 1 INTRODUCTION

Introduction

Children who are currently enrolled in elementary through post-secondary school have grown up and are being raised in the digital age. Technology is advancing at an exponential rate, and it is our job to prepare our students for jobs that have not even been created yet. The Partnership for 21st Century Skills (2011) uses a framework that focuses on student outcomes that should coincide with their learning of course content. Students should be challenged to integrate life and career skills, learning and innovation skills, as well as information, media, and technology skills into all core subjects. This framework describes a support system that involves standards and assessments, curriculum and instruction, professional development, and learning environments. The goal for teachers is to utilize all of the components in this framework to engage their students and prepare them to be competitive on a global scale. This is the challenge set forth for educators. One piece of the framework is encouraging creative learning methods with supportive technologies. One such tool to support this goal is the interactive whiteboard or IWB.

An IWB is a large whiteboard that has a projected image from a computer on its screen. The screen is directly connected to the computer by a USB cable allowing it to be touch-enabled which in essence allows a finger or a designated object such as a whiteboard stylus, to act as the cursor or mouse of a traditional computer. Some of the capabilities of the IWB are drawing, zooming, highlighting/coloring, annotating, taking screenshots, lesson recording, hyperlinking, spotlighting, recognizing handwriting, dragging and dropping, and simply using the Internet (Türel, 2011, p.2445).

IWBs have been around for the past two decades and are becoming a prevalent part of global education. Countries such as Australia, Italy, Mexico, the Netherlands, New Zealand, Turkey, the UK, and the US have invested much time and money into the implementation of this technology (Türel, 2011, p. 2441). In 2010 it was reported that the UK had the highest saturation rate in the world at 73% with US in the middle of the pack at 35% (Johnson & Türel, 2012, p.381). This large investment of time and money warrants research to justify these expenditures.

There have been many different studies conducted on IWBs as to their perceived effectiveness. Researchers have found that students have a generally positive attitude towards IWBs (Erduran & Tataroğlu, 2010; Şad, 2012; Johnson & Türel, 2012). They find it to be motivating and visually stimulating. Erduran and Tataroğlu (2010) found that students in a high school Mathematics course were more interested in learning when the IWB was used.

Research has also been conducted on the perceptions and attitudes of teachers as well. Teachers observed that their students were more interested in the lessons and more willing to participate when the IWB was being used (Armstrong et al., 2005). The participants (2005) seemed to feel comfortable with the technology regardless of their training. Research has reported that teachers who used the technology more often became confident that their instruction was having a positive effect on the students (Armstrong et al, 2005; Johnson & Türel, 2012; Marzano, 2009).

Some researchers found that teachers underutilized IWBs and there was a need for further training to increase their effectiveness (Armstrong et al., 2005; DeSantis, 2012). Lightfoot (2011) and Armstrong et al. (2005) agree that many teachers adapt the

technology to their personal comfort as opposed to adapting to the technology. They found that many teachers were using the whiteboard as a traditional means for disseminating information to their students as opposed to using it to truly engage them. In another study, Türel (2012) found that many of the negative student responses from his study resulted from a lack of interaction and collaboration with the IWB. This suggests that a misused or inappropriately used IWB is ineffective and counterproductive to its intended use. It could possibly even have negative effects on students learning (Johnson & Türel, 2012; Şad, 2012).

An area where these studies are lacking is the pedagogy and methodology with the IWB. Wood and Ashfield (2008) state:

There appears to be the potential for enhancements in whole-class teaching and learning through the use of IWBs if pedagogic practice were to adapt and change through creative and innovative use of the particular features of this new technology. (p.87)

Additionally it has been noted that the teachers are the most important factor for effective IWB usage in the classroom (Jones, 2004; Perks, 2002). This literature shows that there is a need to study the way that the IWB is being used in the classroom. How are teachers using this technology to engage their students?

It is clear that these tools are commonly found in more and more classrooms throughout the United States. Much time and money is spent on purchasing and providing professional development. It is imperative that our students stay up-to-date with the newest technological tools, but it is also important that our students become true 21st century learners who will constructively and creatively contribute to the global

society (“The Partnership for 21st Century Skills”, 2011). The only way this is possible is to have highly trained professionals implement the appropriate skills to engage the students in using this prolific resource (Bybee, 2001; Ferguson, 2006; Hunzicker, 2011; Niederhaser & Wessling, 2011).

My first interaction with the SMART Board® came in the spring of 2005. Being a recent college graduate, I was surprised that I had never come into contact with this technology during my undergraduate studies. I immediately recognized that this was a revolutionary tool for the elementary classroom. It was with much enthusiasm that I explored the technology and the accompanying software, and began to integrate it into my classroom instruction. The following fall, I participated in a technology lead teacher development program provided by the ACTS (Aligning Curriculum to Standards) grant from the Pennsylvania Department of Education. During this time, I networked with other teachers and realized how important it was to assist my fellow colleagues learn how to utilize the multitude of available technological resources in their instruction. I saw firsthand how timid teachers could be when faced with a new technology. I conducted many informal and formal district workshops on different technologies including the SMART Board®. This helped me recognize the need for consistent professional development.

One major problem was the inconsistencies of technology integration throughout the district. Each school had autonomy for technology purchases through their Parent Teacher Organization (PTO), and my principal chose to push the integration of the SMART Board®. The district was unable to provide the necessary professional development to keep teachers consistently using the SMART Board®. The district would

provide some workshops at the beginning of the year, but after a few months, some teachers would stop using the board or forget what they had learned. After a few years, my district decided to standardize the hardware and software throughout the district. Currently, all of the elementary schools in the district have hard-mounted SMART Board® s in the regular education classrooms.

I often tell my students, “A calculator is only as good as the person who is using it.” In the same way, so is the IWB. It is a tool that teachers must be consistently and properly trained how to use (DeSantis, 2012; Türel, 2011). I agree with Lightfoot (2011), and Beauchamp and Prakinson (2005) that the board must be used to interactively engage the students. The teachers in Calendar School District have responded well with the full-scale integration of the SMART Board®, but they have not had much professional development for the technology in the past year. Based on my observations, some of the teachers in Calendar have become stagnant and reverted to only using the technology at their comfort level. Conversely, there are some teachers who continue to adapt and grow with their IWB integration in Calendar.

The purpose of this qualitative case study is to highlight the best practices of IWB integration being employed by certain teachers in Calendar school district. Calendar, like many other districts, has invested much time, money, and resources into this technology. This qualitative study will help provide a narrative lens of these different methods.

Problem Statement

The impetus for this study stems from the lack of research regarding specific methodology used to integrate the IWB into the classroom. Some schools districts in the

United States are beginning to integrate this technology throughout their entire school district (Davis, 2007). Calendar School district is one such district. They have provided professional development at the onset of introducing this innovation, but have not used evaluative measures to see if the technology is still being used effectively. One study has shown that some teachers can revert to the same instructional practices they were using prior to the IWB implementation (Smith, Higgins, Wall, & Miller, 2005).

Education is a recursive profession where continual learning and adaptation are necessary components to ensure that all learners' needs are being met (Kauchak & Eggen, 1998; Tomlinson, 1999; Whitehead, Jensen, & Boschee, 2003). Advances in technology are continually providing teachers with resources to teach more content in different and interesting ways for the students. One such method is IWB technology.

The SMART Board® is an IWB widely used throughout the world, and has been in schools for the past decade. It began with basic software components such as handwriting recognition, hiding and revealing objects, ability to save class notes, drawing, zooming, highlighting/coloring, and spotlight (Perks, 2002; Türel, 2011). The software has become more developed and there is also a community network that allows teachers to upload and share lessons they have created (“SMART Exchange® training, content, and community”, 2012).

The problem regarding different levels of teacher usage is described by the study by Glover, Miller, Averis, and Door (2007) that found that 28% of teachers used the IWB as a visual tool, 30% used it as an interactive tool with software such as PowerPoint®, and 42% used it for “enhanced interactivity” which encouraged students to think critically. They defined this as “a focus on using the technology as an integral part of

most teaching in most lessons, and integrating concept and cognitive development in a way that exploits the interactive capacity of the technology. More teachers need to manipulate this tool in a manner that promotes “enhanced interactivity” (2007). They need to network and discover new resources that are available. It is not beneficial to the students to merely use the SMART Board® as a presentation tool in the classroom (Brown, 2004; Manzo, 2010; Wood & Ashfield, 2008). The students will benefit from teachers who continually find new ways to interactively engage their students with this technology (Jones, 2004; Smith, Higgins, Wall, & Miller, 2005; Wood & Ashfield, 2008).

Purpose

The purpose of this qualitative case study is to explore the ways that highly technology proficient elementary teachers from four different schools in a Philadelphia suburban school district use the SMART Board® to interactively engage their students. For the purpose of this study, interaction will be defined as student use and manipulation of the physical board as well as the construction and presentation of materials on the board. This can be as simple as a student using a stylus pen to draw on the board or as complex as having the students create their own products for the teacher to assess or their classmates to see. These teachers have received some professional development on the SMART Board®, so my study also seeks to highlight the application of the SMART Board® in response to the professional development.

In Calendar school district, the SMART Board® is typically used in whole class instruction as the main presentation instrument for the children. This allows the teacher

to incorporate a range of different technologies with the interactive features of the SMART Board®. This study will highlight how these highly technology proficient teachers integrate multimedia, websites, and different software into their instruction in a way that allows the students to interact directly and indirectly with the content. My goal is to discover consistencies across the four different teachers' usage and the students' response to this tool.

Research Questions

The problem to be answered in this study is “In what ways do suburban elementary school teachers who are proficient with technology use an interactive whiteboard to engage their students?” The observations and data from each case study will be used to answer the following research questions:

1. What level of technological ability did the teachers have prior to getting the IWB and what development have they had to prepare them to use it?
2. How do teachers use the IWB on a daily basis?
3. In what ways is the IWB being used differently than a traditional presentation board?
4. How do the parents, teachers, and students perceive students' learning is affected by the IWB?
5. In what ways do parents, teachers, and students think the IWB could be used more effectively?

Definitions

The following terms are essential to both the questions above and the purpose of this study. While there may be additional components or definitions for any of these terms, these definitions are the ones used for this study.

Classroom response system – a polling system that is a combination of hardware and software. Each participant is provided with a remote often called a “clicker”. The software allows the presenter to create multiple choice questions. The participants’ responses are displayed on the computer or can be projected for all of the participants to see.

Interactive Whiteboard (IWB) – an interactive whiteboard is a whiteboard that is connected to a computer with a USB cord. The display of the computer is projected on to the whiteboard. The whiteboard then functions as an interactive touch screen because it is directly connected to the computer, therefore allowing a person’s finger or any other object to act as the “mouse” of a typical personal computer.

IWB Levels of Use –Basic – Basic usage of an IWB would be using it the same way a chalkboard is used. Only the teacher uses the stylus pens to take notes in a traditional manner and uses the computer to project presentations or webpages

Proficient – the teacher understands and utilizes the tools made available from the IWB manufacturer’s software. With specific regards to the SMART Board®, the teacher uses SMART Notebook® lessons that are designed to have the students utilize the interactive touch element of the IWB. The teacher also knows how to use the stylus pens to annotate PowerPoint®, webpages, and other media projected on the IWB.

Partnership for 21st Century Skills – “a coalition bringing together the business community, education leaders, and policymakers to position 21st century readiness at the center of US K-12 education and to kick-start a national conversation on the importance of 21st century skills for students.” (The Partnership for 21st Century Skills, 2011) They have established a suggested framework for 21st century student outcomes and support systems.

PowerPoint® – a presentation software that comes with the Microsoft Office suite. It is used to present information on a computer one slide at a time. It has many different presentation capabilities that allow it to capture the interest of its audience and it is a program that is commonly used by educators.

Pennsylvania System of School Assessment (PSSA) – a standardized test that is administered to grades 3 through 8 in the areas of Reading and Mathematics.

Additionally, Grades 5 and 8 take a Writing assessment and Grades 4 and 8 take a Science assessment. The Reading and Mathematics tests were used to measure Adequate Yearly Progress (AYP) for the state of Pennsylvania under the No Child Left Behind Act of 2001. Students must earn a score of Proficient or Advanced to count towards AYP.

SMART Technologies® – a technology company that is well known for creating an interactive whiteboard called the SMART Board® and providing different software and hardware for both education and business. Appendix A provides a glossary of terms specific to the SMART Board® and this company.

Delimitations and Limitations

There are many limitations and constraints of this qualitative case study. The foremost issue is the case study itself. In a case study, the researcher is the primary instrument for observation and data collection (Creswell, 2009). The analysis will be limited to the skill and knowledge of the researcher. The observations will only reflect what is seen, heard, and recorded by me. Due to the subjective nature of the case study, this report will reflect how I interpret my observations and data. Another investigator might find something I did not, and may possibly report an opposite perception of mine. This report relies heavily on my credibility and expertise.

Since this is a dissertation study, there is a limit to the longevity of the study. My desire to complete the study quickly has caused me to place a one-year limit on the study. This narrows the observation time frame to one teaching semester, which in turn has caused me to shorten the number of observations. I am also limited with time because I will be working as a full-time classroom teacher while conducting this study.

In addition, a case study typically studies a small sampling (Creswell, 2009). The sampling in this study is limited to four classroom elementary teachers out of a possible sixty-four in the district. I specifically chose one teacher from each of the four elementary schools to attempt to portray an appropriate sample from across the entire district. It is possible that these specific teachers may not accurately represent the majority of the teachers in their respective schools or throughout the entire school district.

Another limitation is the manner in which the teachers were chosen. When I met with the principal of each school, I asked them to provide me with a list of their most skilled SMART Board® integrators. After explaining the purpose of the study, they

provided me with a list of approximately three to four names with their corresponding grades. I did not give a measurable explanation of what a skilled integrator would be, so it is possible that the principals' perceptions might have differed from my own if I had their same knowledge of the teachers in their buildings.

Since the purpose of my study was to look at how highly technology proficient teachers use the SMART Board® in an elementary school, I felt that it was important that I have as many grades as possible represented in my study. I specifically decided to study one teacher from each grade from 2nd, 3rd, 4th, and 5th. I decided that these four grades would provide a better sampling than kindergarten or 1st grade due to the developmental and cognitive limitations of those two age levels. I also made the deliberate decision to make sure that one of the four teachers was a man to make sure that both genders were represented in the study to produce a more accurate sampling of all teachers in Calendar. The main goal of this study is to find the best practices for using the SMART Board® to engage students. By attempting to have each school, gender, and grade represented, I may have overlooked a teacher or teachers who would have better demonstrated this type of integration.

Additionally, my presence might alter the authenticity of the class lesson. It is possible that the teachers may specifically plan a special lesson for my observations. This would not be an accurate reflection of their typical daily lessons. They may also treat the students differently because of my presence or act in a manner that is not representative of their typical personality. . The students may also be affected in the same manner. They may feel nervous to participate because they might be embarrassed

to make a mistake in front of me. They may also act differently because there is a video camera recording the events.

Finally, this study is limited by the school district and area where these students live. Calendar School District is a mid-Atlantic suburban school district west of a major metropolis. The district is comprised of approximately 3,500 students enrolled in six different schools: one high school, one middle school, and four elementary schools. The diversity of the district consists of approximately 87% white, non-Hispanic, 10% Asian/Pacific Islander, 2% Black, not Hispanic, 1% Hispanic, and less than one percent American Indian/Alaskan Native. Only six percent of the population qualifies for the free or reduced lunch program. Calendar spends approximately \$13,000 per pupil. The white, non-Hispanic population and expenditure per pupil are moderately above the state average and the free or reduced lunch population is well below the state average. Calendar also ranks in the top 100 out of the 500 school districts in Pennsylvania for district performance on the PSSA (Pennsylvania System of State Assessment).

Even though Calendar does not share the same demographics with the majority of schools in Pennsylvania, I believe it is comparable to many suburban schools. Since the goal of the study is to find enhanced SMART Board® usage beyond basic function, I believe that this study will be useful for other school districts that have the same access to technology as this district.

Anticipated ethical issues

In any research study, it is important for the researcher to anticipate any ethical issues that may arise (Creswell, 2009). The majority of the issues fall on the researcher

himself and how he chooses his words (2009). This case study does not propose much risk at all because it is largely focused on an innovation. The Institutional Review Board (IRB) of Temple University decided that this study was more of a program evaluation and did not propose much risk to the participants.

Even though the university deemed this study to have minimal risk, there were many areas where I needed to be careful. The first area of ethical sensitivity was my presence in the classroom. Both the teachers and students may have been negatively affected by my presence in the classroom through feelings of anxiety. I was able to alleviate some of that anxiety through meeting with the teachers prior to the study and sharing my intention of the study as well as my exact methods of observation. I allowed them to use their professional judgment with regards to how they wanted to share my presence with their students.

The majority of the ethical issues came from my writing. The teachers put themselves in an evaluative position by allowing me to observe their instructional practices. They were depending on me to keep our interviews confidential and write in a manner that would keep them from being easily identifiable to anyone who might read this document. It was important for me to provide the most accurate account of what I observed, and reported from the data I collected.

The final area where I needed to be careful was bias. A difficult part of conducting a case study with participants known to the researcher is preventing bias (Creswell, 2009). The people I observed were all colleagues who I knew and admired. It was difficult to keep the report unbiased, especially considering the goal of the study was to highlight effective technology usage, which can be somewhat subjective. As with all

qualitative research studies, the researcher must demonstrate a high code of ethics in reporting objectively (Creswell, 2009). It would have been easy for me to manipulate my observations and data for the purpose of achieving my goal.

Significance of the study

Liz Lightfoot (2011) points out the correlation between PowerPoint® and IWB software. She reminds us that PowerPoint® was originally a replacement for acetate slideshows for business. These presentations can be boring and ineffective when they are overcrowded with text and the presenters read the slides word for word. The tool needs to be used in a masterful way to evoke student learning. The same goes for the IWB. If it is used as a presentation tool, it is basically rendered ineffective. In fact, some researchers even predict that it could hinder student progress if used this way on a consistent basis (Johnson & Türel, 2012). Ron Schechter (2011) encourages teachers to “not get stuck in projector mode”.

The school district being studied has recently purchased hard-mounted SMART Board® s for every elementary classroom. Due to the physical permanence of the board, teachers have no choice but to use it. Research has shown that teachers, like students, work within their own comforts and capabilities (Armstrong et al., 2005; Lightfoot, 2011). Some researchers suggest that teachers will treat the IWB in the same fashion that they treated the blackboard: as a presentation tool (Brown, 2004; Manzo, 2010; Wood & Ashfield, 2008) Some teachers might merely have substituted one board for another where they only use the pen to draw on the IWB and do not use any of the other tools or software (Brown, 2004; Manzo, 2010; Wood & Ashfield, 2008).

This is why a study needs to be conducted on the interactive uses of the SMART Board®. Some districts tend to inconsistently implement professional development or only provide development for the short term (Ferguson, 2006). Research shows that successful professional development needs to be implemented over a long range of time (Murcia & McKenzie, 2009). Most teachers would agree that districts are constantly attempting to integrate new initiatives for technology, curriculum, and pedagogy. It would be simple for educators to become complacent with their use and integration of the SMART Board®. This is especially true considering the likelihood of the district implementing a new program with new professional development.

Teachers need to be aware of all the additional methodologies that are currently being used with the IWB. The effective instructional practices discovered in this study will then be reported to the rest of the district to encourage other teachers to try their new technological tools in more effective ways. Additionally, schools that have a similar structure and technology capabilities as this district will be able to integrate these pedagogical methods into their schools.

CHAPTER 2 LITERATURE REVIEW

Introduction

The focus of this study is how the SMART Board® is used by “proficient” teachers as defined in Chapter 1. The literature will be organized by the context of the study, the person being studied, and the innovation. In this case, the literature will specifically focus on the elementary school, teaching pedagogy, and the SMART Board®.

The elementary school is a place that lays the foundation for learning and how to learn. Students need to be guided both academically and socially, so they can become civic-minded members of society (DeMarrais & LeCompte, 1999; Kauchak & Eggen, 1998). Children learn in many different ways and it is important for the teachers to recognize the variance of learners within their classroom. They are digital natives who have been born into a society that is immersed in technology (Prensky, 2001). It is important that they know how to do more than merely use the technology. They must be 21st century learners and apply their use of technology to the same principles and morals that are being taught during their time in elementary school (“A global imperative: The report of the 21st century literacy summit”, 2005). They need to use technology to help them think critically and communicate in a clear and positive manner (2005).

Teachers are the main focus of the study. Their personality and teaching style will make the difference as to whether or not students learn (Sutliff & Baldwin, 2001). Teachers take the time to learn about the individual needs of all the students in the classroom and make sure that they are instructed in a manner that will help them learn

(Cramer, 2004; Falk & Blumenreich, 2005; Kauchak & Eggen, 1998; Maxim, 1999; Tomlinson, 1999). One tool that will help students learn is technology. It is not enough to just give teachers the technology (Cramer, 2004). They must be given the skills on how to use it in a way that will increase student comprehension (2004). Just how students learn differently, teachers will choose to adopt the new technology at different rates. Some teachers will adopt and adapt more quickly (Rogers, 2003; Sherry, Bilig, Tavalin, & Gibson, 2000; Whitehead, Jensen, & Boschee, 2003). They need to collaborate and share to help other teachers accept this change (Fullan, 2007). Change is a process that must be embedded throughout the school culture (2007). For this to occur, teachers must have meaningful, on-going professional development, and the opportunity to collaborate with their peers (Bybee, 2001; Fullan, 2007; Hunzicker, 2011)

Much of the technology that is used in education begins in the business world (Greiffenhagen, 2000). The interactive whiteboard is one of the more recent innovations being used in the classroom. There are other companies like SMART Technologies that have paired the board with software that allows for multiple interactive benefits. Studies have found that students are more motivated when the board is used, but much still depends on the teacher. Teachers need to use the board in a way that would be different than the traditional chalkboard (Brown, 2004; Manzo, 2010; Wood & Ashfield, 2008) There is limited research on the academic benefits of the board, but the general research finds that teachers and students perceive it to be beneficial (Beauchamp & Prakinson, 2005; Brown, 2004; Dolan, 2010; Erduran & Tataroğlu, 2010; Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Johnson & Türel, 2012; Jones, 2004; Manzo, 2010;

Marzano & Haystead, 2009; Şad, 2012; Saltan & Arslan, 2009; Schachter, 2011; Smith, Higgins, Wall, & Miller, 2005; Türel, 2011; Wood & Ashfield, 2008).

Different Learning Styles

Learning styles is a general term used to describe people's preferred method of processing and storing information. Many people by adulthood and even early adolescence are able to recognize their strengths and weaknesses of learning. As a result, they become more in tune with their own unique learning style. Theorists such as Piaget have informed us about how children develop cognitively and emotionally (Maxim, 1999; Parson, Hinson, & Sardo-Brown, 2001). He has given general guidelines for how students learn. More recent theorists, such as Howard Gardner, have gotten more specific about individual intelligences or strengths (Berk, 2002; Maxim, 1999).

There are a few basic points for all students to learn: students need to have a certain amount of background knowledge and they need to be able to make connections to new information (Berk, 2002; Kauchak & Eggen, 1998; Maxim, 1999; Parson, Hinson, & Sardo-Brown, 2001). Piaget (2001) places cognition into four categories: schema, assimilation, accommodation, and equilibration. Children need to access their schema when they are trying to comprehend new information. They then need to assimilate this new information with their current background knowledge. The stage of accommodation involves converting this new knowledge into eventual schema. The final stage of equilibration is balance. Not all new knowledge is necessary for future access and the brain needs to determine whether it should become schema or not be processed (Parsons,

Hinson, & Sardo-Brown, 2001). Although some educators or scholars might disagree that students follow this exact process, it gives a general idea of how students learn.

Constructivism and constructivist theory are popular ways to describe the ideal learning scenarios for children. Constructivism is centered on learners creating their own meaning through social interaction and authentic tasks (Kauchak & Eggen, 1998).

Vygotsky feels similar to Piaget with regards to the importance of background knowledge, but he also feels that learning is a social activity and students must have enriching interactions with their peers and teachers to maximize their learning (Maxim, 1999). Cooperative learning is an ideal learning method, but it is only one of many that are beneficial to children.

In 1997, the American Psychological Association (APA) published Learner-Centered Psychological Principles. These ideas were geared towards school reform. In addition to the principles of Piaget and Vygotsky, they recognized that individual differences do have a great effect on learning as well as motivation and the classroom environment (Kauchak & Eggen, 1999; Parsons, Hinson, & Sardo-Brown, 2001). The classroom is a complex place for students to learn. There are multiple factors that a teacher must consider when implementing instruction to a diverse group of learners.

The first is students' preferred modality or mode of learning. Howard Gardner (1999) describes eight different types of intelligences:

- Logical-mathematical – students who like to problem solve, discover patterns, and think in a concrete manner
- Verbal-linguistic – students who love words, new vocabulary, and enjoy creating stories

- Musical-rhythmic – students who enjoy listening to music and are adept at creating it
- Visual-spatial – students who are skilled at drawing, painting, constructing, and building
- Bodily-kinesthetic – students who have good psychomotor skills
- Interpersonal – students who have a good sense of how other's are feeling
- Intrapersonal – students who are in tune with their own strengths and weaknesses
- Naturalist – students who have a strong understanding of plants, minerals, and animals

Good educators must take the time to identify each individual student's strengths and give them the opportunity to discover new ones. They must do more than merely appeal to children's visual, aural, and kinesthetic senses (Collinson, 2000).

Another area of importance is cooperative learning. Heeding the suggestion of Vygotsky (1978), teachers must decide which learners work better in a group and which students work better alone. Collinson (2000) found that students' level of achievement affected their preferred choice of learning. In his study he found that high achieving students preferred to work by themselves whereas low and middle performing students preferred to work cooperatively with their peers. An area where teachers have limited control is the physical environment, but the low achieving students in the survey found that they learned better in the afternoon. Structure and support is another area where teachers must cater to different learners. Some students need more adult support while other students can learn efficiently independently.

Children's Ability to Adopt New Technology

Prensky (2001a) asserts that many people would agree that there is something different about this generation of children. They act and communicate differently than the generations before them. They are presented with a multitude of technological tools that were not available to their predecessors. Adults feel that all children can learn and use technology much easier than they can. Perhaps this is because they are “digital natives”.

The term digital native is centered on the concept that children are born with this technology. Conversely, everyone else who was not born before the technology of the Internet, computers, digital music players, and smart phones would be called digital immigrants (Prensky, 2001a). Arguments can be made that learning technology is similar to learning a language and studies have proven that children under the age of 12 have a higher propensity for learning a second language due to their continuing cognitive development. On the opposite end, one could argue that not all children born during this time are necessarily digitally proficient (Ng, 2012). There are multiple other factors that can affect a child's technological proficiency. The most relevant factor is interaction with the technology itself.

Prensky (2001b) mentioned a study conducted on the attention span of children. A test was given to a group of children on what they remembered from a Sesame Street episode. One group paid attention 87 percent of the time while the other group only paid attention 47 percent of the time because they were playing with toys. Both groups scored the same. Even though the children were playing with toys, they were also able to extract

the main concepts of the show. This demonstrates that children can pay attention if the topic interests them.

Wolfe (2001) stated that studies of the brain reveal that it does have plasticity. It can change. This supports the idea that the brains of digital natives are wired differently than other generations. It also suggests digital immigrants can change the processing and organization in their own minds (Prensky, 2001b). Most importantly, it shows that since these children think differently, they will learn differently.

21st Century Learning

Teachers have the challenge of educating a different learner, a 21st century learner. Students are growing up in an environment that is vastly different from their teachers and it is continuing to advance. Teachers need to understand these new learners and help them grow ("A global imperative: The report of the 21st century literacy summit", 2005). "Digital natives expect to be able to speak the language of 21st century literacy, and to be understood when they do, not only among their peers but also at home, at school, and at work." (2005).

Many people assume that it is the role of educators to teach students how to use technology. This is where they are mistaken. Students are not concerned with the function of technology, but how to utilize it to meet the expectations of a given task (Ng, 2012). Using a computer, the Internet, and cell phones is likened to the ease with which earlier generations could use a radio. Using these technological tools has almost become automatic with this generation (A global imperative: The report of the 21st century literacy summit, 2005; St. Lifer, 2005; Whitehead, Jensen, & Boschee, 2003).

There are multiple characteristics that make these 21st century learners different than previous generations. This generation is capable of learning through multiple pathways at the same time. They understand a new digital language that incorporates text, video, audio, and graphics in one package to deliver messages. With the instant access of the Internet, students can follow a random progression of links to answer their questions. Learning does not have to be organized in the same linear manner that has traditionally been used (A global imperative: The report of the 21st century literacy summit, 2005; Ng, 2012; Prensky, 2001a; Whitehead, Jensen, & Boschee, 2003). With these advancements or advantages, come some drawbacks. Today's children seem to lack the reflective and critical thinking skills necessary to progress (2001a).

The Partnership for 21st Century Skills has been advocating for a change in education since 2002 (Cookson, 2009). They believe there is much more to a 21st century learner than using technology. Their framework outlines multiple student skills, content, and support structures. All of the categories are interconnected and should be embedded in all learning activities.

One component is Life and Career skills. Students need to develop the skills to become responsible leaders in the global market understanding the social repercussions of the profession while remaining flexible with the ever-changing world. Another component is Core Subjects and 21st Century Themes. Students must possess a global awareness with such major issues as the economy and sustainability of the environment. They must understand what it means to be a citizen of the world in addition to mastering the content of the Reading, Writing, Mathematics, Science, and Social Studies. The next component is Learning and Innovation Skills. This is an area where the students will

need to develop their problem solving and critical thinking skills. They need to be prepared for a complex world that is constantly confronted with new challenges. The final category is Information, Media, and Technology Skills. The expectations for 21st century learners go well beyond mastering the function of the technologies. Students must recognize the social responsibility that comes with easy access to people's personal information through social networking sites. They need to understand what copyrights are and how there is a moral obligation to follow them. They need to think critically and question their use of technology and media ("Framework for 21st century learning", 2011).

The Partnership for 21st Century Skills highlights all of the skills necessary to prepare our students for the future. Other educational advocates have focused more on technology itself. At the 21st Century Literacy Summit, they focused on digital literacy. They defined 21st century literacy as "the set of abilities and skills where aural, visual, and digital literacy overlap. These include the ability to understand the power of images and sounds, to recognize and use that power, to manipulate and transform digital media, to distribute them pervasively, and to easily adapt them to new forms." ("A global imperative: The report of the 21st century literacy summit", 2005). 21st century learners communicate differently than traditional students. Cell phones have made everything instantaneous for children (Prensky, 2001a). They can instantly text their friends or promptly look up a question on the Internet. Students are accustomed to constant written and visual communication through text messages, multimedia messages, and social networking (Ng, 2012). This digital literacy blends technical, cognitive, and social-emotional skills (2012). It is the job of educators to first understand this new language,

recognize how to model it, and then provide the students with opportunities to creatively use these new skills (2005).

The role of the teacher is perhaps more challenging now than it ever was before. They must reach a generation who values the opportunity to express their identities, social interaction, constant entertainment, instant discovery, and the ability to create and record using digital media (Markopoulos, MacFarlane, & Read, 2008). Teachers need to do their best to provide students with “edutainment”, a blending of education and entertainment (Markopoulos, MacFarlane, & Read, 2008; Prensky, 2001a). If they are willing to rise to this challenge, we could see some exceptional progress from these 21st century learners.

Different Teaching Styles

There are many different ways to disseminate and receive information. A teacher needs to equip herself with the tools necessary for transferring the information to the various types of learners in her classroom. Just as there are many different modalities for learning, there are many different methods for teaching, but there are also some basic characteristics shared by these different pedagogies. Lessons must be carefully planned to address the needs of each student. Instruction needs to be delivered in a manner consistent with the students’ learning styles. Teachers need to guide the students through questioning, group work, and independent activities. These are a few components of effective teaching pedagogy. Children in the elementary school are still developing intellectually and emotionally making them especially impressionable to positive and negative teaching. Poor teaching and teachers can have a prolonged negative effect on

children and even falter their trust with other adults (Green, 2010). This is why it is so crucial for teachers to make themselves well versed in effective instructional practice.

Lesson planning is the first piece needed to implement a successful lesson (Wu He & Hartley, 2010). A major component of the lesson planning process is getting to know the recipients. Effective teachers need to understand and learn the students' individual needs and modalities for learning. Teachers need to differentiate their instruction so that all students will have the opportunity to learn the content (Kauchak & Eggen, 1998; Tomlinson, 1999). One way to gain insight into how students learn is to administer a learning style inventory (LSI) (Beck, 2001; Sutliff & Baldwin, 2001).

Before teachers can differentiate their instruction, they first must understand how the students in the class best process information. Glenn (2009) found arguments both for and against matching learning styles with teaching styles. In general, the different scholars agreed that using an LSI will result in the teacher trying different teaching methods that would then result in more students of different styles learning the content (2009). There are many different learning style inventories that can be administered, so it is important that the teacher provides one that will allow for all of the different modalities to show (Beck, 2001). This is an imperfect system because some students can learn in multiple ways (2001). It is also tricky because different subject areas may be learned more effectively with different pedagogy (Richardson, 2003). Harold E. Pashler, a professor of psychology at the University of California hypothesized that all students would score higher on a science test on molecules if a physical model was used in comparison with only using the textbook. His argument is that all students would benefit from the kinesthetic approach, not just the students who learn best kinesthetically (Glenn,

2009). The main idea is that it is the responsibility of the teacher to figure out how students learn best, and one way that they can do so is by administering an LSI (Beck, 2001; Cook-Sather & Reisinger, 2001; Falk & Blumenreich, 2005; Glenn, 2009; How can different learning styles be addressed with consistent expectations?, 2012; Parsons, Hinson, & Sardo-Brown, 2001; Sutliff & Baldwin, 2001).

Teachers need to have “sound knowledge of why they are teaching, whom they are teaching, what they are teaching, and how they are teaching.” (Maxim, 1999, p.3) Using an LSI can help teachers address the whom and the how, but it is also important to recognize that students have different skills, interests, strengths, and needs (Falk & Blumenreich, 2005). Students can range from low-functioning to extremely high-functioning in the regular education classroom. These students can be physically, mentally, or emotionally gifted or impaired (Parsons, Hinson, & Sardo-Brown, 2001). A teacher must also plan accordingly to meet the needs of these different learners in conjunction with delivering the content in a manner that appeals to their style of learning. Kauchak & Eggen (1998) suggest these strategies for at-risk students, but they are also effective strategies for teaching all students: make sure students are actively engaged, use manipulatives and examples, have the students practice, and provide them with feedback. When students have really high needs, teachers must be flexible with their time, vary the learning objectives, adapt the learning materials, offer different activities, or use technology as an aide (1998). Other teaching strategies that can effectively reach learners of different modalities are: learning centers, individualized tasks, long range studies, learning contracts, problem based learning, group investigation, or portfolios

(Tomlinson, 1999). It is necessary for the teacher to manipulate the content in a way that the students can understand (Kauchak & Eggen, 1998).

After carefully planning instruction around the needs of each individual student, the teacher must effectively deliver the instruction. The teacher must be the guide who facilitates learning through all of the different styles that are needed to reach each student (Tomlinson, 2001). They must scaffold their instruction and help correct mistakes and misconceptions along the way (Maxim, 1999). They need to continually change their questions until the student understands (Power & Hubbard, 2002). This is all possible if the teacher truly believes they can make a difference, sets clear expectations, provides clear feedback, and presents the material with enthusiasm (Kauchak & Eggen, 1998).

Professional Development for Technology Integration

Professional development is another important factor that affects teacher effectiveness. All teachers go through accredited pre-service programs to prepare them to teach in the classroom, but it is also important that they continue to be educated on the most current educational practices. Professional development is an integral component of implementing change in a school district (Fullan, 2007). Successful implementation may have some barriers, but there are some general guidelines districts should follow when implementing professional development as well as some specific areas to focus on when training staff on new technology.

There are many barriers that can affect successful professional development. First is the teachers' willingness to implement the new program or technology (Niederhauser & Wessling, 2011). Similar to any change in the school system, teachers need to feel a

certain sense of efficacy when it comes to the topic being developed. Teachers need to feel that what they are learning is meaningful and will help them professionally.

Teachers can often be easily distracted during trainings (Hunzicker, 2011). Time is another major factor affecting successful professional development (Ferguson, 2006). Many teachers feel like professional training is too much work and there is not enough support (2006). Hunzicker (2011) states “when teachers feel supported, they are more willing to take professional risks by trying new things” (p.178). A final barrier to success can be funding (Bliss, 2003). Lack of funding can frequently result in inadequate training.

Professional development needs to be supportive, job-embedded, instructionally focused, collaborative, and ongoing (Bybee, 2001; Ferguson, 2006; Hunzicker, 2011; Murcia & McKenzie, 2009; Pianfetti, 2001). Support needs to come from administration as well as the innovation whether it is technology or a new curriculum. Student learning needs to be the primary focus of the training because ultimately they should be the ones to benefit from the new program. Teachers need the opportunity to discuss the successes and failures of the new program with their peers throughout the course of implementation. Continuing the development over the long term is important because time is one of the major barriers affecting effective implementation. It will also reiterate the importance of the program and help to embed it into the school system.

New technology is rapidly being introduced into schools in the form of both hardware and software. It is pertinent to have adequate professional development for the new technology. Many teachers in the profession have a basic proficiency with technology. (Whitehead, Jensen, & Boschee, 2003). “Much more has to be done than put

technology in the schools; teachers must be empowered to use it effectively” (Bliss, 2003, p.83). Teachers need to be well prepared in how to use the technology to help students learn, not just on how to use the technology (Niederhauser & Wessling, 2011). Teachers’ technology self-efficacy can positively or negatively affect student performance (Watson, 2006). A National Center for Educational Statistics report found that only 33% of teachers felt well prepared to teach their students using technology (Niederhuaser & Wessling, 2011). In another report it was found that 66% of teachers received less than 8 hours of in-service training in technology (2011). Bliss (2003) found that 70% of the participants in a study of Oklahoma elementary teachers claimed that they spent 5 or less hours in training for the year. In a 2001 survey, Whitehead, Jensen, and Boschee (2003) found that only 5% of teachers felt unprepared when they had 9-32 hours of training, 34% felt very prepared, and 61% felt somewhat prepared. Niederhauser and Wessling (2011) also found that 78% of the participants felt that most of their training was completed independently. This shows that the majority of teachers with 8 or less hours of training did not feel well prepared to use the technology.

In a 2001 survey, 50% of the participants felt that the following were great barriers for technology implementation: lack of release time for teachers to learn, practice and plan, not enough computers, outdated or unreliable computers, and the Internet was not easily accessible. Districts need to pay attention to the research and put money towards preventing these barriers. (2003). All of these barriers can affect the attitudes of the teachers as well as their rate and level of adoption.

Districts need to budget their money appropriately to foster successful implementation. Pianfetti (2001) found that the majority of money is spent on hardware

and software, but not educational practice. Watson (2006) stated that approximately 15% of a technology budget is used for training, but Whitehead, Jensen, and Boschee (2003) feel that it should be more like 20-25%. Teachers need to learn how to integrate the technology into their instructional practice. This is why there is a need for professional development.

A final component that can assist with successful professional development is evaluation. The three main areas to be looked at are the development itself, teacher outcomes, and student outcomes (Ham, 2010). Teachers need to give feedback, so the district can make changes to the content and delivery of the development (2010). Technology is an area that needs to be carefully implemented because of all the barriers. Districts need to use multiple sources to make sure that they can successfully implement the most effective professional development for new technology.

School Change

Change is an intricate process that must be taken on by a whole organization. The problem is that each organization is comprised of individuals and those individuals will ultimately decide if and how the change will work. All real change involves uncertainty and some struggle (Fullan, 2007). Teachers and administrators must accept this fact. Another basic idea that can affect school wide change is that quality teachers do make a difference with how well students learn (Fullan, 2007, 2011). The final most basic element of change is motivation.

Teachers come with many different personalities and beliefs, which makes it difficult to motivate them. Yarrow (2009) conducted a study and generalized teachers

into three different categories: disheartened, contented, and idealists. The disheartened teachers make up 40% of the population. They have been around longer than the idealists and see lack of support, discipline issues, and testing as major problems within the profession. The contented group comprises 37% of the staff. They have been teaching more than 10 years. Teaching is what they want to do and they see it as a lifelong career. The final group is the idealists who make up 23% of the faculty. Most of them are under the age of 32, but this is the group that truly believes all students can learn. This is a motivated group because one third of them plan on moving to a different position within the education field later in their careers. These survey results show that the disheartened teachers are the ones who will need the most motivation. Ultimately good teachers teach because they want to make a difference, but this group will need some extra incentives for that to happen (2009).

Fullan (2010) points out the pros and cons of merit pay as motivation for teachers. The research concludes that there are not benefits for merit pay. Instead he suggests some other incentives to motivate teachers: good salaries, decent surroundings, positive climate, strong induction program, extensive professional learning, opportunity to work with and learn from others, supportive leadership, getting helpful feedback reasonable class size, long-term bargaining agreement, and realizable moral purpose (2010, p. 89). These are the types of incentives that will draw quality teachers. Then, the best way to implement change is to institute a culture of professional learning communities (Fullan, 2007; 2010).

The change process can be categorized into 3 stages: initiation, implementation, and institutionalization (Fullan, 2007). Some factors that might affect implementation

are seeing the need for change, clarity of the change, quality and practicality of the program or innovation, and individual teachers' psyche and relationships with others. Stage two is a critical point that will affect whether or not the change becomes a part of the school culture. The final phase, institutionalization, will determine whether or not the change was successful. For continuation to occur, the change must become embedded within the school system.

Innovation Adoption

“An innovation is an idea practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p.12). Rogers describes in depth the process of communicating any innovation into any social system, but his thoughts are relevant for integrating technology into the school system. The school system tends to be late in adopting the most current technology, so technology does not have to be “new” in the sense that it was recently created. It only needs to be new to the system that is adopting it (2003).

When teachers are first confronted with something, they will go through a process of trying to understand this new idea or technology. Rogers (2003) calls this the Innovation-Decision Process. He cites that teachers will follow these five steps: Knowledge, Persuasion, Decision, Implementation, and Confirmation. The first step is obvious because knowledge is merely “knowing” that the technology exists. Some teachers will have knowledge of a technology before it is introduced at an in-service, and other teachers will first learn about it there. Persuasion refers to the initial opinion that a person will form about the technology. This is typically a positive or negative reaction.

The decision of whether or not the teacher will choose to adopt the new technology is the next step. There are a multitude of factors that will affect this decision that will ultimately place the teacher into one of five different stages of adoption. Implementation is the point at which teachers will try the new technology. Just as students need to construct their own meaning about what they are learning, teachers will go through a process called reinvention where they will make the technology their own. The final stage is confirmation, which will come from the district. The best professional development is administered long-term and is on-going. If the training stops, teachers might feel discontinuance, which could result in a negative reaction to the innovation.

Rogers and other scholars like to categorize learners or teachers in this case into five adopter categories. Rogers (2003) five adopter categories are:

1. Innovator
2. Early adopter
3. Early majority
4. Late majority
5. Laggards

The Innovator is the adventurous teacher who is willing to try anything new and does not worry about any of the potential pitfalls. He claims 2.5% of the population fall into this category. The Early adopter is the person who thoughtfully chooses to adopt the technology and will then lead others to follow. They make up 13.5% of the population. The Early majority are typically not leaders, and they need to feel a fair degree of certainty about the technology before trying it. They are 34% of the population. The Late majority need to feel confident that the school system has accepted the innovation

and they will need to be persuaded against any uncertainty. They might need to see the other teachers make it to the confirmation stage of the innovation-decision process before they begin their implementation stage. They represent 34% of the population as well. The Laggards make up the final 17% of the staff who will resist the change because they prefer to stick with what works. They need to see that this new technology works and is not going away before they will decide to adopt it. Rogers five categories focus on the timing of adoption.

Some other scholars have created adoption categories that more closely align with Rogers Innovation-Decision Process. Sherry, Bilig, Tavalin, and Gibson (2000) state that a teacher goes through these five stages of adoption:

1. Teacher as learner
2. Teacher as adopter
3. Teacher as co-learner
4. Teacher as reaffirmer or rejecter
5. Teacher as leader

First teachers learn about the technology similar to the Knowledge stage for Rogers. Then they begin using it. After that, they begin integrating it into the curriculum. As much of the professional development literature pointed out, it is not merely enough to teach the technology. Teachers must learn how to effectively integrate it into their pedagogy so that the students will benefit. Teachers will then analyze the impact that it has on the students and decide whether it is truly beneficial. The final stage is being a leader who might train other faculty, collaborate, or even do some independent research on the new technology.

Whitehead, Jensen, and Boschee (2003) similarly align their Teacher Levels of Adoption with an individual's process of adoption. They are:

1. Entry
2. Adoption
3. Adaptation
4. Appropriation
5. Transformation

These levels of adoption focus on classroom integration with the adaptation stage being the first point at which teachers use the technology in the classroom and encourage students to use it. Appropriation is the point in which the technology has been integrated into all daily learning activities. Transformation seems to be the highest level of adoption where teachers create new ways to use the technology. Even though both sets that focus on the adoption process have five categories each, it is presumed that not all teachers will go through all five stages. Although transformation would be ideal, not all teachers are going to create new ways to use the technology. Rogers names factors that can affect the rate of adoption which would probably also affect the extent to which the technology is adopted.

The five factors that could affect the rate of adoption are: Perceived attributes of innovations, type of innovation, communication channels, nature of the social system, and extent of change agents' promotion efforts (Rogers, 2003). All five of these factors will occur during the knowledge, persuasion, and decision steps of the Innovation-Decision Process. The school district implementing the new technology will have control over how the technology was chosen, how it is communicated to the staff, the climate

that already exists within the district and its promotion. That is why the implementation and professional development of the technology are so critical to its success. The first factor focuses on the individual and her perceptions of the technology. Rogers (2003) describes some but not all perspectives that a person might think of regarding the technology. One is the benefit it will bring. Most people would look at anything new and decide if it will benefit them in some way. Another perspective is how the technology will work with what the teacher is already doing. Its complexity will probably also affect the perception of how easily it can be integrated into the current curriculum. The final two perceptions are individually formed, but do depend on the school's introduction. People will want to try the technology before forming an opinion, and they will want to see results.

Integrating any new innovation can be a complicated process. There are a myriad of factors that will affect the perception of the individual. This is why it is important for a school district to develop a careful plan when introducing new technology. This introduction could change the rate of adoption and even the extent of adoption for the teachers on its staff.

Origins of the Interactive Whiteboard

An interactive whiteboard is a whiteboard with a projected computer image on it. The computer is directly connected to the whiteboard so the user can manipulate the content from the computer on the board using her fingers, designated stylus pens, or other objects. The computer, projector, and board form the standard components, but different

companies package the technology in different ways. This technology was first developed in the business sector for office use.

In 1987, some members of the Xerox Palo Alto Research Center (PARC) developed the idea of a wall-sized computer. The original idea involved putting silicon sheets over the walls that would receive information through electronic pens. This novel idea caught the attention of other members at PARC and they quickly developed the first interactive whiteboard in 1988: Liveboard (Weiser, Gold, & Brown, 1999). The idea was to increase collaboration within the office allowing multiple users to work on a project simultaneously throughout different locations. Before rolling out the first prototype in 1991, a software system was developed to facilitate the function of this interactive technology (Pederson, 2003). Pederson also points out how the goal of the project was for technology “to integrate into normal work activities and practices” (2003). This would be fairly easy to do since it already imitated the standard way that people presented information in meetings (Schuster, 1995). This would eventually become a characteristic that would make it easy to integrate the boards into the classroom (Brown, 2004).

Liveboard was first distributed to high schools in the early 1990s, but production ended in 1998 (Weiser, Gold, & Brown, 1999). By this time, multiple competitors had emerged. Currently the industry leaders in IWB production for K-12 worldwide are SMART Technologies (SMART Board®) and Promethean (ActivBoards). Even though these two companies dominate the education market, there are multiple other companies that carry IWBs: ACCO, Hitachi, Luidia, Mimio, Nuonics Corporation, Panaboards, Plus Vision Corporation, Polyvision, Qomo Hitevision, and 3M Visual Systems (Davis, 2007).

IWBs are being integrated across the globe. In 2007, Decision Tree Consulting predicted that one in every seven classrooms would have an IWB by 2011. This was based off their data on whiteboard sales for 66 countries (2007).

The United Kingdom is the leading integrator of IWBs. Some people estimate that 90% of schools in the UK have IWBs (Manzo, 2010). This statistic is reinforced by Clarke who claims that the UK spent over 50 million pounds from 2003-2005 on IWBs (as cited in Smith, Higgins, Wall, & Miller, 2005, p.92). The UK has initiatives similar to the No Child Left Behind Act that focus on Math and Reading. They are called National Literacy Strategy and National Numeracy Strategy. Since much money was allocated to purchase IWBs as part of these initiatives, the majority of the research on IWBs has been conducted in the UK. The USA, Canada, and Australia are the other largest adopters of IWBs throughout the world (2005).

Interactive Whiteboard use in education

Interactive Whiteboards have been used in classrooms since the early 1990s. The fundamental function of this technology is similar to any touch screen device where the user touches the screen instead of using a mouse. If the board were to only be used in this manner, it would really not have much more benefit than being just a presentation device. Many scholars are concerned with this happening in our schools and use the terminology “glorified chalkboard” to describe this phenomena (Brown, 2004; Greiffenhagen, 2000; Manzo, 2010; Wood & Ashfield, 2008). A pilot study in 2000 found that a necessary component for making this technology work in the field of education is the software (2000). The need for education friendly software could be the

reason that SMART Technologies and Promethean are the industry leaders. Both companies include software with their boards that allows the user to manage and manipulate the content in interactive ways that will benefit student learning. Appendix B includes a list of some of the different features of the SMART Notebook® software.

In addition to offering software to accompany the board, these companies have an online forum. Teachers are able to submit their own lessons that they have created or download pre-existing lessons.¹ It seems as though anyone could teach a class if they became familiarized with the hardware and software of IWBs, but Pat Perks (2002) disagrees. She states:

What is important to stress is that many of the files do not, in themselves, permit the education of awareness, it is the pedagogical decisions, the teacher choices, which allow them to become useful and interesting tools for learning mathematics. (p.58)

The final components that make the IWB an appealing instructional tool are the ease of Internet access, multimedia presentations, and the incorporation of classroom assessments (Manzo, 2010).

Benefits and Drawbacks of Interactive Whiteboards

Many studies have been conducted on the perceived benefits of the IWB from both the perspective of the teacher and the student. Although Marzano (2009) claims there is limited research on the board's effect on student achievement, the touted benefits

¹ SMART Technologies forum is called SMART Exchange® - <http://exchange.smarttech.com> and Promethean's forum is called Promethean Planet - <http://support.prometheanplanet.com>

are motivation and engagement (Brown, 2004; Davis, 2007; Glover, Miller, Averis, & Door, 2007; Hennessy, Deaney, Ruthven, & Winterbotoom, 2007; Manzo 2010; Marzano & Haystead, 2009; Saltan & Arslan, 2009; Smith, Hardman, & Higgins, 2006; Wood & Ashfield, 2008). It is apparent that the features available in the software packages are enough to engage an audience of any age. The presentation capabilities coupled with the interactive technology allow a teacher to reach multiple different learning styles (Wood & Ashfield, 2008; Manzo, 2010). Regardless of the research on student attainment, this technology is having a positive effect on both teachers and students.

The benefits for both teacher and student can be analyzed through Charlotte Danielson's Framework for Teaching: Planning and Preparation, Classroom Environment, Instruction, and Professional Responsibilities (The Danielson Group, 2011). One area that makes planning easier for teachers is the ease of changing the lesson. It is also easy to prepare a multi-faceted lesson because all of the components can be integrated into the presentation. The environment becomes visually and aurally rich for the students with the various media that are used. Instruction becomes more efficient and engaging for the students. Finally, the teachers will increase their professional knowledge through professional development and collaboration.

Planning

One of the greatest benefits for a teacher planning a lesson to be implemented with the IWB is the plethora of resources available in a singular location. Everything becomes centralized around the computer. As mentioned before, the teacher can easily access and search pre-existing lessons on the content that is being taught. Once the file is

downloaded, the teacher can adapt the pages and their components to fit the language and sequence of the school district's curriculum. Teachers can easily access the Internet, and share multimedia presentations (Manzo, 2010).

Teachers can even record movements on the board prior to implementing the lessons to show the students how to complete a task. For example, a teacher could teach a lesson on division using base ten blocks. The teacher would record the screen showing the students how to drag the blocks into groups until there were not any groups left. Then when it would be time to teach the lesson, the teacher could simply press play and narrate the steps as the board went through the movements. This would allow the teacher to stand in any part of the room as opposed to being stuck up front by the board. This helps increase the efficiency of the lesson (Brown, 2004; Haldane, 2007; Saltan & Arslan, 2009; Smith, Higgins, Wall, & Miller, 2005; Wood & Ashfield, 2008).

The additional components that increase the efficiency are the time spent adding visuals and other multimedia into the lesson. Wood and Ashfield (2008) feel that this affords the teacher more creativity when planning a lesson. The gallery in the accompanying software is packed with clip art, images, and interactive media. Also, the teacher can incorporate any other images found from the Internet and link directly to webpages from the designed presentation.

Planning for an IWB can be quite time consuming, especially if the teacher is designing a lesson for the first time. The benefit is that once a lesson is designed, the teacher will need much less time planning the same lesson in the following years (Smith, Higgins, Wall, & Miller, 2005). Despite the large amount of time needed to plan for a lesson, the teacher and students will be rewarded with a much smoother, exciting

presentation compared with a lesson prepared for a traditional chalkboard (Haldane, 2007; Jones, 2004).

Environment

Walking into a classroom where a traditional chalkboard is used as the primary instrument for instruction can be dated back almost two centuries. Having an IWB in the classroom gives the room a modern look (Smith, Higgins, Wall, & Miller, 2005). This effect is compounded by the different multimedia being used on the computer. An important element of a lesson is student engagement. This can be categorized under both the classroom environment and instruction. Lessons instructed with an IWB are proven to have motivated and engaged students (Brown, 2004; Davis, 2007; Glover, Miller, Averis, & Door, 2007; Haldane, 2007; Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Jones, 2004; Manzo, 2010; Marzano & Haystead, 2009; Saltan & Arslan, 2009; Smith, Hardman, & Higgins, 2006; Smith, Higgins, Wall, & Miller, 2005; Wood & Ashfield, 2008)

One of the drawbacks of an IWB is the need for the teacher to be at the front of the class, leading the presentation (Dolan, 2010). Wood and Ashfield (2008) worry that overuse can turn the students into “passive recipients”. Different teachers have different abilities and the better teachers understand how to adapt the technology to meet the needs of the students (Glover, Miller, Averis, & Door, 2007). It is important that the teacher provides the students with opportunities for interaction and group work with their peers. The IWB can promote a positive learning environment when implemented by a well-trained educator.

Instruction

The goal of implementing any new technology is that it will enhance student learning. There are many factors that contribute to the motivation and engagement of an interactive lesson with the IWB. Even though the technology itself presents the resources that are beneficial to the students' learning, it is still the teacher who must craftily lead the lesson (Jones, 2004; Perks, 2002; Smith, Higgins, Wall, & Miller, 2005; Wood & Ashfield, 2008)

Most educators recognize that careful planning can lead to better instruction. Instructional delivery can become seamless with the use of an IWB (Jones, 2004). This allows for the students to spend more time interacting with the board. Students feel that the visuals and the “modern feel” of the lesson are more engaging (Smith, Higgins, Wall, & Miller, 2005). They enjoy the interaction with the board and teachers feel that this is beneficial as well (Davis, 2007; Hennessy, Deaney, Ruthven, & Winterbottom, 2007). Teachers found the ability to change, adapt, annotate, and print lessons for later use to be helpful with instruction (Glover, Miller, Averis, & Door, 2007; Haldane, 2007; Perks, 2002). The main attraction seems to come from the visually stimulating environment and the ability to interact with these visuals.

According to Dolan (2010), there is an assumption that “all these gadgets improve teachers' teaching and students' learning”. Even though some teachers feel this is true, research has proven that it is not (Glover, Miller, Averis, & Door, 2007). Teachers need to be well-trained, confident, and exhibit typical good practices of regular teaching (Haldane, 2007; Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Manzo, 2010; Marzano & Haystead, 2009). There is a fear that many teachers will adapt to using the

IWB in the same manner that a chalkboard is used. This turns the board into a mere presentation tool and removes all of the benefits provided by the interactivity and software of the IWB. It is evident that teachers need to adapt their pedagogy to effectively utilize the IWB to enhance their students' learning.

Upon implementing IWBs in their school district, Kent County required the teachers to attend summer training, monthly follow-ups, participate in a teacher blog, and study the relevant literature on IWBs (Manzo, 2010). Thomas (2009) makes note of a common practice with technology in education: "introduce first and think about it later". Much of Kent County's success is due to the carefully planned implementation of IWB integration in their classrooms. Marzano and Haystead (2009) found that teacher confidence was one of the many correlating factors that contributed to an increase in student achievement when IWBs were used. This confidence is a result of training and experience.

Clearly the teacher is an integral factor in effectively using an IWB to instruct children. This innovative and exciting technology is enough to motivate and engage the students, but it is the artful teacher who must facilitate this resource in the proper way to enhance student learning.

Professionalism

Although it is concluded that professional development is a key component for effective IWB use, teachers can still benefit from using the technology. An important part of being an educator is remaining educated and up-to-date on the best teaching practices. Some teachers are forced to use IWBs because of district or country initiatives.

Other teachers have the opportunity to volunteer. Typically the districts that force the technology on their staff have some type of plan that involves professional development. Often, the teachers who volunteer are left to figure out how to use it on their own. SMART Technologies and Promethean have provided the opportunity for collaboration with educators throughout the globe. They have online forums as well as the opportunity to share lessons. This digital collaboration will benefit both teachers and students. If teachers continue to have the ambition to learn, the students will benefit.

Research has shown many benefits through teacher and student perspectives and researcher observations. Even though literature has been lacking with regards to student achievement, Marzano Research Laboratory has provided the field with a comprehensive study on student achievement. The study was a quasi-experimental design consisting of 70 teachers from 50 schools in 29 cities throughout 19 states. Every grade from kindergarten through twelfth was represented in the study and nine out of the twelve grades showed positive gains in student achievement from IWB use. Regardless of the achievement gains, all grades demonstrated positive student engagement, which reinforces the existing literature. Marzano and Haystead (2009), through extensive analysis, concluded that student achievement would increase with IWB use when the teacher is experienced, has used the technology for a few years, uses the board 75-80% of the time, and has confidence in her technological aptitude. This study can be used as a model and a motivational tool for educators to effectively integrate IWBs into their daily instruction.

CHAPTER 3 METHODOLOGY

Assumptions and Rationale

A case study approach was used to conduct the research for this study. This is defined as “a strategy of inquiry in which the researcher explores in depth a program, event, activity, process, or one or more individuals” (Creswell, 2009). This approach gave the participants and me the opportunity to analyze lessons for reflective purposes. The natural setting allowed for genuine results, which were then interpreted and coded for themes. The case study format gave me the flexibility to discover multiple themes that arose as opposed to steering the study in a particular direction. Involving teachers, students, parents, and myself provided multiple perspectives of the same events.

The goal of the study was to report methods used by teachers in Calendar School District (a pseudonym to insure the confidentiality of the teachers and students) with incorporating the SMART Board® into daily instruction. Effective pedagogy can be measured by student achievement, but it can be difficult to correlate the usage of the SMART Board® in the classroom and student achievement. Marzano and Haystead (2009) were able to demonstrate a correlation between IWB usage and student achievement data with an experimental pre-test and post-test design. It can also be suggested that student achievement on written tests is not the only measure of effective teaching. Many other studies have shown that students perceive the IWB to be beneficial to their learning.

Using studies that have shown how students perceive IWB usage to benefit their learning and Marzano and Haystead’s study, I sought to observe and understand the

different pedagogy used to effectively engage the students with the SMART Board® by focusing on teachers who are identified as proficient user of this tool. The qualitative design of the study allowed for a cross-analysis of each descriptive case study including teacher interviews, student questionnaires, and parent questionnaires. This allowed for multiple perspectives from multiple cases to be taken into consideration. Yin (2009) stated that the conclusions arising from multiple case studies will provide more powerful results than a single case study which is why I which is why I chose this format.

The Role of the Researcher

Creswell (2009) states that in a qualitative case study, the researcher is the primary instrument for gathering data. The interpretive nature of a qualitative study makes it important that I provide a detailed description of my own background and propensities. This allows the readers to analyze whether certain characteristics or experiences might have created the potential for researcher bias.

I began teaching in an elementary school in Calendar School District in the fall of 2004. I was one of the first teachers in the school district to integrate the SMART Board® into my classroom instruction in the spring of 2005. The first SMART Board® in October Elementary was a portable SMART Board® that another teacher received from the ACTS grant. I then took it upon myself to play with the board to better understand its use and capabilities. I attended trainings at the local intermediate unit and continued to advance my knowledge on my own.

This prompted me to pursue a Master's Degree in Instructional Technology. Throughout the pursuit of this degree I continued to integrate different types of

technology into my instruction. In 2009, I was given the first hard-mounted SMART Board®. The idea was that I would pioneer the new way this technology was used and be a reference source for teachers who would have a hard-mounted board installed in their room. This trend continued throughout the district with full-scale hard-mounted integration into regular education classrooms being completed by the spring of 2011.

Since 2005 I have conducted informal workshops in Calendar to assist the teachers in my building. I have also been the leader of full-scale professional development workshops at the district level. Since Calendar is the district where I work and have conducted all of these workshops, I have a prior relationship with each of the teachers in the study. This can increase the chance of a biased report (Creswell, 2009).

The collegial relationship with the observed teachers created the potential for bias. I had to maintain a high code of ethics to protect the teachers from any possible evaluative harm in the event that the respective principals of each teacher might read this study. In addition, I could not allow my relationship with the subjects to influence the content of my report. In all case studies, it is important to maintain confidentiality for all parties involved.

Another particular area of sensitivity was the inclusion of students in this study. I made sure to carefully formulate questions in a manner that the students would understand. I had to make sure that the students understood exactly what I was asking. In addition, all data regarding students was presented in aggregate format to protect the confidentiality of the students even though they were not the focus of this study.

Population and Sample

Calendar School District transitioned to a hard-mounted SMART Board® in every regular education classroom throughout the district in 2011. Marzano and Haystead (2009) found a few characteristics to be correlated with positive student achievement and SMART Board® usage: teacher experience, teacher confidence in technological ability, and substantial use of the technology in instruction. Many of these characteristics were taken into consideration when choosing the population for this study.

One teacher from each elementary school would be observed to provide a sample and reflection of elementary teachers in Calendar School District. I met with the principal of each of the four elementary schools in Calendar School District and explained that I was looking for teachers who demonstrated the most comfort with the SMART Board®, used it the most consistently, and demonstrated the highest level of innovative practice. Each principal provided me with a list of multiple teachers who could be observed. I then analyzed each list so I could select one teacher from each school and also observe one teacher from each grade level from second through fifth grade. The purpose of my study was to record effective methods of technology integration by highly proficient teachers in the elementary school, so I chose to represent as many grades as possible.

Elementary school can often be categorized as two different levels: primary and intermediate. The primary grades are from kindergarten to second and the intermediate grades are from third to fifth. The four teachers selected from the principals' lists were all purposely chosen to center the study on one teacher from each of the following grades: second, third, fourth, and fifth. Through my observations within my own

building I determined that kindergarten and first grade teachers would be limited by the cognitive and physical development of the children preventing them from using the SMART Board® as creatively or variably as the older grades.

An additional layer of sampling comes from the subject areas. I chose to observe each of the four teachers teaching one lesson from each major elementary subject area: Reading, Mathematics, Science, and Social Studies. Studies on IWBs do not always delineate the different subject area in which the technology is used. Pedagogy carries many similarities across the curriculum, but it also has differences. It is in these differences where I believed this study would potentially reflect guidelines for using the SMART Board® in any teaching capacity for these grade levels.

Data Collection

Multiple sources of data were collected in this study. The first data was collected through a pre-observation interview of each of the four teachers. The teachers were asked to distribute the parent questionnaires which also included the parents' permission to video tape the students. Then I began my observations. Each observation was video taped and I wrote my observations in a triple journal. At the end of each lesson, I had a post-conference with each teacher. They also had the option of completing the post-conference questions through email. They also provided me with lesson materials such as webpages or computer files. Once I completed all of my observations, I distributed the student questionnaire.

Timeline

February 2013 – Interviewed all four teachers. Gave student permission and parent questionnaires to the teachers.

March 2013 – Collected student permission and parent questionnaires. Completed four observations and post-conferences.

April 2013 – Completed four observations and post-conferences.

May 2013 – Completed eight observations and post-conferences. Distributed and collected student questionnaires.

Observations and interviews

In face-to-face meetings and phone conferences, I was able to explain the study to each elementary principal allowing the principal to assist in choosing the best candidates for the study. The principals then provided me with a list of teachers in their building who they perceived to be proficient to above proficient users of the SMART Board®. I then chose one teacher from each building. The chosen teachers were observed over the course of three months on four separate occasions teaching each of the four core subjects: Language Arts, Math, Science, and Social Studies. Due to the instruction design of Calendar's elementary schools, two of the teachers were only observed in three subjects with the exclusion of Science because their students learned Science from a different teacher. Prior to the first lesson, each teacher was individually interviewed in a semi-structured interview at his/her building. This gave the teachers the opportunity to provide their philosophy on technology integration into the classroom with a specific focus on

using the interactive whiteboard. They were asked to discuss their most successful lessons with the IWB and elaborate on why they thought they were effective.

During my observations, I kept a triple-journal, narrating the events of the lesson, the relevance of the events to the study and my perceptions of the lesson. This allowed me to objectively record what was occurring in the classroom as well as record my own thoughts, feelings, and ideas (Creswell, 2009). The focus of the observations centered on the specific methods that the teacher used to engage the students in the lesson with the IWB.

After the observations, I scheduled a post-conference with the teacher to reflect on the lesson. I shared my observations and perceptions of the lesson in each discussion with the teacher. The teacher reflected on the effects that the IWB had on the lesson. Each interview specifically focused on the subject that was taught and if this type of methodology would have worked for a different subject. These interviews were conducted after all fourteen observations and recorded for transcription purposes.

The final pieces of data were the lesson materials used by the teachers. I collected materials such as websites, PowerPoint®, and SMART Notebook® files.

Questionnaires

A questionnaire was sent to the parents/guardians at the same time as the consent for video taping of their child's lesson that occurred prior to the first classroom observation. The parents were asked general questions about their knowledge of the SMART Board® such as "Did you know that your child has a SMART Board® in his/her

classroom?” They were then asked follow up questions about their perception of the SMART Board® and how it affects their child’s learning.

Students were given a reflective questionnaire after all of the observed lessons. The questions focused on their attention during the lesson, interaction with the SMART Board®, and understanding of the content. They shared their perceptions on how the SMART Board® affected their learning of that specific content.

Digital video

Each observed lesson was video taped. This allowed me to confirm the accuracy of my notes with the actual events. This also assisted in the coding of each lesson. In addition, each conference with the teacher was audio taped. This helped contribute to the authenticity of the case study narrative.

The observations, interviews, questionnaires, audio, and lesson materials all added to the legitimacy and validity of the study. Themes that were revealed through the multiple different sources in multiple settings supported my observations. This triangulation helped to legitimize my findings.

Data Analysis

The data analysis began with an extensive and detailed description of the setting, actors, and the history. This information was an important part of the results of this study. A baseline analysis was completed on the first teacher interviews and parent survey data. The parent data was converted into a table for each elementary school. I checked to see any similarities and differences between the different parent responses. I

then checked to see if the parents written responses reported the same types of SMART Board® that the teachers stated in their interview with me.

The observations and interviews were progressive and recursive. An analysis was completed after each observation so I could adapt the interview questions. This also gave me the opportunity to compare my observations with the teachers' perceptions of the lesson.. Once all of the observations were completed, I compiled all of the post-conferences responses into one document allowing me to see the similarities and differences between each lesson for each teacher. I read through the pre-observation interview and post-conferences and manually highlighted any themes that I saw. The primary focus of the themes and codes were on teacher usage of the SMART Board® to facilitate student interaction. I reviewed the video of each lesson and looked at lesson materials to aid me in understanding my journal notes. The final piece of data that I analyzed was the student questionnaire. The questionnaires were converted to a data table for each elementary school. These results were then compared with the teacher interview results, my observations, and the post-conference results.

A chronological and descriptive case study was written on each observation site. Then I provided the interpretation of the data and the conclusions. I found similar themes by subject, teacher's experience, and parental and student perceptions.

Methods of Verification

The validity of all qualitative studies depends on the role of the researcher and relies on his description of bias. In this case, it was important for me to accurately

describe my relationship to the participants. I made my intentions and expectations of this study clear.

I felt that it was necessary to triangulate multiple sources of data (Creswell, 2009). Some case studies focus on one school, but this research studied one teacher from each of the elementary schools. The themes that showed up throughout all of the schools helped validate my findings. In addition, each teacher was observed in four different subject areas. These subject areas were cross-examined for similarities and differences. The similarities found throughout all subject areas validated general pedagogy for SMART Board® integration and similarities found within specific subject areas confirmed specific pedagogy for those specific subjects.

Another important component of the study was the post-conference. Creswell (2009) refers to member checking as an auxiliary means for validating the data. This post-lesson interview helped to reinforce my observations and confirm the themes with the participants. These themes were also cross-checked with the students' reflection of each lesson.

The pre-lesson interview and parent questionnaires added another layer of validity to the study. The interview and questionnaire allowed me to have an understanding of the climate that the teacher had established in the classroom. It was assumed that questions implicating a positive climate for technology use would correlate to exceptional usage in the observed lessons.

CHAPTER 4 FINDINGS

Introduction

The findings of this study are the result of my observations and interpretations of my interviews and questionnaires. Since the researcher is a key part of the data in a qualitative study I chose to include my journal observations as part of my findings (Creswell, 2003). My observations consisted of a triple journal: my scripted observations of the activities, observations relevant to the study, and my thoughts and feelings about the other two. The results that follow are specific to the four teachers of Calendar School District. Prior to sharing the results of this case study, it is important to understand some background information about the curriculum and technology used by Calendar School District.

The first SMART Board® arrived in Calendar School District in the spring of 2005. There were only a few in the entire district, and they were portable boards on wheels. The principal of October Elementary embraced the new technology and began purchasing more of this technology the following year with funds raised by the Parent Teacher Organization (PTO). The initial goal was to have one SMART Board® per grade level/department. That was accomplished by the 2006-2007 school year. During this time, the other elementary schools in Calendar school district had purchased the SMART Board® for their schools with PTO money, so the district administration decided to step in and make the technology uniform and equitable across all of the schools. This information is important, because these new resources now had an effect on new curriculum.

The Language Arts curriculum was the first new curriculum to be purchased. In 2008, Calendar chose to purchase the Houghton Mifflin Harcourt Series “Storytown” which had an online complement to it, and was the first curriculum in the elementary schools that had an online component. This curriculum was based around anthology stories with spelling, vocabulary, grammar, reading skills, and writing skills interwoven throughout the book. The website thinkcentral.com gave both the teachers and students online access to all of the physical books, workbooks, and other physical resources. The only additional pieces that the online program offered were a quiz for each lesson that focused on some reading skills and some vocabulary practice. The new online program was seen as a positive incentive for our district because the classroom teachers had the ability to project these resources onto the SMART Board® for the students to see and manipulate. In essence, the need for transparencies, and thus the overhead projector, was eliminated because the workbook and textbook images could be directly manipulated on the SMART Board®. This, then, became a trend for the next two curriculum choices in the elementary schools.

The next new curriculum was Teachers Curriculum Institute (TCI) Interactive Social Studies Textbooks and Curriculum. This was purchased in 2011. It included access for teachers and students just like the Harcourt Series. It packaged every physical resource online similar to Harcourt, but it added a presentation component. There was a presentation for every lesson in the textbook that followed the suggested script for how to teach each lesson. The teachers did have the ability to manipulate, and change the slides to individualize it for their classroom. This curriculum also provided some online only components such as a jeopardy-like game at the end of each unit and other games

embedded into the lessons. Calendar School District began hard-mounting the SMART Board® in 2011, so it was important to have a curriculum for each subject area with a strong online component.

Then, in 2012, the elementary schools implemented a new Math curriculum called envision MATH Common Core by Pearson. Pearson packaged everything the same as the other two companies with teacher access, student access, and digital resources in place of physical resources. There was a small quiz at the end of each lesson (that did not always work because the program was new). The students were also able to take their tests on the computer and then their scores would go directly into the teacher's gradebook. This program also included a presentation/video component designed to teach the students the new skill for each math lesson, but the teachers were not able to edit the video.

This information about the new curricula is important because it did affect the observed lessons. Kauchak and Eggen (1998) documented that effective teachers need to adapt each lesson to meet the needs of their students. This task would, presumably, be even more difficult as the teachers grapple with the new technology and additional curricular changes. Fullan (2007 & 2010) pointed out the importance of quality teachers and their role in school change. These four teachers are good examples of how an entire district embraced a new technology and changed the culture of the school district.

| Table 1 2012 -2013 Calendar school district enrollment by elementary school | | | | |
|--|------------------|----------------|-----------------|-----------------|
| <u>Enrollment</u> | <u>September</u> | <u>October</u> | <u>November</u> | <u>December</u> |
| Students | 315 | 323 | 309 | 379 |
| Black | 4% | 1% | 1% | 1% |
| Asian | 9% | 5% | 3% | 6% |
| Hispanic | 1% | 2% | 1% | 1% |
| White | 85% | 92% | 94% | 92% |
| Economically Disadvantaged | 21% | 15% | 12% | 16% |
| English Languge Learner | 4% | 4% | 1% | 5% |
| Special Education | 23% | 24% | 22% | 15% |

("Pennsylvania School Performance Profile: The Philadelphia Inquirer", 2014)

Case Study #1 – September Elementary School – Ms. Second

Background

September Elementary School was the second smallest of the four elementary schools in Calendar in terms of enrollment. It is located in the middle of a housing development behind a local shopping center. Enrollment was 315 students. The school was comprised of 85% White, 9% Asian, 4% Black, and 1% Hispanic students. It was a Title I school with 21% of the population classified as Economically Disadvantaged. The special education enrollment comprised 23% of the school's population and 4% were English Language Learners ("Pennsylvania School Performance Profile The Philadelphia Inquirer", 2014).

Ms. Second has been working at September Elementary for 10 years and this is her ninth year teaching second grade. She is a resident of the school district and had children in attendance at different schools throughout the district when she first began her

teaching position. Teaching is a second career choice for Ms. Second, so her 10 years at Calendar account for all of her teaching experience.

She gave me extensive background information about her training and philosophy regarding the SMART Board® and technology use during a one-on-one interview. She answered my first research question in the beginning of the interview: *What level of technological ability did the teachers have prior to getting the interactive whiteboard and what development have they had to prepare them to use it?* When Ms. Second first began teaching in January, she was immediately asked to participate in the ACTS grant. This was a state funded grant designed to turn teachers into technology leaders within their schools and districts. Prior to this grant she had no training with the SMART Board®. Then, the following fall, she began using a portable SMART Board® in her classroom.

Her technology skills developed out of the opportunities presented to her when she was hired and her composed personality. When I asked her if she considered herself to be more proficient with technology than her colleagues she answered:

Yea. I think it's more like interest. I think because I was new I wanted to learn as much as I could instead of having done other ways. . . So I knew this was the way I should be doing it. . . I think it's personality. I don't really have fear. . . If something goes wrong, I think I've always been this way, it's like oh well it will get fixed. What's the worst thing that could happen? I think people are afraid. Like what do you do if it's in front of the kids?

She entered the profession with an open mind as many new teachers do and she has thrived with the new technology. She did not share her technology background prior to teaching, but like many others who do well with technology, she took the time to teach herself. This happened once she was able to keep the board in her classroom on a more consistent basis.

I started in January. I got a contract. I started using it, (but) I didn't have one in my room. The following September I was put back into second grade again right. I was kind of juggling but, I starting learning more cause I was able to play around with it.

The only formal training she had with the SMART Board® was during this ACTS grant, which lasted for approximately four half-day sessions.

I am more familiar with Ms. Second's technological prowess in comparison to the other teachers I observed, because we were in a cohort for a Master's Degree program in Instructional Technology. We took every class together for two years. During that time, I was able to witness the type of work she produced and implemented in her classroom. One instructional practice that sticks out in my memory was that she designed a PowerPoint® for every Math lesson at that time. She clearly put much time and thought into the presentation and incorporated interactive websites to supplement the students' learning. After receiving her Master's Degree, Ms. Second began running district workshops as well as Intermediate Unit workshops on how to use the SMART Board®.

Teaching and Instructional Practice

My next two research questions were answered through my pre-observation interview and actual observations:

How do teachers use the interactive whiteboard on a daily basis?

In what ways is the interactive whiteboard being used differently than a traditional presentation board?

In the interview I asked Ms. Second how she uses the board to engage her students. She talked about the routine of starting with a daily language review using the SMART Board®. During this time, the students will come up and write on the board. Then she

mentioned trying to incorporate interactive games and SMART Notebook® lessons. She specifically talked about certain activities within the SMART Notebook® software called the Lesson Activity Toolkit, and finished up by discussing the use of interactive websites.

Then we began talking about each subject. We discussed how in Math it is difficult to incorporate many activities because of the curriculum's scripted lessons, but she did mention how she will try to go to find a website on the same content and said, "I believe in games." She did not talk about anything being supplementary for the new Social Studies curriculum but did point out how the presentation was online. For Science, she listed PowerPoint® and other interactive activities that she found or created as additional resources she used to support what is being learned in the science kit.

Before I discuss my observations, I want to point out that I do not believe Ms. Second changed her teaching style or the structure of any of her lessons because I was there. This assertion is based on our discussions about teaching prior to my study. My perception was also confirmed in my post-observation reflection questions where Ms. Second stated that each lesson I observed was a "typical" lesson and that she did not change anything because of my presence. I also want to note that it was evident throughout every observation that she had created an environment where the technology was an integrated part of the classroom learning environment, and the students were very comfortable with using it. This was evidenced by the students' interaction with the board. Each student came up to the board with a certain amount of comfort. None of the students had to ask the teacher what to do or how to use the board, and some students even used the tennis ball or their knuckle, which demonstrated a more advanced

understanding of the IWB's touch capabilities in comparison with students who would only use their finger.

The observed subject area lessons closely mirrored her description in the pre-observation interview. In math, she taught a lesson on reading an analog clock. The lesson started out with one student acting as the teacher and leading the class through a math quiz on the SMART Board®. This quiz was part of the new EnVision math program. She enhanced the lesson at the end by going to an interactive website where students had to match a digital clock with an analog clock. The students were extremely motivated to play this game, eagerly raising their hands to be chosen to touch the board, and the teacher fairly alternated between boys and girls as she chose students to come up to the board to play.

The Social Studies lesson was a typical TCI lesson. The teacher followed the scripted presentation, which elicited much discussion from the students. The students did not have the opportunity to directly interact with the board during this lesson. She used the SMART Board® to annotate and direct the students throughout the lesson. I asked her in the post-conference why she did not have the students come to the board to write answers or complete brainstorming and she informed me that this specific class period had been shortened because of an assembly. Seeing how she incorporated the extra activity in math and knowing that math program is newer than the social studies program reinforces our post-observation discussion about how she tries to get the students to interact with the board as much as possible, but sometimes she is limited by the amount of time in the period.

Calendar's elementary science curriculum is the Science and Technology Concepts (STC) kit curriculum, so I was surprised in the interview when Ms. Second mentioned PowerPoint® lessons and interactive files because most lessons involve some type of hands-on activity. The lesson I observed was a summary lesson on the metamorphosis of butterflies. She was able to have half of the class write on and manipulate the SMART Notebook® lesson that she had created. One boy had difficulty moving one of the boxes on the board and Ms. Second gave him a tennis ball. The tennis ball served as a better touch point than his finger thus demonstrating her knowledge of how to troubleshoot issues with the interactive whiteboard.

The final lesson I observed was a language arts lesson. This lesson had two components: Foundations® and reading. Foundations® is a phonics program used by Calendar in kindergarten, first, and second grade. Ms. Second actually had Foundations® separately built in to her daily schedule, but I placed it under the major subject area of language arts because phonics is a subcategory of English and grammar instruction.

The Foundations® lesson began with the daily language review as Ms. Second had stated in her interview. She then wrote in a calligraphy font on the board with her finger showing her advanced understanding of how the board works. She had some students come up to write the answers, and one girl was able to use her finger, but the boy needed to use the stylus. She then opened a SMART Notebook® file that contained all of the phonic blends and had students come up and show how to mark up the phonetic spellings of different words to show blends, vowel sounds, etc. She utilized the dual page function of the software. The one page included all of the phonic blends and the other page was blank. Using the dual page allowed her to drag the blends from the one page onto the

blank page. I asked her in the post-conference why she did not allow the students to drag the blends, and she once again noted, “it would have really slowed the lesson down”. This missed opportunity for interaction did not change the students desire to come up to the board at all as evidenced by the 92.5% response in the student questionnaire that they found the lesson to be interesting. Every hand was still raised at the opportunity to use the SMART Board®.

She incorporated the extra element of video in her reading lesson. When discussing using the SMART Board® as an interactive tool or a presentation tool Ms. Second emphasized that she used it predominately as an interactive tool, but she did like to use “video clips to introduce things” and “to be funny”. The observed lesson began with a SMART Notebook® file that she had created. The first few slides reviewed the skills that coincided with the Harcourt lesson for that week. Then she linked to a YouTube video to help the students understand making inferences. She showed three clips that prompted much discussion, but the students did not have an opportunity to physically interact with the board. This made me begin to question the importance of interacting with the board physically because the students were visibly engaged through their eagerness to participate and ask questions about the lessons. I brought this up in the post-conference:

Me: With everyone I’m seeing and I think myself too, it’s like you can’t have the kids come up for everything

Ms. Second: Today we do a few; tomorrow we’ll do a few (referring to students coming up to the board). The videos I used were kind of funny so that’s always a risk when you’re trying to get something across to the kids because they get carried away, but I think they got the point. They understand what inferring means and actually they talked about that video for a few days after.

Ms. Second demonstrated a strong understanding of how to keep students engaged in each lesson. She knew that her students could only handle so much time on one task, and she was sure to switch up the lesson topic and give them a chance to move around. Many of the observed SMART Board® activities involved the students sitting on the rug in front of the SMART Board® instead of at their seats. This allowed for them to move to a new environment and made the board more easily accessible to everyone. She also made sure that each student was engaged in the lesson through corresponding worksheets, gel boards, and the clock manipulatives used in the Math lesson. She was able to keep every student engaged in the lesson. Almost every student in the class raised their hand to come up to the SMART Board® each time they were given the opportunity. They were enticed by this opportunity and seemed motivated to learn because of it. Using the evidence from my interview, observations, and post-conference, I believe it would be reasonable to state that Ms. Second demonstrated more than proficient skill with regards to using and integrating the SMART Board® technology into her daily instruction as defined in Chapter 1. She would be categorized as an “innovator” according to Rogers (2003) levels of adoption, and displayed instances of reaching Whitehead, Jensen, and Boschee’s (2003) “transformation” level of adoption.

Students’ role

The students definitely played an active role in the instruction of Ms. Second’s classroom. The physical environment displayed much of their created work and pictures. The aura of the classroom exuded comfort, equality, and evident technological exposure. Although the main focus of this study was on how the teachers used the SMART Board®

to engage their students, the students' perceptions of the lessons and the SMART Board® were also useful. They completed a questionnaire after I had finished all of my observations of Ms. Second to help me answer this research question: *How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?*

| Table 2 | | |
|--|---------------|----------------|
| Second grade students answering "yes" to post-observation questions | | |
| <u>Question</u> | <u>Number</u> | <u>Percent</u> |
| Did you get to go up to the SMART Board® for any of the lessons that Mr. Manno observed? | 22 | 81.5% |
| Did you find these lessons to be more interesting because your teacher used the SMART Board®? | 25 | 92.6% |
| Do you think you will remember these topics better because your teacher used the SMART Board®? | 23 | 85.2% |
| Do you like all lessons better when the teacher uses the SMART Board®? | 27 | 100% |

Note: 27 students completed the questionnaire. Some students were not in attendance for all observed lessons.

The questionnaire was handed out to the whole class and read aloud by the teacher. She also clarified the questions for students who did not understand what was being asked. This may have skewed the answers to the second and fourth question, but these results are consistent with my observations. The majority of the students did seem to genuinely be excited about the lessons that I observed as noted above. I also analyzed the data by separating the students who did not get to use the SMART Board® during the lessons to see if that would effect the positive outcome, but the responses were still predominantly yes. 80% of the students who did not get to go up to the board still found the lesson to be

interesting and felt like they would learn more because the SMART Board® was used. There were two students who did not like the observed lesson more because the SMART Board® was used, but still felt that they would remember it better.

The age level and small sample size do not make these numerical findings credible for any generalization, but they do reinforce my perception of the teaching of Ms. Second. These perceptions are also consistent with my interview, post-conference, and parent survey. It would be fair to state that Ms. Second's students enjoyed the lessons with the SMART Board® and state that they are learning more because of its use. However, I do not have data that supports the assertion that they are learning more compared to other forms of instruction.

Case Study #2 – October Elementary School – Mr. Third

Background

October Elementary School was the second largest of the four elementary schools in Calendar in terms of enrollment. It is located in a local neighborhood on a street that leads to the district's high school. Enrollment was 323 students. The school was comprised of 92% White, 5% Asian, 1% Black, and 2% Hispanic students. It was a Title I school with 15% of the population classified as Economically Disadvantaged. The special education enrollment comprised 24% of the school's population and 4% were English Language Learners ("Pennsylvania School Performance Profile The Philadelphia Inquirer", 2014).

It is important to note that this is the elementary school where I taught fifth grade during the time of these observations. It was difficult for me to choose which teacher to

observe in my home building. I was looking for someone who was on a similar level as myself with technology integration. One of my fifth grade colleagues actually introduced me to the SMART Board® when I first began teaching, but we have too close of a relationship for me to have produced an unbiased report. That is why I chose Mr. Third. Fifth and third grade teachers do not spend much time working together directly, but Mr. Third and I had interacted much during my nine years at October Elementary. We had participated in study groups together, and were even chosen to co-lead a building level in-service on the SMART Board® in 2011. Even though I knew Mr. Third fairly well, we always had a professional relationship, so I do believe that my findings are unbiased and credible.

Another reason Mr. Third was a good candidate was his teaching experience. He was the most veteran teacher I observed with twenty-five years of teaching service in Calendar. He actually began his career at December Elementary as a Special Education Emotional Support teacher. He taught there for six years before moving to October Elementary where he has taught third grade for the past nineteen years.

We had a frank and fluid interview which was consistent with the philosophies I already knew about Mr. Third. He answered my first research question in the beginning of the interview: *What level of technological ability did the teachers have prior to getting the interactive whiteboard and what development have they had to prepare them to use it?* Mr. Third started out by discussing how it took a couple of months to really feel comfortable with the SMART Board®. It was difficult at first because the SMART Board® was on wheels and shared between multiple grades and then individual grade levels before finally being hard-mounted permanently in each classroom. He said it felt

like he has been using the hard-mounted SMART Board® for five or six years, when we only had it hard-mounted for two years, which implies that he was using it often in his daily teaching since it was first mounted.

He mentioned how much of his training was “trial and error” even though he stated, “I guess we’ve had a couple workshops but it’s been minimal.” The third method of learning was through peer support and in his words “just asking someone who knows better than you.” October has created a culture of professional collaboration where grade level partners and even teachers across grades feel comfortable to discuss and share new websites and activities that could benefit all students. I believe this also correlates to why a veteran teacher was so successful with a new technology. He had a positive attitude and a willingness to learn.

When asked about how he compared to his peers, he said it was contingent upon who was being compared. He felt like he could be an “8, 9, or 10 compared to some and a 1, 2, 3, 4” compared to others making specific reference to the new teachers who have grown up with technology as a part of their life. He shared:

For two-thirds of my career I didn’t know anything about a SMART Board®. When I get into my forties, now all of sudden they’re throwing something new at me. . . So I kind of have tried to work harder to close that gap of my lack of technology as a high school, college (student) and in my early years of teaching.

It was interesting to hear him say this because he used the technology easily in his classroom.

Teaching and Instructional Practice

My next two research questions were answered through my pre-observation interview and actual observations:

How do teachers use the interactive whiteboard on a daily basis?

In what ways is the interactive whiteboard being used differently than a traditional presentation board?

During the interview, Mr. Third repeatedly mentioned the new math curriculum stating, “With the new curriculum being more online, it lends itself (the SMART Board®) to be used even more.” He walked me through the daily usage of the board beginning with lunch count and attendance showing how the board is truly used for every part of the day. He then emphasized using it for the new curriculum, but having “sounds”, “different gimmicks”, “bells and whistles”. With regards to the SMART Notebook® software he said,

I just either borrow someone else’s and make it mine or make my own up to just enhance my lesson and give kids a chance to come up and touch and move and do things with some of the interactive things that the SMART Board® has to offer.

The final point he highlighted was how the SMART Board®, or more specifically the capabilities of the SMART Board®, allowed him to keep his lessons focused and organized. He really liked how you can package the lesson in one place. He said, “I don’t have to go to a lesson plan book. When I open up what I need for Language Arts or Math, that’s going to guide me through the next hour or two hours of the lesson.” This was evident through each lesson I observed.

He also mentioned how the SMART Board® is “sometimes used as a twenty-first century blackboard” and he doesn’t “think that’s a bad thing either”. I did allude to this issue at the end of the interview and I asked him if he uses it more as a presentation tool or an interactive tool. His response was, “Probably 70/30. Sometimes just because of time. If you have 10 kids walk up and it takes them 10 seconds, all of a sudden the time

and energy to get them up and back. So sometimes I'll do the interacting." Even though he does the touching of the board, he will still elicit whole class responses through think-pair-share, choral responses, hand signals, or jotting quick notes. He stressed the importance of having "everybody taking ownership", but also stated that the SMART Board® is a valuable contributor to the students' learning.

Everything Mr. Third mentioned in the interview was apparent during the observed lessons. From the moment I walked into his classroom, there was a culture of focused, organized learning. Mr. Third had emphasized the benefit the SMART Board® added to the structure and guidance of the lesson, and he utilized those features from the onset. He began the Math lesson with a review of some difficult test problems from the day before. Once he had finished reviewing those problems, he closed that file, and the Perimeter and Area file was already open underneath it. This demonstrated how he prepared all of his files ahead of time to make for smooth transitions throughout the lesson. He then clicked on a box that faded away to reveal the essential learning question. I overheard a student say, "That's amazing" in a sarcastic tone of voice, which really surprised me. I will address this more in the data analysis on student perspectives.

This Math lesson reflected all of the major components that Mr. Third had mentioned in the interview: seamless management, strong visuals, videos, student interaction, and everybody working. He actually admitted in the post-conference that he would not have had as many students come up to the board if I were not observing. He said, "They're a smart group and I would tend to expedite things and move quicker because of them, not because of me." He also noted that students who did not get to interact with the board during that specific lesson know they will get to later that day or

that week. Their eagerness to go up to the board did not change even when they weren't called on. A culture was established where these students were extremely comfortable and accustomed to the classroom integration of the SMART Board®. The lesson was very well organized and transitioned from SMART Notebook® software to a BrainPOP video online to the software again to the Pearson designed video back to the software. This classroom management contributed positively to both the teaching and the learning during this lesson.

The Social Studies lesson began the same way. There was a SMART Notebook® file on the levels of government opened as the students gathered their materials. Mr. Third went to touch the board and it did not work. He said to me, "It's not working", with a hint of panic, but he quickly unhooked the cable to troubleshoot. This demonstrated he was able to deal with the problem relatively easily.

Classroom management once again stood at the forefront of my observation. The students were all engaged, participating, and interacting with each other. There was a slide in the TCI presentation that included song lyrics about supply and demand, and Mr. Third allowed the students to stand up and sing and dance along with the song. In the post-conference he shared how the new series does not have much opportunity for interaction, so he tries to "add some SMART Board® stuff" when he can. He did mention the visuals of a buyer and seller in the curriculum's presentation helping the students to process the concept more easily. Once again he stayed consistent with his interview. He used the board as an organizational management tool as well as an interactive tool interspersing videos, visuals, and tactile elements throughout the lesson.

Mr. Third chose to start the Math and Social Studies lessons with a SMART Notebook® file instead of the packaged presentation, which highlighted the skills of Mr. Third. I would place him in the “early adopter” category of Rogers (2003) five stages of adoption for SMART Board® usage, but I feel that he would be near the top of Whitehead, Jensen, and Boschee’s (2003) teacher levels of adoption for curriculum integration. Mr. Third’s integration of SMART Notebook® lessons, conjoined with the new curriculum, puts him at the “appropriation” stage for teacher levels of adoption. He has clearly integrated the technology and new curriculum across all subject matter and is on his way to the “transformation” stage, which is creating new ways to use the technology or curriculum. This is not how the majority of veteran teachers responded throughout Calendar.

The final observed lesson was in Language Arts. This lesson began with two online resources provided by Houghton Mifflin Harcourt. These two resources were originally provided as transparencies, so rather than use an overhead projector, Mr. Third was able to project them through the computer. He used them to review the vocabulary and skills that were taught the previous day. Then he switched to an online assessment preparation resource called Study Island® where he had a page about inferences already opened. Study Island® is online software that specifically tests students on the content standards for Math and Reading. Even though it is typically used to test individual students, Mr. Third demonstrated the versatility of the software by using it to introduce a concept during whole group instruction. There was a video clip that posed some questions on “inference.” Mr. Third had some students come up to the board to answer the questions. His finally activity was a SMART Notebook® file created by him. It

started out with word lists that he emphasized by using the screen shade function of the board, and ended with large pictures. Even though the students did not come interact directly with the board for this part of the lesson, the words and pictures prompted much discussion.

Mr. Third demonstrated a well-refined teaching craft. His classroom management was excellent, and was further enhanced by his structured lessons focused around the SMART Board®. He recognized the value of this technology and worked through his lack of technological background to design lessons that would benefit his students. The students were always engaged, paying attention, and respectful. Every lesson included many visual elements, opportunities for interaction with the board, and opportunities for discussion with peers. The data from the interview, observations, and post-conferences validates Mr. Third as a more than proficient user of the SMART Board® based on my definition in Chapter 1. Although he was not an “innovator” with regards to Rogers (2003) five stages of adoption, he certainly integrated the SMART board® into his every day teaching placing him at the “appropriation” level of adoption according to Whitehead, Jensen, and Boschee (2003).

Students' role

Even though only fifty percent of the students actually interacted with the SMART Board® during my observed lessons, I observed all of the students actively participating and discussing the lessons. The students were focused and attentive to all media that was being used on the board. Mr. Third was very structured with his organization and instructional delivery, but the classroom environment was a place where

students could be themselves. Mr. Third gave the students opportunities to be silly, but none of the students ever became disruptive. The students all knew their role as learners and the expectations of Mr. Third. The student questionnaire was given to them once I had completed all of my classroom observations. My goal was to help me answer this research question: *How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?*

| Table 3 | | |
|---|---------------|----------------|
| Third grade students answering “yes” to the post-observation questions | | |
| <u>Question</u> | <u>Number</u> | <u>Percent</u> |
| Did you get to go up to the SMART Board® for any of the lessons that Mr. Manno observed? | 15 | 50% |
| Did you find these lessons to be more interesting because your teacher used the SMART Board®? | 28 | 93.3% |
| Do you think you will remember these topics better because your teacher used the SMART Board®? | 25 | 83.3% |
| Do you like all lessons better when the teacher uses the SMART Board®? | 22 | 73.3% |
| Note: 30 students completed the questionnaire. Some students were not in attendance for all observed lessons. | | |

The questionnaire was handed out to the whole class and read aloud by the teacher. He also clarified the questions for students who did not understand what was being asked. I think he may have overemphasized that it was okay for them to answer no, because his class had the lowest percentages of the four classrooms I observed. I do wonder if the students were beginning to feel indifferent to the SMART Board®. Mr. Third did talk about how the novelty is wearing off in the interview: “But even though that wow factor

of newness or novelty is gone, I still find that they're always very interested.”

Additionally, there was that one student who made the sarcastic remark when the teacher used the touch and reveal feature in SMART Notebook®. There could be many different reasons for the students' lower response to that final question. 87% of the students who did not get to physically interact with the SMART Board® said they like all lessons better when they use it. This mediates the possibility that these students did not enjoy the lesson or all lessons because they did not get to touch the board.

Just like September Elementary, the age level and small sample size do not make these percents credible for generalized use. These perceptions are consistent with my interview, post-conferences, and parent survey. It would be appropriate to say that Mr. Third's students are enjoying the lessons with the SMART Board® and feel that they are learning more because of its use.

Case Study #3 – November Elementary School – Ms. Fourth

Background

November Elementary School was the smallest of the four elementary schools in Calendar in terms of enrollment. This school is located in a more affluent township than the other three elementary schools. Many of the residents who live in this township choose to send their children to private schools resulting in this school having the lowest enrollment for the district. Enrollment was 309 students. The school was comprised of 94% White, 3% Asian, 1% Black, and 1% Hispanic students. It was a Title I school with 12% of the population classified as Economically Disadvantaged. The special education

enrollment comprised 22% of the school's population and 1% were English Language Learners ("Pennsylvania School Performance Profile The Philadelphia Inquirer", 2014).

It was difficult to schedule the interview with Ms. Fourth because she was very busy. She also became nervous when I first mentioned that my goal was to see the SMART Board® employed beyond basic functionality. She was not uncomfortable with me, but she did seem uncomfortable with the idea of being observed. She also eluded that she was having some personal issues at home. Her answers in the interview and the post-conferences were the shortest of all the teachers. Another reason for the brevity in the post-conferences was due to her written responses. I gave all of the teachers the option of completing the post-conference over the phone, in person, or they could write their answers. She was the only one who chose to write her answers.

This was Ms. Fourth's seventeenth year in Calendar School District, but she had only been teaching for the past six years in fourth grade. She stayed home for a few years when her daughter was born, and had just come back to November Elementary six years ago. Even though she is a veteran teacher, she has a fresh perspective on education from some training she had completed while she was on leave.

She shared this with me when I asked my first research question: *What level of technological ability did the teachers have prior to getting the interactive whiteboard and what development have they had to prepare them to use it?*

Well, when I took off after I had my daughter, I put my certificate on hold and you had to take one more, I don't know, one or three credit course and I just so happened to take it in SMART Board® technology.

She began using it immediately when she returned to the district because there was one in her classroom. She played with it on her own, and looked at the software at

home. She took a few district courses after her first year back, but now she teaches some of the district courses on technology. When asked if she is more proficient with technology than her peers, she simply replied, “I would say so. People come to me if they have questions.”

Ms. Fourth was given a hard-mounted SMART Board® two years ago. She did not feel like she used it anymore now than she did earlier because she kept the portable SMART Board® in her classroom and used that all the time. She also reported that the other teachers in her school used it “minimally” because they would have to reorient the SMART Board® whenever it would get bumped. That is why she used it more than the other teachers, because for them “. . .it was inconvenient. It was hard to learn”. The past six years of having a SMART Board® in her room have clearly developed Ms. Fourth’s skills.

Teaching and Instructional Practice

My next two research questions were answered through my pre-observation interview and actual observations:

How do teachers use the interactive whiteboard on a daily basis?

In what ways is the interactive whiteboard being used differently than a traditional presentation board?

Ms. Fourth has integrated the board into every part of her daily instruction. She begins the day with attendance and lunch count, and continues to use it in every subject. One trait she considers to be beneficial is the fact that students who do not typically participate in class will raise their hand to go up to the board. She said, “It encourages them to do that because it’s “fun”.”

The Math lesson I observed began with the attendance and lunch count as she had stated in the interview. The actual lesson was delayed because certain students were leaving school to attend an elementary band rehearsal. This resulted in her having a smaller than usual class size. Once the students were ready, she began with a “Mad Minute” which is a timed worksheet testing basic facts. She chose to use a timer in her hand when she could have opened one in the SMART Notebook® software.

She then integrated another technology called the ELMO. This is a document camera that works like a traditional overhead projector, but can project paper or three-dimensional object in color on the SMART Board®. It is accompanied by software that allows the user to manipulate the image on the SMART Board®. She used this to go over the homework and had students come up to the board one at a time to answer the questions from the previous night’s homework. After each student wrote the answer, the rest of the class stood up at their seats if they got it correct. This worked well to keep those students engaged and helped the teacher recognize who understood the homework.

The next activity was a PowerPoint® for the day’s lesson: Multiplication Word Problems With and Without Extra Information. This was a presentation Ms. Fourth had designed by simply taking the scanned image of a worksheet and cutting and pasting one problem onto each slide. She shared in the interview that she liked the screen shade function in the SMART Notebook® so she could chunk information, and in the post-conference she shared that she purposefully split the worksheet to chunk the information for this lesson. The lesson centered on highlighting information in the text to see what was needed and what was extra. The students were very excited to come up to the board, and the teacher demonstrated her knowledge of how to use the board by recommending

they use their knuckle to do the highlighting. She stated that using the SMART Board® helped “direct their attention to a specific question” and kept them “focused on the specific problems”.

The Language Arts lesson began with a PowerPoint® presentation on grammar. This was a PowerPoint® that she had created based on the grammar from the Houghton Mifflin Harcourt curriculum. In the post conference she shared that this was a typical review she had created for every grammar lesson. She shared, “The children enjoy it and even ask if we can do it again.” She used an additional technology in this lesson called a classroom response system. This is a polling system where each student had a remote control that allowed him or her to type in his response to each question. All of the responses are then projected in a pie chart on the board, and the correct answer is revealed. The answers are reported anonymously on the computer, so the teacher had the students write their answers on individual whiteboards to allow her to check for individual understanding of the content.

The students were very engaged in this lesson. Ms. Fourth gave me a clicker so I could be directly involved in the lesson, and I thought it was fun and entertaining. I found it to be notable that they would all cheer with excitement when one hundred percent of the class got the answer correct, but they did not cheer when only ninety-three percent of the class answered a question correctly. The teacher prepped them for the lesson by prompting them to sing a song about helping verbs. She also read certain questions aloud, and helped guide the students towards the correct answer. One function she wished the CRS provided was an indication of who responded. There were times where she had to wait for one or two students to respond, but she did not know who they

were because the software only shared the number of students who responded, not the specific students.

The final lesson that I observed was a Social Studies review on the Mid-west States. Ms. Fourth had created a SMART Notebook® file with those states and their names covered up. She once again had the students all get whiteboards and made it into a game. She called one student up to the board to choose a state. He or she would then wait until all of the students had answered to click and reveal the answer on the SMART Board®. Then they had to write the capital for bonus points.

In my journal I recorded my feelings on the lesson, and I felt like seventeen minutes was a little long to be focused on one slide, but the students did seem to enjoy this part of the review. She had links embedded into the next slide, which were links to interactive websites on the states and their capitals. She continued the same pattern of having the students write their answers on their whiteboards and having one student come up to reveal the answer. A positive feature of this website was the feedback it gave, because it allowed the user know if the response was correct and kept track of the correct answers. The students liked seeing the number they had correct on the screen. Ms. Fourth noted that the students enjoyed the lesson and asked to do it again. She also felt that it helped the students isolate the specific states and capitals that they still needed to study before the test.

She did not use the curriculum resources for any of her lessons. Based on her reaction during our initial interview, it is possible she purposefully scheduled me to observe these lessons because she believed that the SMART Board® was being used beyond basic function. She did state in the post-conference that these were all typical

lessons, and more specifically the Social Studies and Language Arts were typical review lessons. In the interview she talked about using the Lesson Activity Toolkit activities in her lessons, but she did not use them for any of my observed lessons.

Even though she specifically had me observe her most interactive lessons, I was able to see that she was skilled with technology. All of the presentations she used were created by her, which shows that she has the ability to not only use the technology, but also create lessons to be used with it. She utilized multiple different technologies throughout my observed lessons and used each of them without any problems. The students were noticeably accustomed to these technologies and the SMART Board® as well. She would be considered an “early adopter” according to Rogers (2003) levels of adoption, but similar to Mr. Third, she demonstrated a comfort with the technology and integrated it across multiple curricula. She would be classified at the “appropriation” level for Whitehead, Jensen, and Boschee’s (2003) Teacher Levels of Adoption for curriculum integration. Based on my observations, interview, and post-conferences it would be accurate to say that Ms. Fourth used the SMART Board® beyond its basic functions.

Students’ role

During my observations, the students were engaged and excited to use the different technologies in Ms. Fourth’s class. The majority of the students’ raised their hands to participate throughout all of the lessons. She had very clear routines and procedures. In one of my observations, I noted that she still sounded serious, even when she was making a joke. The students responded well to her and it was evident that she

had a good rapport with them. The student questionnaire was given to them once I had completed all of my observations. The questionnaire was designed to help me answer this research question: *How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?*

| Table 4 | | |
|--|---------------|----------------|
| Fourth grade students answering “yes” to the post-observation questions | | |
| <u>Question</u> | <u>Number</u> | <u>Percent</u> |
| Did you get to go up to the SMART Board® for any of the lessons that Mr. Manno observed? | 23 | 92% |
| Did you find these lessons to be more interesting because your teacher used the SMART Board®? | 23 | 92% |
| Do you think you will remember these topics better because your teacher used the SMART Board®? | 18 | 72% |
| Do you like all lessons better when the teacher uses the SMART Board®? | 20 | 80% |

Note: 25 students completed the questionnaire. Some students were not in attendance for all observed lessons.

The questionnaire was handed out to the whole class when I was not there. I do not know if Ms. Fourth read it out loud or if she just had the students complete it independently.

The 92% response for liking the observed lessons is consistent with my observations, and Ms. Fourth's post-observation answers. Only two students from the Math lesson did not get to go up to the board. Everyone had at least one opportunity to go up to the board in Social Studies and nine students had multiple opportunities. I was surprised that seven students did not feel like they would learn more because the SMART Board® was used

considering the Language Arts and Social Studies lessons were both review lessons for a test.

Similar to the other elementary schools, the age level and small sample size do not make these percentages credible for generalized use. These perceptions are consistent with my interview, post-conferences, and parent survey. It would be fair to assert that Ms. Fourth's students do enjoy using the SMART Board® and think they are learning more because of it.

Case Study #4 – December Elementary School – Ms. Fifth

Background

December Elementary School was the largest of the four elementary schools in Calendar in terms of enrollment. It is located on a local state highway near the township library and the police station. Enrollment was 379 students. The school was comprised of 92% White, 6% Asian, 1% Black, and 1% Hispanic students. It was a Title I school with 16% of the population classified as Economically Disadvantaged. The special education enrollment comprised 15% of the school's population and 5% were English Language Learners ("Pennsylvania School Performance Profile The Philadelphia Inquirer", 2014).

Ms. Fifth was a fairly new teacher in the school district. She had taught fourth grade for one year at December Elementary, and this was now her third year teaching fifth grade in the same building. We had the opportunity to interact at different in-services because we both taught fifth grade. She had also attended one of the SMART Board® workshops that I conducted during an in-service for Calendar School District.

She was very open to my study, and we had lengthy conversations for the interview and post-conferences. We started the interview with my first research question: *What level of technological ability did the teachers have prior to getting the interactive whiteboard and what development have they had to prepare them to use it?* In the beginning of the interview, she stated, “Our tech aide at the time was really helpful with it because when not everyone had it, there wasn’t really any formal training for it when there were just a few floating around.” It wasn’t until later in the interview that she remembered that she had attended one of my workshops. Part of her informal training came from the technology assistant for December Elementary. The assistant had taken the time to come in and show Ms. Fifth and some of the other new teachers in the building how to use certain features. She then said that the assistant would ask them to teach building level workshops, “so she provided us with a lot of materials to familiarize ourselves with some of the different aspects of it.” The technology assistant taught her the main functions, but she learned a lot from “trial and error” and she “kind of played around with it”.

Ms. Fifth did not instantly feel comfortable with the SMART Board®. She did not use the board much her first year because it was on wheels. She felt like she never knew if it would work properly and she wanted to be well prepared for her lesson. After the technology assistant sat down with her that first time, she became much more comfortable. She found that she was “kind of lost” when she wasn’t using it every day. Now that it is hard-mounted she uses it every day for every lesson because she “could rely on it to work all the time”.

Teaching and Instructional Practice

My next two research questions were answered through my pre-observation interview and actual observations:

How do teachers use the interactive whiteboard on a daily basis?

In what ways is the interactive whiteboard being used differently than a traditional presentation board?

In the interview, Ms. Fifth emphasized using the SMART Board® for a range of functions from simply writing notes to student interaction with the board. She discussed using math manipulatives such as rulers, protractors, and dice. She mentioned using the Social Studies curriculum. She also talked about using a random group generator, so she could fairly choose partners. Another feature that she really liked was the ability to pull up something from the Internet to share with the students:

We were talking about pinnacle yesterday. It was a vocab word. So I pulled up a picture of the Empire State Building and a few other famous buildings. We were like, "This is the pinnacle." It's just like certain things that being able to have Internet access and show the kids everything has been so helpful because whether it's pictures or video or what's this word.

The Math lesson I observed was a continuation of the previous day's lesson on ratios. The lesson began with the Daily Common Core which is part of the new math program. The teacher went to project the worksheet on the board, but began going over the answers because it was taking too long to load. This was a situation that reinforced her reluctance to use the board when she first began teaching, but she was able to troubleshoot with ease. She then projected the homework on the board to go over a few problems. After that, she opened a SMART Notebook® file that she had created on ratios. She had interactive dice on the board, and allowed students to go up to create

ratios. On the next slide, there were two columns: simplest form and not simplest form. The students were able to come up and slide the answer into the correct column. Only two students did not have the opportunity to touch the board at this point, so Ms. Fifth went on to another slide. She gave those two girls the opportunity to come up to the board to match the ratios, and then she just called on students and moved the numbers herself. In the post-conference, we discussed her leading the manipulation of the board. She said, “If I could let them play on that all day I would but with math we’re like moving, moving, moving.” She did state that the students were picking up the lesson quickly, so I think she would not have had so many students go up to the board if I was not observing.

Ms. Fifth changed her schedule to accommodate my observations. She typically would teach Writing after Math, but she taught her Social Studies lesson. Other than that, it was a typical lesson. All of the students had their Social Studies textbooks, and she opened a page on the board. She used a visual on one of the pages to prompt a discussion about the Revolutionary War. Then she opened a SMART Notebook® file that she had created with the Lesson Activity Toolkit to review the major events. She used the random group generator to pick partners and then had the students write the answers to the matching activity in their notebooks. In the post-conference we discussed how this specific matching activity was limiting because of the number of characters it showed. The event names were so long that the students had to come up to the board and touch the name of the event so it would marquee the rest of the name. Ms. Fifth liked how the students felt comfortable enough to just go up to the board and do this without asking. It showed that she had created an environment of trust.

She then gave the students a chance to come up to the board and move the answers. There was a special education student who came up to answer the last question. Ms. Fifth had mentioned in the interview how she thinks the board encourages students to participate and was emphatic when talking about this particular student in the post-conference:

He never, ever, ever participates in anything. The fact that he raised his hand twice and I called him up once was such a huge deal. I don't know if you heard some kids say "good job" because that was so different for him. The fact he even wanted to get up and do it. I was just blown away. I think it also appeals to all your audiences because he wouldn't (pause) because if the SMART Board® was off and I just asked the classic question he would never raise his hand.

Ms. Fifth finished the lesson with a compare/contrast diagram that she had created displayed on the SMART Board®. She then chose new groups with the random generator and had the students work in their notebooks. After they had enough time to complete the diagram, they shared their answers orally with the class.

She opened an interactive timer on the SMART Board® to countdown the students' transition to put their books away. This was something she did on a daily basis. Three students came up to present a Revolutionary War project. Two students had created a PhotoPeach presentation. This website allowed the students to create a simple slideshow that incorporated text, graphics, and music. The students all seemed to enjoy the presentations and were even moving along with the music.

The Language Arts lesson did not present itself with many opportunities for student interaction with the SMART Board®. Ms. Fifth did share in the interview that she believes she uses the board as a presentation tool about 50% of the time. She followed the format set forth by Houghton Mifflin Harcourt by administering a spelling pre-test. After she had the students grade one another's pretests, she transitioned into a

PowerPoint® on the vocabulary for that lesson. One teacher in Calendar had found a website that shared resources for every lesson in our Language Arts curriculum. That was where she found this PowerPoint®. The routine was evident. The students raised their hands to answer questions posed by the PowerPoint®. The culminating activity was a character trait chart that Ms. Fifth had created. She used the Random Partner Generator and had the students work together to write down traits for three characters from the novel they were reading. She then gave the students the opportunity to come up and write the traits on the board. She said she felt guilty that she could not have all of the students come up, but noted in the post-conference that the students began to raise their hands more once they knew this was an option. When she informed the students that she was trying to pick unique traits, the students tried even harder to come up with a unique word.

The Science lesson I observed was a group of different students. These students had another teacher for Math, Language Arts, and Social Studies. I could tell that the classroom environment was clearly different from Ms. Fifth's homeroom.

Ms. Fifth opened the lesson with a video, which is something she had mentioned in the interview. In the post-conference we both discussed how some students were not very attentive, but they did become more interested when they had the opportunity to come up to the board to answer questions at the end of the video. She then opened a SMART Notebook® file that she had downloaded from the SMART Exchange® and adapted for her lesson. The students were copying vocabulary definitions, but they were able to come up to reveal the definitions. She ended the lesson with a SMART Notebook® activity on biomes that she had also downloaded from SMART Exchange®.

She provided the students with a copy of this presentation because she “felt they would need a visual because it was a lot of information”. Participation increased at the end of the lesson to both go up to the board and just answer the question.

Ms. Fifth demonstrated a wide range of technological ability throughout these lessons. She adeptly created her own files, modified files, used the curricula resources, and supplemented with online resources. She was easily able to troubleshoot issues such as slow loading and lost files. She emphasized student participation as one of the most beneficial aspects of the SMART Board®, and she was able to use the board to get her students actively engaged in her lessons. She demonstrated a high level of proficiency with the SMART Board® considering this was only her fourth year teaching. Through my observations, interview, and post conference data, she was noticeably able to use the SMART Board® beyond its basic functions. Ms. Fifth adopted the technology in the beginning of her career making her an “innovator” by Rogers (2003) criteria, and displayed full integration of the technology into every subject area placing her at Whitehead, Jensen, and Boschee’s (2003) “appropriation” level of adoption.

Students’ role

Ms. Fifth has established an environment of respect in her classroom. The students were active participants and were familiar with the routines. It was evident that they knew how to use the SMART Board® and were comfortable with it. Ms. Fifth had even mentioned in the interview that she felt they were able to learn features of the board on their own because of their age. The student questionnaire was given to them once I had completed all of my observations. My goal was to help me answer this research

question: *How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?*

| Table 5 | | |
|--|---------------|----------------|
| Fifth grade students answering "yes" to the post-observation questions | | |
| <u>Question</u> | <u>Number</u> | <u>Percent</u> |
| Did you get to go up to the SMART Board® for any of the lessons that Mr. Manno observed? | 31 | 53.4% |
| Did you find these lessons to be more interesting because your teacher used the SMART Board®? | 52 | 89.7% |
| Do you think you will remember these topics better because your teacher used the SMART Board®? | 48 | 82.8% |
| Do you like all lessons better when the teacher uses the SMART Board®? | 55 | 94.8% |

Note: 58 students completed the questionnaire. Some students were not in attendance for all observed lessons.

The questionnaire was handed out to the students when I was not there. I do not know if Ms. Fifth read it out loud or if she just had the students complete it independently. The 89.7% response rate for liking the observed lessons was skewed by the Science class. Only 82.6% of the Science class liked the observed lesson while 94.3% of the other classes liked the lessons. Those numbers relate better to my and Ms. Fifth's observations. The 94.8% response to the last question reiterates the point that the students do enjoy the SMART Board®.

Similar to the other elementary schools, the age level and small sample size do not make these percents credible for generalized use. These perceptions are consistent with my interview, post-conferences, and parent survey. It would be fair to assert that

Ms. Fifth's students do enjoy using the SMART Board® and think they are learning more because of it.

Teacher, Student, and Parent Perspectives

My fourth research question deals with the perceptions of all parties involved in the study. I administered a questionnaire to the parents prior to the study, a questionnaire to the students after my observations, and post-conferenced with the teachers after every lesson. The question being asked is: *How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?*

| Table 6 | | |
|--|---------------|----------------|
| All students answering "yes" to the post-observation questions | | |
| <u>Question</u> | <u>Number</u> | <u>Percent</u> |
| Did you get to go up to the SMART Board® for any of the lessons that Mr. Manno observed? | 91 | 65% |
| Did you find these lessons to be more interesting because your teacher used the SMART Board®? | 128 | 91.4% |
| Do you think you will remember these topics better because your teacher used the SMART Board®? | 114 | 81.4% |
| Do you like all lessons better when the teacher uses the SMART Board®? | 124 | 88.6% |
| Note: 140 students completed the questionnaire. Some students were not in attendance for all observed lessons. | | |

The total student data is consistent with the data from each individual case. In each case, the students' perception that they will actually remember the observed lesson had the lowest response of "yes". 81% of the observed students think they will remember the

lessons more because their teacher used the SMART Board®. I included students' enjoyment of the lesson in the questionnaire because that was something teachers would often say. Over 88% of the students liked the observed lesson and stated that they like all lessons when the SMART Board® is used. The majority of the students observed in this study enjoy the SMART Board® and perceive that they will learn more because of its use.

| <u>Question</u> | <u>Number</u> | <u>Percent</u> |
|--|---------------|----------------|
| Do you know what a SMART Board® is? | 82 | 96.5% |
| Did you know your child's teacher is using the SMART Board® in your child's classroom? | 81 | 95.3% |
| How did you find out that your child's teacher uses a SMART Board®? | 82 | 96.5% |
| Back to School Night | 36 | 43.9% |
| Parent Visitation | 34 | 41.5% |
| My child told me | 27 | 32.9% |
| Does your child talk about his/her teacher's SMART Board® use in the classroom? If they do, can you describe some of the activities that your child has mentioned? | 55 | 64.7% |
| Do you think using a SMART Board® is beneficial to your child's education? | 78 | 91.8% |

Note: 85 parents completed the questionnaire.

The parent data shows that the majority of the parents perceive the SMART Board® to be beneficial to their child’s education. In addition, many of the parents who answered “yes” to the last question included a phrase or sentence as their response. Here is a list of a few answers from each of the four elementary schools coded by grade:

Second grade: Absolutely! It seems like a great way to incorporate technology into the classroom. It allows kids to use tactile learning with an interactive piece of equipment.

Second grade: Yes I do! I feel as though it brings reality into the classroom. They also give opportunity to explore and manipulate concepts.

Second grade: Yes. It allows her to learn in another fun and exciting way. All of her teachers had SMART Boards (kindergarten, 1st and 2nd grade). She would probably notice that it was gone and question it.

Third grade: Absolutely! These kids are very technologically savvy so this is a fun way for them to learn

Third grade: Yes, the more ways children are exposed to information the more likely they are to retain it. Visual, auditory, interactive, etc.

Third grade: Definitely, it is one more tool to hold their interest. It is interactive, so I believe they will look at it and understand it more than a chalkboard or piece of paper

Fourth grade: Yes, I think it would be fun for the kids and keep their attention

Fourth grade: Yes. I believe it engages them better than less sophisticated means such as a black board

Fourth grade: I think the SMART Board® has done a great job of incorporating interactive technology into whole class instruction. It is a very effective way, or tool to use, for modeling in the classroom.

Fifth grade: Absolutely. . . without doubt it has added to the fundamentals of teaching

Fifth grade: Yes, I believe the SMART Board® helps to engage the students. It also helps the kids to visualize the information more effectively. Also, current information is more readily available through a SMART Board®.

Fifth grade: Yes. Much more versatile and engaging than a traditional blackboard

I also wanted to note that not a single parent answered “no” to the last question. Four were uncertain, two left that question blank, and one wrote “not really”. The parent response was consistent across all of the elementary schools in Calendar school district.

The teacher post-conferences were set up as a post-lesson reflection. The final question that I asked each teacher after every lesson was: *Do you think the SMART*

Board® helped the students understand the concept of this lesson better than had you not used the SMART Board®? All four teachers answered yes for every observed lesson.

Here are some of their responses:

Ms. Second Math: Absolutely. The students can see and manipulate the board. The activities are fun and engaging which helps them understand what they are learning.

Ms. Second LA: Yes. Yes for each one. Yes for Foundations®. Definitely for the Language Arts.

Ms. Second SS: I think it helps them attend, number one. So if you have their attention you have more likelihood they're going to understand what you're teaching them.

Ms. Second Science: I think the board enhanced the students' learning.

Mr. Third Math: Yea, I would think. The colors, it's vibrant, the graphs. . .It just makes it so clean and neat.

Mr. Third LA: Yes! And many other skills taught during the school year!

Mr. Third SS: I don't know how good that would have been if they couldn't see and really respond to it, seeing the pictures of the buyer and the seller. All those things the SMART Board® makes better.

Ms. Fourth Math: I feel it kept the students focused on the specific problem we were working on

Ms. Fourth LA: The SMART Board® and Turning Points encourage all students to be active participants in the lesson.

Ms. Fourth SS: It helped them visualize the location of the state as well as engaging them more in the review lesson.

Ms. Fifth Math: I think because they were actively engaged in the lesson they were really understanding and paying attention to what was being taught.

Ms. Fifth SS: I do think it helped them understand the concepts better because they were more engaged in the lesson.

Ms. Fifth LA: I think having the visual up there. . .just kind of seeing it up there and then being able to be a part of it, see other people's opinions really helped instead of if we just didn't have anything displayed.

Ms. Fifth Science: I think especially with this group. I think the visuals were key. Like really important to help them stay focused was having everything displayed for them up there and then having the opportunity to come up.

The teachers emphasized the visual and engaging capabilities of the SMART Board® and how it helps to keep the students focused on the lesson at hand. It is evident that these four teachers believe that the SMART Board® is helping the students learn.

The majority of all three groups (teachers, students, and parents) perceived the SMART Board® to have a positive effect on student learning. 100% of the teachers stated that the SMART Board® helped their students understand each lesson, 91.4% of all the students found the observed lessons to be more interesting because the SMART Board® was used, and 91.8% of the parents feel the SMART Board® is beneficial to their child's education. Both the teachers and the parents specifically cited the visual and tactile benefits of using the SMART Board®. The fact that all three groups agree that the SMART Board® is a positive learning instrument reinforces that the SMART Board® has become an integral part of the Calendar elementary schools' learning culture.

Summary

The different groups (teachers, students, and parents) and different data sets helped answer all of the research questions in this study. There were consistencies across all four cases that further validate the findings in this study. Here is a summary of what was found for each research question.

Question 1: *What level of technological ability did the teachers have prior to getting the interactive whiteboard and what development have they had to prepare them to use it?* Ms. Second and Ms. Fourth had the only formal training conducted outside of Calendar school district. Everyone but Ms. Fourth had attended a district level workshop that I instructed. They all made some reference to learning a lot by having the board in their respective rooms and using it. Much of their learning was discovery-based through trial and error. Even though it initially took them different lengths of time to become comfortable with the board, all of the teachers have led training on the SMART Board®

at the building or district level. They all agreed that having the board hard-mounted in the classroom contributed to their overall usage and comfort with the board.

Question 2: How do teachers use the interactive whiteboard on a daily basis?

Every teacher used the board from the start of the day to the end of the day. They all began with attendance and lunch count. They all used the online components of the new Math, Social Studies, and Language Arts curriculum. I observed each one of them use a teacher created or adapted SMART Notebook® lesson. Everyone but Ms. Fourth used an activity from the Lesson Activity Toolkit in an observed lesson, but she did discuss using it in the interview. Ms. Second, Mr. Third, and Ms. Fifth used video clips from the Internet to accentuate their lessons while Ms. Fourth used interactive websites. They all noted that it is not possible to have the students interact with the board for every lesson of every day and that there are times when they use it to present the information. Everybody said they use it as an interactive tool for at least 50% of the time with the rest of the time being used as a presentation tool.

Question 3: In what ways is the interactive whiteboard being used differently than a traditional presentation board? There were many differences and similarities between the teachers. All four teachers used or stated they used the board to display the presentation for the new Math curriculum, but Ms. Fourth and Ms. Fifth did not for my observation. Ms. Second, Mr. Third, and Ms. Fifth all supplemented the lesson with an interactive website or a SMART Notebook® file for interaction. They all used SMART Exchange® to download lessons that were already created. Students were able to write answers on the board, move objects, click objects, and interact with the interactive

website. Ms. Fourth had the students write their answers on the board and highlight information in a PowerPoint® she created with their fingers or knuckles.

In Language Arts, the teachers used the board very differently. Ms. Fourth had me observe a lesson where she used a classroom response system. Even though the students were not physically touching the board, they were interacting with it. Ms. Second had a teacher created phonics lesson in the SMART Notebook® where the students were able to slide, manipulate, and write on the lesson. Mr. Third showed a video from Study Island. He had students come touch the board to answer the quiz at the end. Ms. Fifth had the students write their answers in a graphic organizer on the board.

In Social Studies, every teacher used the Teach TCI website but Ms. Fourth. Ms. Second followed the presentation slide for slide. She wrote some answers on the presentation, but had the students respond with finger signals on their hands so every student would be involved. Mr. Third supplemented with a SMART Notebook® lesson he had created and gave the students the opportunity to click boxes, move boxes, and write on the board. The presentation also included a song where he allowed the students to stand up, sing, and dance. Ms. Fifth also supplemented with a matching lesson she designed in the Lesson Activity Toolkit. Students were able to slide the words to match their corresponding definitions. Ms. Fourth reviewed for a test with a SMART Notebook® created lesson and an interactive website. Each student had the opportunity to slide a box on the board to reveal an answer or match an answer.

Ms. Second and Ms. Fifth were the only two teachers who taught Science. They both used a SMART Notebook® lesson that allowed the students to manipulate some aspect of the board. Ms. Second included an image match from the Lesson Activity

Toolkit, and Ms. Fifth had the students draw lines to connect pictures with their corresponding definitions.

Question 4: *How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?* The data shows that the parents, teachers, and students perceive the SMART Board® to positively affect student learning. 92% of the parents who responded to the parent questionnaire think using a SMART Board® is beneficial to their child's education. All four teachers reflected in the post conference that the SMART Board® helped the students understand the concept of each observed lesson better than had they not used a SMART Board®. 81% of the students responded that they would remember these lessons better because the SMART Board® was used and 89% of the students answered that they like all lessons better when the SMART Board® was used.

The answers to these four questions highlight how these four teachers from Calendar Elementary use the SMART Board® to engage their students in learning. The data shows that they all utilized the SMART Board® beyond its basic functions.

CHAPTER 5 CONCLUSION

Introduction

Interactive whiteboards are an emerging and present technology in schools throughout the world. In 2010 it was reported that the US had interactive whiteboards in 35% of its classrooms (Johnson & Türel, 2012, p.381). The purpose of this qualitative study was to specifically look at how the selected teachers in Calendar school district, a suburban mid-Atlantic school district, integrated this technology into their daily instruction. The impetus for this study stemmed from Calendar's integration of the hard-mounted SMART Board®. I was curious to see how the teachers' usage of the board and instructional delivery would change based on the permanence of the SMART Board®. My goal was to highlight the different methods and media that are used to instruct the students in each elementary school of Calendar school district. I also intended for this study to become a professional resource for effective instructional methods for incorporating an interactive whiteboard in daily instruction.

The research questions in this study were based on the teachers' usage of the SMART Board®, and the students' and parents' perceptions of how it is being used. The research questions were:

1. What level of technological ability did the teachers have prior to getting the interactive whiteboard and what development have they had to prepare them to use it?
2. How do teachers use the interactive whiteboard on a daily basis?

3. In what ways is the interactive whiteboard being used differently than a traditional presentation board?
4. How do the parents, teachers, and students perceive students' learning is affected by the interactive whiteboard?
5. In what ways do parents, teachers, and students think the interactive whiteboard could be used more effectively?

The findings of this study are consistent with the current literature on technology adoption, interactive whiteboards in the classroom, and best practices for student learning. In this chapter, I discuss my interpretation of the findings and what they mean for Calendar school district.

My original thought when developing this study was the term “interactive” meant that students had to physically touch the SMART Board®. Is it possible for students to be interacting with the content of the instruction without actually touching the SMART Board®? This question leads into the difference in usage between elementary school students and middle school students. I began this study as a fifth grade elementary school teacher and finished my analysis while teaching sixth grade at Calendar’s middle school. My personal observation is that student manipulation of the board is almost non-existent in the middle school. Could it be said that the middle school students are still interacting with the board?

One facet of current pedagogy is focusing on using formative data to guide instruction. Teachers are asked to make measurable goals to prove student growth. Does there need to be a quantitative study that correlates student achievement to SMART Board® usage to prove its effectiveness?

The final implication I would like to explore is technology as pedagogy itself. Schools currently employ multiple different technology with their students such as IWBs, laptops, and tablets. Gardner's theory of multiple intelligences and other learning style inventories indicate that students learn material in different ways (Beck, 2001; Collinson, 2000; Maxim, 1999; Parsons, Hinson, & Sardo-Brown, 2001; Tomlinson, 1999). Is technology an additional style of learning? If scholars would agree that technology is a different modality, would that change how technology is used in the classroom?

The literature and data of this study have led to two major conclusions. First, teachers need to strive to reach a transformational stage when implementing new programs and new technology in their respective classrooms. The teachers in this study all adopted and adapted the technology to better meet the needs of their students. Lastly, students must be active participants in their learning. The teachers in this study used many different methods in addition to the SMART Board® to ensure that all students in their classrooms were learning.

Discussion of Findings

Research Question #5

Research Question #5 questioned, "*In what ways do parents, teachers, and students think the interactive whiteboard could be used more effectively?*" This question was not included in the parent questionnaire, student questionnaire, or post-conference questions and it was worded differently in the teacher interview. The question asked in the interview was "What do you think are the most effective ways to use the SMART

Board® in the classroom?” I originally had a similar question in my post-conference questions, but it seemed redundant and the teachers would most likely give me the same answers. That question was “What do you think are the most effective ways to use the SMART Board® with the students?” Since this question is different than the originally proposed research question, I chose to discuss these findings here in Chapter 5.

All of the teachers stated that the SMART Board® was effective at gaining the students focus and attention. They felt that their students were motivated by the opportunity to come up and interact with the board. Ms. Second summed up her feelings at the end of her answer: “Anything where they can see it, touch it, listen. They like it.” She also mentioned how it reaches three different learning styles: auditory, visual, and kinesthetic.

Mr. Third mentioned the students interacting with the board but largely focused on the effectiveness for instructional delivery. He discussed creating, adding, and changing existing SMART Notebook® lessons from previous years to adapt to his current curriculum. He likes that you can easily transition from the Internet to a worksheet to SMART Notebook® in a matter of seconds. He claimed that it “definitely helps me to stay organized and focused on where I want to be and then it does add some bells and whistles”.

Ms. Fourth stated, “The most effective way is to get those kids maybe that wouldn’t normally volunteer to get them up there to write their answer up there or to move something.” She did not elaborate much on this question, but based on my observations I could tell that she did use the board to garner student interest and participation. She demonstrated multiple methods for effectively engaging the students

such as the ELMO document camera, PowerPoint®, SMART Notebook®, and classroom response system.

Ms. Fifth also felt that student motivation was the most effective way to use the SMART Board®. She stated,

If we're going over homework or something it's hard to engage them all. The second you offer up the marker or say "show me how you did it up here", the class is fully participating because they want an opportunity to go up to the SMART Board® and show the class what they're doing.

In each of my observations, Ms. Fifth planned an activity that would allow students to go up to the board. The students were clearly motivated by the possibility of coming up to the board and showed great comfort and skill when they did.

In reflecting upon this study, I realized that I asked the teachers the correct question in the interview, but proposed the wrong question in my research question. My original goal of this study was to look at how teachers used the board to interactively engage students. Then that goal evolved into observing teachers use the board in multiple different ways to engage their students. These different methods are the effective ways of using the SMART Board®.

The teachers did not understand what I was asking in the interview even though they each shared some evident benefits of the SMART Board®. I was looking for the most effective methods for implementing the board, and I was able to observe that. Each of the teachers tactfully used the SMART Board® to present created lessons, videos, websites, and presentations. They effectively incorporated these different media in a manner that actively engaged the students through direct participation with the SMART Board® and prompted discussions with their classmates. There is not one most effective way to use the SMART Board®. There are many different features that can effectively

enhance instruction that must be implemented through careful planning as the teachers in Calendar did.

Limited professional development

Murcia and McKenzie (2009) emphasized that professional development needs to be long term rather than short term. The teachers in Calendar school district have been using the SMART Board® since it was first introduced in the district, but they each claimed to have received limited professional development. Similar to 78% of the participants in Niederhauser and Wessling's (2011) study, the teachers in Calendar reported that the majority of their training was independent. For example, Ms. Fourth made the decision to seek training while she was on maternity leave so she would be equipped with the most current pedagogy with technology when she returned. These teachers were initially provided with professional development when the technology was first introduced to them, but then they were left to develop their skills on their own.

Bybee (2001) stated that having a lead teacher or mentoring program would be an effective strategy for professional development. Even though this was never clearly defined by administration, the observed teachers did take it upon themselves to lead workshops when they were asked. Rather than being purposefully trained to become lead teachers, they each evolved into this role because of their "Innovator" or "Early Majority" personality types (Rogers, 2003). Schifter (2008) noted that time to practice new skills is an important component for infusing technology, and even though Calendar did not provide the teachers with this time, they took it upon themselves to explore the different capabilities of the software and hardware from SMART Technologies®. They

each were able to effectively refine and adapt materials, create their own, and reflect on their own teaching (Bybee, 2001). The most important trait that these teachers exhibited was using the SMART Board® as a tool to enhance student learning (Bybee, 2001; Ham, 2010; Pianfetti, 2001).

Teachers' level of adoption

The purpose of this study was to see how teachers skillfully integrated the SMART Board® into the classroom. This technology had been in the district for approximately eight years, but only recently became a permanent fixture in each classroom making it fairly new. The teachers in Calendar school district not only had to learn a new innovation in regards to this technology, but they were also given three new curricula over the course of four years. This is a testament to their skill and personal character. Knowing that student learning should be the most important focus in all facets of instruction, these teachers exhibited Hall and Hord's (1987) highest levels of use and concern with an innovation: refocusing and renewal.

It is evident that each teacher had carefully taken the time to determine how to use the SMART Board® better and they continued to reflect on better practice in my post-conferences. Each teacher noted the benefits of having the students directly interact with the SMART Board®. At some point during my observations, each teacher had used a file that was downloaded from the SMART Exchange®. These files were lessons that were already designed by other teachers. The teachers of Calendar each took the time to reflect and refine the file to meet the needs of their students. This occurred through embedding links to videos that supplemented the lesson, deleting slides that were not

relevant, adding interactive elements such as hidden text, and creating their own interactive slide with the lesson activity toolkit.

In addition to the innovation of technology, the teachers also had to deal with the innovation of new curricula. Each teacher made adjustments to the provided online resources of each curriculum to maximize student learning and engagement. Ms. Second used the introductory video and quiz portion provided by the math curriculum, but supplemented with an interactive website to allow for more student engagement with the SMART Board®. Mr. Third used the introductory video provided by the Math curriculum, but supplemented with another online video as well as a SMART Board® lesson to facilitate student involvement. Ms. Fifth only used the online resources to display the worksheets that the students were working, but supplemented with a SMART Notebook® lesson that featured interactive dice. Hall and Hord (1987) state that the highest Level of Use of the Innovation is Level 6 – Renewal. This is where teachers make adjustments that will maximize the benefit for students. Through my observations and post-conference data it is apparent that these teachers planned their lessons with this in mind.

Implications for Calendar and beyond

This qualitative case study focused specifically on four different teachers from four different elementary schools in Calendar school district. These teachers were chosen because of their highly proficient SMART Board® pedagogy. When I approached the principal of each of the four schools, they provided me with a list of names of who they perceived to be their best SMART Board® integrators. This study shows that the

principals were correct in their assessment of these teachers being above proficient users of the SMART Board®. The principals and Calendar's upper administration can continue to utilize these teachers to train the other teachers in their respective buildings and throughout the district.

Further evidence to support Calendar's successful implementation is the data received from the parents. The elementary schools of Calendar are typically comprised of multi-student families. This means that many of the parents who responded to my survey may have had another child in another classroom in that respective elementary school. Almost 97% of the parents knew what a SMART Board® was when I asked them in the survey. Throughout all of the elementary schools, 43.9% of the parents stated they were first introduced to the SMART Board® at "Back to School" night. This was the most common answer given in each of the four elementary schools. It is important to note that this was an open question without any sample responses. The fact that it was consistently given as the top answer means that this number is reflective of all four elementary schools in Calendar school district. This also indicates that approximately 44% of the teachers across all of the elementary schools purposefully introduce the SMART Board® to parents during this visitation. Another statistic that supports Calendar's successful integration is that 91.8% of the parents perceive the board to be beneficial to their child's learning.

Calendar's professional development of the four observed teachers does not align with the best practices proposed in research, but they do seem to have success with integrating this new innovation. Fullan (2007) states that change must eventually become embedded as part of the culture and the school will be successful with quality teachers.

The data from the students, parents, and teachers is enough to suggest that Calendar school district is effectively implementing the SMART Board® in its elementary school classrooms.

Possible areas for future study

Interactive Whiteboard use in the Middle School

Since this was a qualitative case study, I was one of the primary instruments for data (Creswell, 2009). While writing this study I moved from my position as a fifth grade teacher at October Elementary school to a sixth grade teacher in Calendar's middle school. Being engrossed in this study caused me to analyze the usage of the SMART Board® in the middle school. Even though this study focused on the elementary schools in Calendar, I found some implications for future research at the middle school level. My personal observation as I walk through the hallways and speak with my colleagues is that the teachers do not attempt to provide the students with opportunities to directly interact with the SMART Board®. One of the main goals of my study was to observe the different ways that teachers use the board to interactively engage their students. It is quite the cultural shift at the middle school. Here I chronicled the industrious efforts of four elementary teachers, from four different grade levels, who thoughtfully and carefully designed lesson around student learning through interaction with the SMART Board®. Now I am teaching at the middle school and student interaction with the board is almost non-existent by my observations. I believe that this would be a worthwhile study at Calendar, considering the financial investment in this technology. The parents of

Calendar also displayed a belief in this technology, and I wonder if they notice or care about the change from elementary to middle school.

It would also be interesting to study how the SMART Board® is used in other middle schools throughout the country. In all of the research I read that involved interactive whiteboards at the secondary level, none of them focused on this application of the board. Is this consistent throughout other school districts? Do teachers stop using the board as a tool for physical interaction at the middle school level? If this is true, is there a reason for it?

Define “Interactive”

This leads to the question about interactivity. According to dictionary.com (2014) the definition of an interactive whiteboard is a large touch-sensitive board connected to a computer and a digital projector, used for teaching in the classroom. One definition for “interactive” is a computer program or system interacting with a human user, often in a conversational way, to obtain data or commands and to give immediate results or updated information (dictionary.com, 2014). This definition would apply to the use of an interactive whiteboard in the classroom. The question is whether the student must directly touch the board to be interacting with it, or can they inform the teacher of the answer and have the teacher manipulate the board. The same “conversational” effect should result with the student providing some type of input and receiving an output from the computer. The only difference would be the absence of the tactile learning for the student.

Glover, Miller, Averis, and Door (2007) defined three characteristics of SMART Board® use in their study of secondary schools: supported didactic, interactive, and

enhanced interactivity. Supported didactic was likened to teachers using the board for presentation content. Their definition of interactive was when the teacher would use different software on the board to grab student interest and attention through visual, auditory, and kinesthetic methods. Lastly, they defined enhanced interactivity as a method that catalyzes discussion with partners or groups and prompts the students to relate the application of the content with the real world. Even though their definitions of interactive and enhanced interactivity contained the kinesthetic element of the board, they never stressed that as the only means for interaction.

In summary, I agree with Glover, Miller, Averis, and Door. The board was clearly designed for a person to kinesthetically interact with the board. This is only one form of interaction. The teachers in Calendar all reflected on the amount of time it takes to have students leave their seats, touch the board, and go back to their seats. They made sure that the students had opportunities to touch the board, but also made sure all of the students were prompted to learn by the content on the board. Enhanced interactivity involves a balance between the students' tactile use of the board and the discussion the board can illicit amongst the students. In both situations they are "interacting" with the lesson. This idea of defining interaction with an interactive whiteboard through physical touch is an area that would need to be researched more directly to come up with a definitive answer.

Do Interactive whiteboards have to raise student scores to be considered effective?

This study in Calendar school district focused on the teachers' usage of the board to interactively engage their students. If the students are engaged in the lesson, does that

mean the lesson was effective? Do students have to score well on an assessment to prove the effectiveness of the SMART Board®?

According to Marzano and Haystead's (2009) study, the teachers I observed at Calendar could all have noticeable gains in student achievement. Marzano and Haystead's research was the only research I could find on the connection between the interactive whiteboard and student achievement. Nine out of the twelve grades in their study showed positive gains in each grade level using a pre-test, post-test design. They concluded that teachers with six to fifteen years of experience showed the most gains. That would include all of the teachers in Calendar except Mr. Third. Also, they found that students made greater gains after their teachers had been using the board for a while. All four teachers in Calendar have been using the SMART Board® for at least eight years. Teachers who used the board for 75-80% of their instruction had the most gains. The teachers in Calendar used the board every day for every subject. The final indicator of student growth was confidence. All four teachers were humble, but confident in their ability to use the SMART Board® to instruct their students. Based on Marzano and Haystead's study, I could surmise that the students of these four teachers are likely to score better on their assessments than the students of teachers who do not use the board in the same ways, but we do not know for sure. The students reinforced this idea with 81.4% of them believing they would remember the topics better because their teacher used the SMART Board®.

It is only speculative to say that the students in Calendar will have higher scores because their teachers used the SMART Board®, but I would argue that the lessons I observed were effective based on the students' and teachers' perceptions of the lessons.

All of the teachers stated that the students enjoyed the lesson better because the board was used. 88.6% of the students that I observed indicated they liked every lesson better when the SMART Board® was used. The students were attentive, engaged, and eager to participate in the lessons that I observed. These positive perceptions and my observations of positive classroom behavior show that the SMART Board® had a positive effect on the students' learning. Some say their effects on motivation are not that extensive (Smith, Hardman, & Higgins, 2006). But there is much evidence to support the fact that students are motivated and engaged when the SMART Board® is used (Beauchamp & Prakinson, 2005; Brown, 2004; Dolan, 2010; Erduran & Tataroğlu, 2010; Hennessy, Deaney, Ruthven, & Winterbottom, 2007; Johnson & Türel, 2012; Jones, 2004; Manzo, 2010; Marzano & Haystead, 2009; Şad, 2012; Saltan & Arslan, 2009; Schachter, 2011; Smith, Higgins, Wall, & Miller, 2005; Türel, 2011; Wood & Ashfield, 2008). Can that be labeled effective?

A 10th multiple intelligence

There is much research to support the fact that students learn in different ways. Howard Gardner is a well-renowned theorist who describes nine different modalities of learning: logical-mathematical, verbal-linguistic, musical-rhythmic, visual-spatial, bodily-kinesthetic, interpersonal, intrapersonal, and naturalist (Berks, 2002). This study of the SMART Board® and how teachers use it to engage their students has demonstrated that technology is a tool for instruction, but could it also be considered a modality for learning?

The general data from the students in Calendar supports that learning with the SMART Board® is a preferred modality. As when mentioned earlier, 88.6% of students said they enjoy all lessons more when the SMART Board® is being used. Gardner's multiple intelligences relate each intelligence to being skilled in that area. For example, a naturalist would be good with animals, minerals, and plants (2002). Could technology be another modality in Gardner's multiple intelligences?

A study would need to be created to find the appropriate questions that would relate to such a modality. These questions would need to focus on multiple different aspects of technology and how it is used to learn. If the use of technology is found to be one modality of learning that would beacon another question: If this is only one modality of learning, is it appropriate to use this method all the time? If this is not only one modality of learning, is it possible to use technology to enhance the other modalities?

Conclusions

This study has provided much data to support the current research. Students perceive the SMART Board® to be a motivational and engaging tool (Beauchamp & Prakinson, 2005; Brown, 2004; Dolan, 2010; Erduran & Tataroğlu, 2010; Hennessy, Deane, Ruthven, & Winterbottom, 2007; Johnson & Türel, 2012; Jones, 2004; Manzo, 2010; Marzano & Haystead, 2009; Şad, 2012; Saltan & Arslan, 2009; Schachter, 2011; Smith, Higgins, Wall, & Miller, 2005; Türel, 2011; Wood & Ashfield, 2008). Teachers need to incorporate the SMART Board® or any other technology regularly to purposefully enhance student learning (Bliss, 2003; Bybee, 2001; Ham, 2010; Hunzicker,

2011; Niederhauser & Wessling, 2011) This can occur when teachers strive to reach the highest levels of technology diffusion.

These four teachers of Calendar school district demonstrated a high level of technology adoption and innovation adoption with regards to the new curricula. They went beyond the understanding of each innovation and carefully took the time refine, adapt, and create material to maximize the learning of their students. They were able to utilize all of the resources available with the new online curricula and integrate them with other materials to increase student learning and engagement.

One method or teaching style will not be effective in reaching all learners in all grade levels. The teachers of Calendar implemented traditional methods along side the new technology to maximize the opportunity for all students to learn. They used traditional think-pair-share strategies when posing questions on the SMART Board®. They gave the students opportunities to move around the room during different parts of the lesson. Traditional manipulatives were used in conjunction with the SMART Board® like clocks, whiteboards, and gel boards. They recognized that all students need to be active participants to increase learning, no matter the technology or media.

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APPENDIX A

SMART TECHNOLOGIES GLOSSARY

Lesson Activity Toolkit – a gallery of tools and templates that promote interaction with the SMART Board®. The subfolders of the Lesson Activity Toolkit are Activities, Examples, Games, Graphics, Pages, and Tools. Everything is able to be customized for any content or lesson.

Random word chooser – an interactive activity from the Lesson Activity Toolkit that allows the user to type in a set of words and click a button to choose the word at random. Some teachers in this study typed their students' names into this tool and used it to randomly choose students to come up to the SMART Board®.

Random group picker – an interactive activity from the Lesson Activity Toolkit that allows the user to type in a set of words, such as a class list, and randomly place it into groups. The user can decide the number of words or students in each group.

SMART Board® – a specific brand of interactive whiteboards created by the company SMART Technologies®.

SMART Exchange® – a free online community for the SMART Board®. Teachers can upload and download files that they have created in SMART Notebook®. Files are sorted by Subject, Grade, and Standard. Teachers can also access training resources and an educator blog.

SMART Notebook® - a software designed specifically for the SMART Board®. It includes multiple digital resources allowing users to create and design an interactive presentation that allows its audience to interact with the content being presented through stylus pens or their fingers.

APPENDIX B

SMART NOTEBOOK FEATURES

Pages:

- Multiple blank pages for design and presentation
- Dual page ability
- Page zoom
- Extend the page – this allows the user to continuously scroll down in a vertical manner
- Page display sidebar – this allows the user to skip through the presentation to a certain page
- Add/delete/clone page
- Screen shade – this acts as a shade that can be pulled vertically or horizontally to gradually uncover information from a presentation

Tools:

- Stylus pens and erasers
- On-screen keyboard
- Highlighter, other pen colors, creative pen colors
- Magic pen – the ink disappears after a few seconds and if the user draws a circle it spotlights the information inside the circle
- Handwriting recognition
- Shapes and lines
- Text insertion
- Table insertion
- Undo button
- Camera – can take a screen shot of the computer and insert it in a page as an image

Gallery:

- Pictures – can be inserted onto the page
- Interactive and Multimedia files – an example is inserting the image of a clock where the hands can be manipulated
- Full page images
- Backgrounds and themes

APPENDIX C

TEACHER CONSENT FORM

Title of the research study: How do teachers in a mid-Atlantic suburban school district use technology to interactively engage their students?

Name and Department of investigator: **Justin Manno: Department of Psychological, Organizational, and Leadership Studies**

This study involves research. The purpose of the research is to reveal the ways that teachers have adapted to using the SMART Board®. A specific focus will be on the different methods used to integrate the SMART Board® into daily lessons and engage students in a manner beyond the basic functionality of this technology.

What you should know about a research study:

- Someone will explain this research study to you.
- You volunteer to be in a research study.
- Whether you take part is up to you.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide, it will not be held against you.
- Feel free to ask all the questions you want before and after you decide.
- By signing this consent form, you are not waiving any of the legal rights that you otherwise would have as a participant in a research study.

The estimated duration of your study participation is **for four separate classroom lessons in Math, Language Arts, Social Studies, and Science from the present until June 2013.**

The study procedures consist of **an interview prior to my observations, my observations, and a post-conference after each lesson.**

The reasonably foreseeable risks or discomforts are **feeling uncomfortable or embarrassed by any events that happen while I am observing.**

The benefit you will obtain from the research is knowing that you have contributed to the understanding of this topic **and are considered to be one of the more advanced technology integrators in our school district. I believe you will also benefit from our collaboration and discussions on technology before and after the observations.**

The alternative to participating is **not to participate, and/or withdraw from the study. There will be no negative consequences.**

Please contact the research team with questions, concerns, or complaints about the research and any research-related injuries by calling me via telephone (610) 359-4300 x7414 or email: tuc22885@temple.edu or my study advisor Dr. Catherine Schifter via telephone (215) 204-3477 or email: ccs@temple.edu at any time.

This research has been reviewed and approved by the Temple University Institutional Review Board. Please contact them at (215) 707-3390 or e-mail them at: irb@temple.edu for any of the following: questions, concerns, or

complaints about the research; questions about your rights; to obtain information; or to offer input.

Audio and video recording

By checking this box, I agree to be audio recorded during my teaching. This recording will only be listened to by the investigator and used to accurately document the events that occurred during the lesson.

Confidentiality: Efforts will be made to limit the disclosure of your personal information, including research study records, to people who have a need to review this information. However, the study team cannot promise complete secrecy. For example, although the study team has put in safeguards to protect your information, there is always a potential risk of loss of confidentiality. There are several organizations that may inspect and copy your information to make sure that the study team is following the rules and regulations regarding research and the protection of human subjects. These organizations include the IRB, Temple University, its affiliates and agents, Temple University Health System, Inc., its affiliates and agents, the study sponsor and its agents, and the Office for Human Research Protections.

The study will use pseudonyms for both the school name and your name. Therefore, anyone other than myself will not know who you are or where you work.

Signature Block for Capable Adult

Your signature documents your permission to take part in this research.

DO NOT SIGN THIS FORM AFTER THIS DATE →

Signature of subject

Date

Printed name of subject

Signature of person obtaining consent

Date

Printed name of person obtaining consent

Signature Block for Children

Your signature documents your permission for the named child to take part in this research.

DO NOT SIGN THIS FORM AFTER THIS DATE

→

Printed name of child

Signature of parent or guardian

Date

Printed name of parent or guardian

- Parent
- Guardian (See note below)

Note on permission by guardians: An individual may provide permission for a child only if that individual can provide a written document indicating that he or she is legally authorized to consent to the child's general medical care. Attach the documentation to the signed document.

Signature of person obtaining consent and assent

Date

Printed name of person obtaining consent and assent

Date

APPENDIX D

TEACHER INTERVIEW QUESTIONS

Interview Questions

How long have you been teaching?

How long have you taught this current grade?

How long have you used the SMART Board® in your classroom?

What type of training have you had to prepare you to use a SMART Board® in your classroom?

Do you consider yourself to be more highly proficient with technology use than your colleagues?

What are some of the different ways that you use the SMART Board® to engage students in your classroom?

What are all the different ways you use the SMART Board® in your instruction?

What do you think are the most effective ways to use the SMART Board® in the classroom?

What do you think are the most beneficial aspects of the SMART Board®?

When did you get a hard-mounted SMART Board®?

Do you think the hard-mounted SMART Board® has increased your use of the SMART Board® in your instruction?

Do you find you use the SMART Board® as more of a presentation tool or an interactive tool?

What features of the SMART Board® do you find the most helpful with instruction?

How long did it take to feel comfortable using the SMART Board® in your classroom?

How often do you use the SMART Board®?

APPENDIX E**TEACHER POST-CONFERENCE QUESTIONS**Post-conference teachers

How do you feel the lesson went?

Were you able to use the SMART Board® exactly the way you planned?

What do you think worked well or didn't work well?

What do you think you could have done differently?

How do you think the students responded to the SMART Board® use of this activity?

Do you think the SMART Board® helped the students understand the concept of this lesson better than had you not used the SMART Board®?

What do you think are the most effective ways to use the SMART Board® with the students?

APPENDIX F

PARENT PERMISSION/QUESTIONNAIRE

Dear Parents/Guardians,

My name is Justin Manno, and I am a fifth grade teacher at Elementary here in . I am also a graduate student at Temple University. I am currently working on my dissertation which is titled: How Do Teachers in a Mid-Atlantic Suburban School District Use Technology to Interactively Engage Their Students?

Ms. has been gracious enough to allow me to observe her for this study. The purpose of this research is to reveal the ways that teachers have adapted to using the SMART Board®. I will specifically focus on the different methods used to integrate the SMART Board® into daily lessons and engage students in a manner beyond the basic functionality of this technology. I will be recording how the students use the SMART Board® during this class time.

I am asking for your permission to use my classroom observations in my study. I will be videotaping, so I can cross-check my notes for accuracy. All names will be completely anonymous including Ms. name, the district's name, and the school's name. Your child will be referred to in the study by gender and number, for example, Boy #1 or Girl #1. The only interaction your child will have with me will be to complete a written questionnaire after my final observation. You may choose to withdraw his/her participation at any time. Other than seeing me sit in the back of the room, it will feel like a normal lesson.

I will be coming in to observe Ms. for one Math, Language Arts, Science, and Social Studies lesson between May 6, 2013, and the end of the school year. Please feel free to contact me or my advisor with any questions, concerns, or complaints about the research via telephone (610) 359-4300 x7414 or email: tuc22885@temple.edu or my study advisor Dr. Catherine Schifter via telephone (215) 204-3477 or email: ccs@temple.edu at any time.

In addition, I am also interested in parent/guardian insight. It would be greatly appreciated if you could answer the attached questions and return them to Ms. by Friday, May 10, 2013.

With much appreciation,

Justin Manno

Please detach and return the permission slip ASAP.

My child, _____, has my permission to be written about in this dissertation study. I realize that his/her name will not be used in the study, and Justin Manno will be the only person who has access to the video.

Signature of Parent/Guardian

Please return this portion by Friday, May 10, 2013

Parent Questionnaire

Do you know what a SMART Board® is?

Did you know your child's teacher is using the SMART Board® in your child's classroom?

How did you find out that your child's teacher uses a SMART Board®?

Does your child talk about his/her teacher's SMART Board® use in the classroom? If they do, can you describe some of the activities that your child has mentioned?

Do you think using a SMART Board® is beneficial to your child's education?

APPENDIX G

STUDENT QUESTIONNAIRE

| | | | |
|--|-------------|-----------|-------------|
| Did you get to go up to the SMART Board® for any of the lessons that Mr. Manno observed? | Yes | No | |
| Did you find these lessons to be more interesting because your teacher used the SMART Board®? | Yes | No | |
| Do you think you will remember these topics better because your teacher used the SMART Board®? | Yes | No | |
| Do you like all lessons better when the teacher uses the SMART Board®? | Yes | No | |
| How often does your teacher use the SMART Board®? | Every class | Every day | Once a week |