Is There a Relationship Between Electronic White Boards in the Classroom and Student Success?

John Joseph Mundy
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The University of Southern Mississippi

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by

John Joseph Mundy

A Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

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December 2011
ABSTRACT

IS THERE A RELATIONSHIP BETWEEN ELECTRONIC WHITE BOARDS IN THE CLASSROOM AND STUDENT SUCCESS?

by John Joseph Mundy

December 2011

The purpose of this study was to determine the effect of interactive electronic white boards, an advanced technology, on the academic performance of kindergarten through fifth grade elementary students. The participants represent seven local school districts with approximately 700 teachers instructing 16,421 students. The research gathered data from the teachers through a questionnaire designed by the researcher. Student data was also gathered as well as perceptions of trainers, teachers and administrators.

The study was designed to examine the independent variables and the impact or effect it has on students’ achievement in a Kindergarten through fifth grade elementary classroom. The independent variables are level of degree the teacher holds, national board certification of the teacher, the time spent actively using the board in the classroom, and use of student response devices. The independent variables also investigated were the teacher’s perception about ease of use of an interactive electronic white board in the classroom, and administrator and teacher perception of student participation and enthusiasm.

The dependent variables collected were term grades and content by term grade or nine weeks test for available by terms. These grades were collected from each teacher based on general subjects, such as math, language and
reading. Some teachers’ instructional responsibilities were for a single subject, two subjects, or as a self-contained teacher responsible for all subjects. The data was analyzed in SPSS with an ANOVA and t-test, as well as a Tukey multiple comparison analysis.

The data of the study revealed that teachers who use the interactive electronic white boards for 120 minutes or more per day had students who showed better scores than if the interactive electronic white boards were used for less than 120 minutes a day. The research also showed that trainers, teachers, and administrators had positive perceptions and views of the interactive electronic white boards as an instructional tool.

The recommendation for policy and practice is for teachers to increase the use of interactive electronic white boards as instructional tools in the classroom on a daily basis. It is also recommended that administrators provide professional development to assist teachers in developing best practices for the use of interactive electronic white boards in the classroom.

Future research should be designed to consider if there is a novelty effect associated with interactive electronic white boards. The interactive electronic white board is subject to an examination, as is any new resource. As the focus of this study, consideration must be made for the possibility that there is a novelty effect with interactive electronic white boards, and that student engagement, teacher enthusiasm, and motivation eventually decline over time. If the novelty effect is indeed a factor, researchers must determine at which point an interactive electronic white board loses its effect so that teachers can be aware of it.
ACKNOWLEDGMENTS

The word “thank” is a verb that means to express gratitude, appreciation, or acknowledgment. I would like to say a special thank you to the Ulmer, Cook and Wilson families. Jeff & Terri; Holly, Mike, Colby & Canon; Jeremy, Kasie, Jackson and John Lowry Ulmer; Harrell, Joyce, Tammi and Buddy Cook, this doctoral degree and my career as an educator would not be possible without their prayer, love, support, encouragement and guidance. Words cannot begin to express my gratitude for encouraging and loving me through this process.

The professors of USM deserve thanks for their understanding, support, and encouragement during this process. I would not have made it without your guidance, advice, and encouragement to keep going.

I would also like to thank my committee chair, Dr. Ronald Styron, for his assistance, guidance and motivation during this process. I want to say thank you to my committee members, Dr. J. T. Johnson, Dr. Gaylynn Parker, and Dr. David Lee, for their assistance, time, and effort throughout this process. This process has taught me a tremendous amount of about patience and endurance. Your leadership has and will lead me to new paths as an educator.

Last but not least, I would like to thank my colleagues for their support and cooperation during this process. I do not think I would have made it without you. Dr. Tim Holland, “You were right, the light is an exit.” Thank you! Dr. Jenny Webber and Dr. Todd Boucher are just the beginning of the list that is too numerous to name, thank you for your help and understanding through the process.
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CHAPTER I
INTRODUCTION

Electronic whiteboards are the newest technology to be introduced in classrooms across the country. School districts are spending millions of dollars to equip teachers and classrooms with the latest technology (Cohen, 1988). The continual growing rate of computers in homes, schools, and businesses is a trend, which will continue to develop in coming years. The largest area of attention is being placed on the increased use of computers, in conjunction with program choices regarding other devices utilizing technology in instruction. One particular area of rigorous development is that of electronic whiteboards as presentation devices and systems. As electronic whiteboards gain popularity with administrators, teachers and trainers, there is an increased demand for software that can be used in this capacity. The use of technology in the classroom such as computers, white boards and student response devices has changed the role of both the student and the teacher in classrooms (Levin & Meister, 1985). Students have the opportunity to take an active role rather than simply receiving information from teachers and textbooks. They can manipulate and control their learning, giving them a deeper comprehension and sense of ownership.

The research leading to best practices for use of technology in instruction should guide the way choices are made to select the hardware and software to purchase, how to use new technology in creative and exciting lessons to which students will respond positively and be engaged in as well. Recent years and development in technologies have brought about many new types of boards,
applications, student response devices and tools that will continue to develop and offer instructional applications using technology. Also, there are many teachers that still need to be persuaded to the value of these innovations and trained in their use (Lawless & Pellegrino, 2007). The present instruction that is offered is of the repetitive variety, and fails to use equipment to its capacity and may fail to inspire teachers (Duffy, 2007). Technology can and should be incorporated into the teaching styles of all teachers who have previously been cautious in using computers for instruction and assessment. The interactive whiteboard is a device, which is gaining popularity as a visual presenter and interactive teaching aid for use in multimedia instruction. Student response devices are the new innovation and enhancement to electronic whiteboards. Active voters, active expressions, e-clicks, i-phone and i-pod-touch are just a few of the available devices that give teachers instant feedback of student knowledge, understanding and encourage student participation in the learning activity.

Statement of the Problem

The purpose of this study was to investigate the use of electronic interactive whiteboards and the teacher’s and administrator’s perception regarding its use in instruction. Technology has changed all aspects of life including how teachers teach and students learn. The interactive whiteboard can offer features that make it effective in group presentations. Notes, diagrams, or other images shown on the surface can be printed out, given to students or posted to a website, wiki or bulletin board. Students’ personal notes can be
enhanced by the distribution of presentation notes to all participants. The presentations can also be recorded and emailed to students or uploaded as a podcast for students to review. The use of highlighting with color markers on the board in the note-taking mode and annotating over text or, in conjunction, with other programs running can provide an important element in focusing student attention on the board as it is used. Users can write on the board and once an image has been projected on it, the teacher can add comments or notations (Loschert, 2004). The capability of duplicating graphs, charts, and other graphics to use as instructional tools is enhanced in all aspects. Students and teachers can use the whiteboard interactively with remote slates that will enhance classroom management, as well as student's participation. The ability to use peripherals (i.e., slate or tablet) will help in the classroom management by giving better proximity control of the students. Students or the instructor can access the whiteboard through a remote slate or wireless device and use the markers or their pen to manipulate the board and interact with it as one would with a traditional screen and mouse. The interactive quality of the board can bring students to a degree of participation not presented by other presentation methods such as the chalkboard or overhead projector and screen (Clemens, Moore, & Nelson, 2001).

Since it is a relatively new product, only recently has it been viewed as an affordable alternative for use in public schools. The research regarding its impact on instruction and the perception of its use is sparse. The interactive electronic whiteboard shows promise in demonstrations but needs assessment in practice
to determine instructional value. Gathering the opinions and perceptions of teachers and trainers who have experienced using the board is one method to begin to evaluate it objectively. Students must be equipped with technology skills, and can no longer be considered an option or enhancement to school classrooms, but a necessity to prepare students for the future in a global marketplace.

Recent qualitative and field research confirms that instruction with interactive electronic white boards has positive effects on student engagement and teacher attitudes. These positive effects motivate teachers to include a wider variety of modalities for student learning (Snyder, 2006). The approach for this research study will measure the amount of time of use of interactive electronic white board, attitudes of teachers, and performance of students. Interactive electronic white boards support effective classroom practices by offering tools that enhance teaching and support instruction. Research has found that classrooms that use interactive electronic white boards experience the following: (a) Teachers use an interactive electronic white board and the class to collaboratively produce a graphic organizer about cause and effect themes from a literature selection, effectively conducting an instructional conversation and keeping everyone involved (Snyder, 2006); (b) Teachers use an interactive electronic white board to attach real world context in the classroom and provide important background knowledge for a science, language arts or math lesson (Snyder, 2006); (c) Teacher creates a classroom discussion by using social studies and past events to engage students in making decisions guided by
historical events (Snyder, 2006); and (d) Teachers models their own construction of a graph on an interactive electronic white board and demonstrates a step-by-step process, then invites students to come up to construct graphs (Snyder, 2006).

Interactive electronic whiteboards offer programs that improve learning by placing the knowledge in the hands of the students. Students take ownership of their own learning. Teachers and students are empowered, as teaching and learning is enhanced in innovative new ways.

Research Questions

The following questions were supported based on statistical tests that were conducted on the data collected from the selection of schools in the geographic region of the researcher.

It is the researcher’s goal that the results obtained from the study provide school leaders with information that assist in selecting equipment, professional development and helping to improve student achievement levels.

1. Is there a change in student performance data following classroom use of interactive electronic white boards?

2. Do administrators, teachers, and trainers view interactive electronic white boards as effective lesson delivery tools?

3. Do interactive electronic white boards impact student engagement?

4. What are the levels of teacher and trainer satisfaction relative to white board usage?

5. How are interactive electronic white boards utilized for delivery of
course content?

6. What are teacher attitudes and perceptions on the change in student performance with use of an interactive electronic white board in their classrooms?

7. Does teacher level of degree certification effect student success?

8. Does National Board Teacher Certification effect student achievement?

9. Does professional development effect student success in the classroom?

10. Does student achievement increase with increased time in use of electronic white board?

Definition of Terms and Acronyms

Activstudio

Activstudio is the software that accompanies PROMETHEAN brand interactive electronic whiteboards. It allows the user to create flipchart pages similar to slides in PowerPoint. It contains a vast library of resources appropriate for K-12 schools.

Activotes

Activotes are a peripheral designed to work in conjunction with PROMETHEAN to record student responses to questions or data in alpha/numeric response.

Activexpressions

Activexpressions are a peripheral designed to work in conjunction with PROMETHEAN to record student responses to questions or data in
alpha/numeric response. The device allows the student to respond to open-ended questions by texting the answer to the PROMETHEAN board.

Collaboration

Collaboration consists of group work, sharing ideas of others, and an environment in which the collective work produces solutions and understanding.

Flipchart

A flipchart is a series of slides or screens used to present information, similar to slides in Powerpoint. A user is able to put text, graphics, videos, and hot links to other files or resources on a flipchart.

Instruction

Instruction is defined as the resources, materials, strategies, pacing, and outcomes selected by the teacher to result in learning and student achievement.

Interactive Electronic White Board

Interactive electronic white board technology is comprised of a computer and an electronic whiteboard surface that reacts to input provided either by touch or by a stylus. Software provides functions that allow drag and drop, hide and reveal, highlighting and animation functions, indefinite storage, fast retrieval of material, and student feedback.

IWB Classroom

An IWB classroom is defined as one that has an interactive whiteboard in place for instructional use, along with an internet-ready computer, LCD projector, and audio speakers. Components, such as handheld response devices, may be present.
National Board Certified Teacher (NBCT)

A certification for teachers that will supplement their pay. Each teacher that applies to become a NBCT must complete an intensive process that demonstrates mastery in his or her subject area. NCLB No Child Left Behind, Federally mandated program that established a set of national standards for public schools. These standards will be evaluated by a standardized test to check for mastery of standards. Rating for each school, district and state will be published for purpose of improvement.

PROMETHEAN

PROMETHEAN is a global interactive whiteboard and learning response systems supplier offering resources, lessons, and support.

State Department of Education

The governing body for all public schools in each state. Each department operates based on the state’s vision and goals.

Years of Experience

This will refer to the total number of years experience for teachers.

Assumptions

The researcher will use an instrument of self-design that is forthcoming and assure the participants the highest prudence possible. An alphanumeric coding system will allow the researcher to match teacher responses to the student data. The district and building administrators will play a pivotal role in the researcher’s ability to ensure that the responses will be used for this study only and at no time will their individual responses be shared with administrators in
their districts. The researcher will make the following assumptions about the study: The researcher will presume the participants will answer the questionnaire with honesty and integrity in a timely manner. The constructed instruments will be appropriate and designed to evaluate the perceptions of administrators, teachers, and trainers on the use of the advanced technology interactive electronic white boards in elementary classrooms for instructional purposes. The researcher will be unbiased when analyzing data. The instrument that will be utilized is reliable and valid. The methods of analyzing data will be appropriate for the research design. The data that will be utilized in this research is reliable and accurate. The results from this research will be valuable in making financial, professional development and instructional decisions concerning the implementation of technology into elementary classrooms. The researcher has high expectations in relation to questionnaire return rates. The validity and reliability of the study will increase in relation to a higher rate of return of questionnaires.

Delimitations

The researcher acknowledges the limitations about the study. The frame of mind of the administrators, trainers, and teachers when they completed surveys may have affected their responses. The difference in individual teaching preferences, strengths, and weaknesses may have affected their responses. The difference in individual learning preferences may have affected their responses. Participants’ limited experience with advanced technology may have affected their perceptions, and therefore, their responses. The study was to determine participants’ perceptions on how interactive electronic white boards influence
student participation and performance.

Term test, 9-week test, mid-term test and content-by-term test are just some of the names that refer to assessments constructed by local districts. These efforts are focused in creating tests that mirror the Mississippi Curriculum Test II, in order to prepare students for state assessments. These efforts are also designed to ensure that students are learning a continuous rigorous curriculum throughout each district. In designing the assessments, questions and question banks are being created by teachers, instructional coaches, lead teachers and trainers. The MCT II is a newly designed assessment, with an increased level of rigor. Proficiency Level Descriptors (PLD) detail the level at which skills and objectives should be mastered by students.

Limitations may exist in assessment design due to several factors. The levels of education by participants, district expectations, access to material to model the structure of question design and the level of rigor at which the question is designed. The limitation may also continue to test administration, test security, grading and scale of grades associated with the assessments. Levels of variability can exist from district to district and even school site to school site. In conducting this study these factors need to be considered while evaluating the data.

Justification

The benefits of the study was the information gained about the effectiveness of interactive electronic whiteboards. This research provided educators with important information on how to effectively integrate technology to
increase student success and achievement. School officials may also use findings from this study to provide evidence to state and federal funding sources on the value of technology integration in the classrooms of a southern state.

The information that was gathered through this study will help in designing professional development that will enhance the interactive electronic whiteboards in the classroom. Teachers can learn how to create and design interactive lessons that are engaging for students. Training to integrate websites that contain area content with videos, webisodes, and learning activities will also give teachers more tools that will bring the classroom into the digital world, where these students live on a daily basis.

In recent economic times, budget shortfalls are forcing many districts to make decisions to spend in areas that will give the most return on the investment. This type of technology research may help in selecting the equipment and training that will prove most effective for student learning in the classroom to prepare them for the global marketplace.

Summary

The implementation of advanced technology such as interactive electronic white board into elementary classrooms could impact the academic performance of students. Technology is an important aspect of curriculum in 21st century schools. Students are being prepared for jobs that do not even presently exist.

Pearlman (2009) quoted Joe Hofmeister as saying:

The biggest change I have experienced is the change from the desired model being a brilliant lecturer to the desired model being a
student-centered teacher, where the activity of the student is the key to the learning experience, where knowledge is being created by the student rather than being "poured in" to a student's mind. In the future, the importance of technology will grow exponentially." The way it will be used, however, will only slightly resemble the way we use it now. More software will become available for education that truly takes advantage of the power of the modern computer. Students will be able to communicate quickly and easily with experts around the world, and classes that meet online will be as common or more common than the actual classes we have today. Far from being more sterile and remote feeling, these classes will be incredibly rich human experiences in which students collaborate in exciting, authentic discoveries. (p. 1)

Recent research supports technology in education as a positive element, focusing on the idea of placing students in control of their own learning. Students need to learn how to learn. Technology is also an important resource for teachers. Not only do teachers use technology to facilitate communication, extend their professional skills, and manage their classrooms; it is now an essential teaching tool. With the demands of No Child Left Behind and adequate yearly progress, teachers are searching for ways to close the achievement gap. Technology has proven to be an effective tool in reaching this goal. Research has shown underachieving students learn more rapidly when they have the opportunity to use technology.

Most research shows a large impact on student achievement with the use
of educational technology. The Milken Exchange, part of the Milken Family
Foundation, is designed to discover and advance inventive and effective ways of
helping people help themselves and those around them lead productive and
satisfying lives. The foundation advances this mission primarily through its work
in education research. The research included both positive and negative impacts
of educational technology conducted in five studies. All studies revealed the
positive impacts far outweighed any negatives, which was either the wrong
approach or teaching style. All five studies revealed an improvement in student
attitudes toward school, which motivated underachieving students (University of
Illinois, 2009).

At a time when financing education is at the forefront of many political and
social dilemmas, research supporting its effects is beneficial. As the budget
continues to suffer cuts, research supporting the benefits of technology will
enhance the awareness of its necessity. The results of this research can be used
in determining if the funds allocated for advanced technology, particularly
interactive white boards, are worth the benefits to student performance.
CHAPTER II
REVIEW OF LITERATURE

Introduction

Educators are in competition with video games systems, personal computers, mp-3 players and hand-held electronic games, a world in which graphics sounds and interactive electronics change every three to five seconds (Cohen, 1988). Electronic whiteboards are a relatively new technology in the classrooms and are used for instructing and assessing students with response devices. This emerging technology is an exciting tool for teachers to compete in the electronic world that students experience on a daily basis (Branzburg, 2006).

As new technology emerges it is making its way into the classroom, and is beginning to shape students’ lives, the way they learn and think (Cohen, 1988). Over the past 60 years of technology’s existence, it has transformed students’ daily lives. The presence of technology has been in the business place and has slowly infiltrated into the educational setting. Technology in education can create a culture that supports learning both inside and outside the classroom and in many ways can enhance student achievement in every subject taught in school (Levin & Meister, 1985). The integration of technology in the classroom allows students to prepare for a global economy and society and bring content to life. Students develop skills in the organization of complex information, drawing inferences, communicating findings, and recognizing patterns (Bialo & Sivin-Kachala, 1996). In a varying world, educational instruction has been constantly stagnant in its methods of teaching children. With this age of rapidly advancing
technology, teachers must harness this technology to capture and motivate their students (Lawless & Pellegrino, 2007).

Nationwide, school districts are annually investing billions of dollars into the development of creating technologically rich environments for classrooms and students (Pratt, 2002). In the 2003-2004 school year, the United States school districts spent $7.87 billion on technology equipment (Stevenson, 2004). The United States Department of Education supplied $659,438,400 during 2004 for grants meant to promote professional development encouraging the integration of technology (Lawless & Pellegrino, 2007). This money is being spent without clear knowledge that students will truly benefit from the new technologies (broadly defined as computer based devices or applications). Yet legislation such as the No Child Left Behind Act ("No Child Left Behind Act of 2001," 2002) drives further investment, and fortunately, research studies are beginning to clarify just how schools might utilize technology to effectively impact student performance. Some even indicate that technology may provide a cost effective means of increasing student achievement (Mann, Shakeshaft, Becker, & Kottkamp, 1999). As yet, however, the pace at which technology enters schools vastly exceeds the pace at which educational research can provide evidence for its use, guidance for best practices, or a methodology for integrating new technological tools into the learning community (Lawless & Pellegrino, 2007). Published research indicates that technology should be everywhere, used as a tool, and fully integrated within existing curriculum (Russell, Bebell, Cowan, & Corbelli, 2002). It is meant that technology should always be present
and available for use. Forms of usage include one-to-one computing (one computer for every student) and the presence of the internet, printers, projectors, and other such devices, the usage of which are considered commonplace and easy to access. Use of technology as a tool means that assigned tasks are accomplished via technology, yet the use of technology was not the reason for the task being assigned. Full integration of technology into curriculum assumes the use of technology and accounts for the change in the learning environment that technology creates. Usage may be achieved via the acquisition of enough new technology to provide every student with full-time access, making this aspect of effective technology use a matter of resource allocation. The concepts of using technology as a tool and integrating technology into the curriculum are more complicated, as they involve the training, or retraining, of teachers. The process of integrating technology effectively depends upon teachers. Purchasing a device will not solve any problems related to student learning. Rather, purchasing will necessitate a need for professional development, experimentation, mastery, and possibly a paradigm shift in teaching pedagogy (Lawless & Pellegrino, 2007). Effective introduction of new technologies thus necessitates a time and resource commitment far beyond the initial investment used to acquire the new technology. How best to facilitate teacher adoption of new technologies has not yet been determined and so is a pertinent and relevant topic for investigation.
Theoretical Framework

The theoretical basis of the study is in the effects of constructivist learning theory and the theory of multiple intelligences on student achievement in the classroom.

The constructivist learning theory is based on the concept that knowledge is built by the learner during environmental interactions, in terms of language arts, science and math instruction. Constructivist theory calls for learners to be able to see, hear, and otherwise engage with content in ways that allow them to confront their own lack of knowledge or misconceptions of principles, and modify them so that accurate learning occurs (Schunk, 2004).

The Multiple Intelligence Theory, in which Gardner defines intelligence as "the capacity to solve problems or to fashion products that are valued in one or more cultural setting" (Gardner & Hatch, 1989, p.1). Using biological as well as cultural research, he formulated a list of seven intelligences. This new outlook on intelligence differs greatly from the traditional view that usually recognizes only two intelligences, verbal and computational. After later adding an eighth intelligences, Gardner definitions are words (linguistic intelligence), numbers or logic (logical-mathematical intelligence), pictures (spatial intelligence), music (musical intelligence), self-reflection (intrapersonal intelligence), a physical experience (bodily-kinesthetic intelligence), a social experience (interpersonal intelligence), and/or an experience in the natural world (naturalist intelligence).

The eight intelligences very rarely operate independently. Rather, the intelligences are used concurrently and typically complement each other as
individuals develop skills or solve problems. The Theory of Multiple Intelligences implies that educators should recognize and teach to a broader range of talents and skills. Another implication is that teachers should structure the presentation of materials in a style that engage most or all of the intelligences. The presentation of material can be enhanced by interactive electronic white boards.

Interactive electronic white boards are particularly developed to allow students access to the sights, sounds, and conversations that accompany scientific instruction and learning (Beauchamp & Parkinson, 2005; Schunk, 2004). The use of interactive electronic white boards in instruction can promote this necessary engagement and motivation, as well as prompt higher-order thinking and problem solving skills (Beauchamp & Parkinson, 2005; Hennessy et al., 2007; Moss et al., 2007; Schunk, 2004). Students can be more motivated by and engaged with content when it is made meaningful through the use of illustrations, video, and simulations.

History of Educational Technology

Charles Babbage (1792-1871) is often thought of as one of the founding fathers of the computer age. He was educated in mathematics at Cambridge University and was an expert on calculation tables used by mathematicians, scientists, astronomers, and engineers (Singer, 1998). Babbage sought to build a steam-powered machine that could calculate and print out tables and numbers that would eliminate human error. In 1832, Babbage created the first automatic calculator (Rosenberg, 1992). Then, around 1840, Babbage had the idea of the Analytical Engine, a machine purposed for finding the value of practically any
algebraic equation. The Analytical Engine was considered the forerunner of the modern computer although it was mechanical and not electronic (Singer, 1998). Over 100 years passed before there were electronic computational devices that were based on Babbage’s ideas (Provenzo, 1999). While Babbage is considered a founding father of the computer age, there has been much advancement in computer technology as discussed by Singer in *20th Century Revolution in Technology*.

Historical trends in educational technology can be traced through film, radio, instructional television, calculators, and the use of computers as the tools most readily recognized until recent years with the implementations of electronic whiteboards (Reiser, 2001). Whenever a new technology is introduced, the first tendency of teachers is to use it as the traditional technology it replaced; this has been the case of technology in current educational settings (Reiser, 2001).

The dawn of the computer age occurred during the 1940s-1960s. During this time computers were used primarily by large corporations or government offices. Once their use was established there, smaller businesses began employing technology in the form of personal computers during the 1970s (Stallard & Cocker, 2001). A significant advancement in technology use in schools took place in 1974 when Ed Roberts, owner of a tiny calculator company, MITS in Albuquerque, New Mexico built a small computer called the Altair 8800 which considered to be the first personal computer. The drawback of the Altair 8800 was that it was difficult to use (Provenzo, 1999). The Altair inspired a group of computer hobbyists in San Francisco, in March 1975, to come together and
form the Homegrown Computer Club (Singer, 1998). The members of the Homegrown Computer Club saw that the personal computer was one of the great technological revolutions in the history of humankind. One of these members was Stephen Wozniak, who began to build his own personal computer (Singer, 1998). His friend, Steven Jobs helped Wozniak improve his personal computer and convinced him to start their own company selling computers, which later caught the attention of millionaire Mike Markulla. Markulla gave the men $90,000 and a warehouse, which land-marked the beginning for the Apple computer company (Provenzo, 1999). Growing competition from other computer manufacturers like Radio Shack and Commodore propelled Wozniak to design a cheaper and more reliable disk drive (or a data storage device), which gave Apple a competitive edge in the computer market (Singer, 1998). The rise of video games that could be played on a computer and the educational software that allowed for the use of computers in the classroom further popularized the use of personal computers and made them versatile and valuable (Rosenberg 1992). In the 1980s, computers began appearing in schools. The aim of educators was to teach basic computer skills to students (Henderson, 1999). During the excitement of educational technology in the mid-1980s, Apple computers began an experiment known as Apple Classrooms of Tomorrow (Apple, 1995). The longitudinal study began in seven classrooms across the United States. In these classrooms, the goal was to create an educational environment that routinely used technology. This was accomplished by placing computers at home and at school for each teacher and student to ensure
continual access. The purpose was to observe the effects of technology on teaching and learning. This project extended through the next decade as Apple Corporation expanded its research and its participation in the educational field. Multiple reports were published in which Apple communicated the positive effects of technology on both teachers and students. These findings became an initial medium for integrating technology in schools across the nation.

In 1981, IBM entered the competition with their personal computer and this resulted in further development of personal computing. Handheld mice and icons that linked directly to the programs were introduced as a result of this competition (Provenzo, 1999). By the mid 1980s, computers were so popular in the culture that instead of naming a man of the year in 1982, Time magazine named a “machine of the year” – the personal computer (Willis, 2003, pp.11-33).

The new technology quickly caught on in schools. In 1982, there were 5.5 million personal computers in use, of which only about 100,000 were in schools, one for every 400 students, but by 1998 there were almost nine million computers in schools (Willis, 2003). Still many believed that this was not enough. Quickly changing technology and how to use it for education is still a concern for many educators and a constant topic of study (Apple, 1995).

The internet was then introduced in the 1990s, and technology changed shape as computers became networked around the world (Stallard & Cockard, 2001). It was also during this time that the need to train teachers became pronounced and administrators began budgeting monies for teacher training.
Film

The classroom use of film was adopted in 1910 by public schools for instructional use (Saettler, 1968). In 1913, “Thomas Edison stated his enthusiasm for films in the classroom with, books will soon be obsolete in the schools. Scholars will soon be instructed through the eye, it is possible to touch every branch of human knowledge with the motion picture” (Cuban, 1986, p. 11). Classroom use of film became a progressive symbol of teaching just as computers have today. A study of film conducted over a period of 21 years, from 1933-1954, showed that only 42% of elementary teachers used film in the classroom while another result indicated that teachers lacked skills required for staff development in educational technology.

Radio

Benjamin Darrow, founder and director of the Ohio School of Air (which was a promoter of radio), proclaimed in 1932:

The central and dominant aim of education is to bring the world to the classroom, to make universally available the service for the finest teachers, the inspiration of the greatest leaders . . . and unfolding world events which through the radio may come as a vibrant and challenging textbook of the air. (National Education Association, 1995, p. 79)

A survey conducted by the U.S. Department of Education showed that teachers used radio in a limited manner in the classroom; the reason for the infrequent use was lack of radio receiving equipment and instructional training.
With the lack of staff development, and changing social expectations by the middle of the 1960s publications and research relating to instructional radio had all but ceased. Course offerings in radio instruction were considerably reduced; commercial radio networks had closed their radio education departments and discontinued tier school broadcast; and the once vigorous leadership of the radio section of the U.S. Office of Education had disappeared. It was evident that educational broadcasting was shifting its focus from radio to television (Seattler, 1968).

Instructional Television

Instructional use of the television in the classroom, like radio and film, was envisioned, formulated, and promoted as the universal remedy for educational problems. In 1952, instructional television was introduced and proclaimed as a proxy teacher. From 1970-1981, research on instructional television found that only two to four percent of instructional time was devoted to this technology. When television was used, it was infrequent and only during a small fraction of the instructional day (Dire & Pedone, 1978).

Television technology in the classroom also suffered from the lack of proper equipment, knowledge and training, inconvenient time schedules, and the training to integrate television into the current curriculum. Developers believe that if television disappeared, American schools would not have noticed its absence. Although the use of television in the classroom still occurs it is only in a limited capacity.
Calculators

Calculators, like radio, film, and educational television, were introduced into schools before computers (Holman, 1995) addressed the need for using calculators in the classroom. Technology has become an important part of modern society. Not preparing young people to work with calculators, one of the most technological advanced devices of its time, will surely place limitations on the students' future learning (Dire & Pedone, 1978).

Many people argued that calculators may take the place of learning and children will no longer need to think if calculators are being used (Bright, Lamphere, & Usnick, 1992). Calculators were proclaimed as an important technology in the classroom. "Clearly the calculator is a critically important tool with which students at all grade levels should be conversant and comfortable" (Hopkins, 1992, p. 165). Despite researchers favoring classroom calculator usage, resistance was encountered from the community, parents, school board members, district and school administrators, and teachers (Super, 1992). "Such resistance can be subtle or insistent, and it is certainly damaging unless thoughtful contingency planning is undertaken by the coordinators of an implementation" (Super, 1992, p. 208). The societal controversy over calculators in the classroom has been a major impediment for usage. If this controversy is resolved, more teachers will begin to use calculators in the classroom. Even with the readily available programs and technologies, such as cash registers that assist in calculating data, students should still have basic operational skills of input and function on a calculator.
Computers

Societal expectations have pressed school personnel to embrace computers as they have film, radio, and instructional television. Tetenbaum and Mulkeen (1985) argue that, presently, the major contribution of the computer is serving as a catalyst during a period of community expectations by providing opportunities to explore "educational issues, to release new energies, to rethink what we do, to reconceptualize schools, and to create a basis for change . . . well-developed proactive, strategies are necessary so education can productively and meaningfully enter the twenty-first century" (Tetenbaum & Mulkeen, 1988, p. 102).

Additionally, many hyperboles were rampant exalting the virtues of computers: There won't be schools in the future . . . I think the computer will blow up the school. That is, the school defined as something where there are classes, teachers running exams, people structured in groups by age, following a curriculum—all of that. The whole system is based on a set of structural concepts that are incompatible with the presence of the computer . . . But this will happen only in communities of children who have access to computers on a sufficient scale. (Papers, 1984, p. 38)

Advocates believe that computers have the potential to lead children into understanding how the mind works in solving problems. Cuban describes the possible power of the computer. There is the powerful influence that the machine has in capturing student interest—the pinball effect. Hooking children into learning with computers, boosters claim, also gives them a growing sense of
self-esteem, a feeling of competence, even control, especially when students can teach adults how to use the machines. This sense of control over the machine, the argument goes, is vital to children acting independently (Paper, 1984, p. 74).

The empowerment of the student has been vital to the success of the computer. In addition to the benefits for the child, there are growing concerns that the United States is losing its influence on markets throughout the world. The momentum for instructional use of computers came from outside the schools (Fiske, 1983).

Computer integration in the classroom has been even more important with the introduction of the internet in the classroom. The computer becomes a portal to the world around us. It allows teachers to take the students to places they may never personally see. Lack of appropriate professional development for computer integration and the limited supply of equipment does hinder the full implementation in the classroom.

Interactive Electronic White Boards

The past technologies such as film, radio, instructional TV, calculators and computers have been foundational in preparing teachers and students to use technology. The forms of Interactive Computer Technology have changed and revolutionized the introduction of computers to teaching classrooms. A most important, emerging aspect of ICT is the interactive whiteboard (IWB). This holds the potential to become the new classroom chalkboard (Butler, 2004, p. 12). The whiteboard appears as a large, flat television screen and comes in various sizes. It connects to a computer or laptop and a LCD projector. The
projector displays the computer image onto the board, and the board functions as a touch screen computer monitor. Instructors can touch the board to select menus or move objects around on the board with the touch of a finger. At the bottom ledge of the board are four colored, electronic pens and an eraser to be used for writing on the board. When a pen is picked up, the pen or the teacher’s finger can be used to write on the board in the selected color. One prominent distributor of electronic white boards (interactive electronic white boards) is SMART Technologies. The company was founded in 1987 and introduced the first Smart Board in 1991. In 1992, SMART joined with Intel for joint product and marketing development. Some early users of SMART Boards were educators who needed to present lectures at a distance. Its use has slowly evolved in businesses and general classrooms. Today the use of the IWB is steadily rising in classrooms as SMART continues to develop new products and upgraded software (SMART Technologies, 2006).

The interactive electronic white board provides a variety of classroom uses, ranging from writing notes to data manipulation. Teachers and students can use specific software to prepare and organize presentations with multimedia capabilities (Loschert, 2004). The SMART software allows teachers to capture and modify images or animations from files, the web, or existing software graphics. The areas of particular importance then can be emphasized by overwriting with the pens. Interactive electronic white boards also promote kinesthetic learning as students can interact with the board by writing and moving objects with the touch of a finger (Butler, 2004). All these interactive electronic
white board applications enhance concept development for students (Glover, Miller, Door, & Averis, 2005).

The interactive electronic white board’s uses are vast, allowing for potential seamless integration of technology into the classroom (Ziolkowski, 2004). Research has shown interactive electronic white board’s to possess concrete learning benefits. Its multimedia capabilities and student interactions are the main reported educational advantage, that is an interactive electronic white board allows multimedia components to be integrated easily into teacher’s presentations and powers teaching by motivating and engaging students. One way this is accomplished is by supporting interaction and conversation with students. It supports presentations by allowing teachers to overwrite on the board to highlight certain elements. This also tends to produce improved teacher organization. The interactive electronic white board can promote student learning as well. For instance, Gerard et al. (1999) contends that the interactive electronic white board supports the cognitive educational process because overwriting allows teachers to emphasize key concepts. This causes students to focus on essential elements and facilitates student organization of information. Also, Gerard et al. argue that interactive electronic white boards may motivate students by generating excitement in the classroom (Gerard, Green, & Widener, 1999).

Branzburg (2006) asserts that interactive electronic white boards bring additional general benefits for special needs students, such as those who are visually impaired because it projects large, bright visuals. Also, interactive
electronic white boards allow for kinesthetic learning, which is often beneficial for special needs students (Branzburg, 2006). Wall reported that non-special education students can perceive that the interactive electronic white boards helps special needs students (Hardman, Smith, & Wall, 2003). The benefits from the interactive electronic white board benefits for hard-of-hearing or deaf students also have been noted (Mackall, 2004). An interactive electronic white board allows teachers to use technology and remain at the front of the classroom where students can see them and understand sign language.

When evaluating interactive electronic white board use, students’ perceptions must be considered. Hall and Higgins (2005) interviewed year six students in British classrooms, assessing their reactions to the interactive electronic white board’s integration into the classroom. In focus groups, students identified both positive and negative contributions of interactive electronic white boards. First, students noted its versatility. They commented that a range of resources could be used with the interactive electronic white board. Students described the plain board as being “boring” (pp. 102-117). Second, students enjoyed the interactive electronic white board’s multimedia capabilities. The sounds, visuals, movements, and color increased their engagement. Third, students commented about the games that could be played with the interactive electronic white board. Students also expressed factors or elements that they did not like about the interactive electronic white boards. The most frequently cited feedback related to technical difficulties. For instance, if the board is bumped, it must be reoriented, and this takes time. Also, some students
complained that they could not always view the board due to its size or the sun’s glare (Hall & Higgins, 2005).

When students were asked what improvements could be made in the board’s use, students said they desired more access to it. They wanted to be able to personally use the interactive electronic white board. Wall analyzed how interactive electronic white boards affected students’ perceptions of their learning. This study was conducted with year six British students. The students provided positive comments and common themes were found among these constructs. First, students believed that the interactive electronic white board facilitated learning. Students noted the use of visual displays, various software, and games. They believed that these items increased their concentration toward the subject matter being taught. Second, students perceived that the interactive electronic white board initiated learning. The main factor they described as influencing this was motivation. Students wanted to use the board themselves. They perceived the board as fun and preferred the visual approach to learning that the interactive electronic white board offered. Third, students commented on the interactive electronic white board’s multimedia capabilities. They enjoyed the integration of sounds, visuals, and colors. Subject-specific advantages were mentioned. Students commented on the interactive electronic white board’s advantages most frequently relating to math. Some stated that the interactive electronic white board changed their opinion of math, that it was easier to understand and comprehend. Its use in science was positively reported. As well, students noted its ability to aid in visualizing concepts. Students believed that
the board benefited teachers by improving their concept explanations and creativity. Although most student perceptions were positive, some negative comments were stated regarding the interactive electronic white board’s use in the classroom. Most of these revolved around the technical reliability of the board. Frustrations included waiting for the technology to work and reorienting the board. Lack of student participation also was noted by students. They did not feel that everyone had enough opportunity to use the board during class. Some students questioned whether the expense justified the interactive electronic white board’s benefits. Finally, some students remarked that the interactive electronic white board’s quickened the teacher’s instructional pace.

Recent developments in multimedia technology have shown benefits of its use in teaching classrooms (Bulter & Mautz, 1996). A specific subset of multimedia technology includes the use of PowerPoint as a presentation aid. Studies regarding PowerPoint are significant because it is one of the ways that the interactive electronic white board has shown effective use. Using PowerPoint in the classroom can significantly alter the classroom environment, and this finding has generated multiple studies on students’ perceptions of its use (Apperson, Laws, & Scepansky, 2004). However, these studies all have been conducted at the college level. Research on students’ perceptions of PowerPoint software at the secondary level was not acquired via an exhaustive search of the published research literature.

With the rising use of interactive electronic white board in the secondary education classroom, it is crucial to gauge its value. The multiple uses of
interactive electronic white boards have been detailed by numerous educators (Loschert, 2004; Ziolkowski, 2004). Modest research has been conducted on its effects. Students’ perceptions were studied in Britain by Walls, Higgins, and Smith (2005), and the study focused on the perceived benefits and limitations of its use. Since these two studies were conducted at the primary level and in European contexts, the question of how students perceive the interactive electronic white board’s use at the secondary level and in America remains. The view of secondary level and primary level students may differ. Thorough studies of American secondary level students’ perceptions have not been conducted, to date. Therefore, it is necessary to explore secondary students’ perceptions of the interactive electronic white board’s benefits and limitations. In addition to researching the general effects of technology on education, it is also imperative to research effects in specific subject areas. Research has been performed on students’ perceptions of technology in the science classroom (Donaldson, 2001). However, the interactive electronic white board has not been specifically considered in the research conducted. Subjects that have been studied with the interactive electronic white board include foreign language, math, and English (Bell, 2000; Gerard et al., 1999; Zirkle, 2003). Since these studies lack in the area of secondary level students’ perceptions of the interactive electronic white boards and in the area of science, this calls for the present necessary research. Science encompasses many facets including physics, chemistry, earth science, and biology. Their distinctive contents result in each requiring its own unique pedagogical methods. Therefore, this study concentrated on interactive
electronic white boards in the context of the biological aspects of teaching science.

Teachers have been using whiteboards in their classrooms since the 1990s. Electronic whiteboards have been proven to improve students’ attitude toward learning and ability to better understand complex concepts. Every aspect of our society, including education has been changed by technology dramatically; these dramatic developments have posed the question, how best to use emerging technology in education? As long ago as 1978, Dr. Alfred Bork described the computer as an instrument of revolutionary change in education. He stressed the need for students to interact with computers and be engaged in the learning process as opposed to being passive recipients of knowledge dispensed by the teacher (Bork, 1978). Technology continues to evolve; the tools have become increasingly complex and capable. Dertouzos (1997) referred to the importance of computer interfacing with other devices and to the development of “smart” tools that would be components in intelligent rooms, where computers will be embedded in all aspects of one’s environment.

The interactive electronic whiteboard has gained recognition and popularity as a teaching tool when used with a computer and video projector. The board can be used to involve groups in lessons displayed on the board. Because students actively participate in these lessons, the board can serve as a valuable tool in an interactive learning environment. The board itself is touch-sensitive, so that students can manipulate applications at the board as if it were a giant touch pad. They can also add notes to any display, make annotations, or
compose original documents, which can be saved, printed and distributed, or sent electronically to recipients in other locations. The user can control any application by touching the board with a finger, and can mark with tools such as a stylus, dry-erase marker, or finger (Bell, 1996). The interactive whiteboard has the "smart" qualities described by Dertouzos (1997) in that it interacts by interface with a computer and in the manner in which it allows interactivity between the computer, the board, and users at both locations. The interactive student response devices will take the board to the next step as an assessment tool in monitoring student learning and success.

Researchers and educators agree that interactive whiteboards can improve a student’s ability to retain and recall information presented in an interactive-whiteboard lesson activity. Both student and teacher experience the heightened engagement in such lessons (Clemens, Moore, & Nelson, 2001).

The interactive whiteboard used as a tool, in combination with an effective teaching strategy, produces dramatic results. Teachers share the enthusiasm of students and of various ways to promote interaction, stimulate discussion and make learning easy. The basic functions of the interactive whiteboard allows teachers to write over digital documents and Internet pages, while allowing students to keep track of ideas introduced in lessons.

Students are not so easily lost, and they know what the teacher wants them to select. Because the teacher can emphasize any particular structure by highlighting, underlining or circling with different colors, it is easier for students to organize new concepts. The enthusiasm and student teacher engagement is an
important factor to improving student scores, especially among those students who traditionally have difficulty learning (Gerard & Widener, 1999). While Reardon (2002) states that it is difficult to draw a direct link between improved grades and the use of interactive whiteboards, Zirkle (2003) reports that interactive whiteboards produced positive grade changes from six-week to six-week period as well as from unit to unit. The improved grades suggest a strong link between delivering lessons on an interactive whiteboard and increased retention of information.

Recent research by Dr. Robert Marzano of the Marzano Research Institute published some extraordinary findings. The results of 85 independent treatment/control studies was statistically significant and showed a percentile point gain associated with the use of PROMETHEAN ActivClassroom, the 17 percentile point increase represents a real change in student learning (Marzano, 2009). The average “real change in student learning” of a 17 percentile point gain caused by the PROMETHEAN ActivClassroom is truly remarkable (Marzano, 2009 p. 7)

The study conclusion states:

The meta-analytic findings suggest relatively large percentile gains in student achievement under the following conditions: the teacher has 10 years or more of teaching experience, the teacher has used the technology for two years or more, the teacher uses the technology between 75 and 80 percent of the time in his or her
classroom, the teacher has high confidence in his or her ability to use the technology (Marzano, 2009, p. 7).

The “relatively large percentile gains in student achievement under the following conditions” caused by the PROMETHEAN ActivClassroom is a “29 percentile gain. This is an extraordinarily high gain in academic achievement” (Marzano, 2009, p. 35).

The Marzano Research group is also completing a second component of the research. Teachers and classrooms were also videotaped and then analyzed the results to verify the original results and determine additional components that will enhance student learning in the classroom. These results will be published soon. This portion of the study was pertinent to evaluate student interaction and engagement.

A report, Teachers and Technology: Making the Connection, noticed the lack of training with pre-service teachers. Training in technology was encouraged at colleges to include technological training in education programs and the technology expansion continued in schools. According to the National Center for Education Statistics (NCES, 2005), the percent of public schools with Internet access increased from 35% to 99% from 1994-2002. Some teachers consider aspects of technology central to their daily instruction. The NCES (2005) reported that 68% of teachers believe that e-mail is imperative, and 61% believe that the Internet connection in classrooms is essential for instruction and planning. These findings were from 2005 and have dramatically increased in recent years. These results were also seen in a national survey of technology
literate teachers. Using e-mail to communicate with colleagues was reported as the most frequent use of technology (Teachers and Technology, 1995). Schools and districts are also pushing for a paperless method to reduce the use and waste of natural resources. Clearly, since its initial introduction, the use and existence of technology has increased in the classroom. According to a report by the CEO Forum on Education and Technology (2001), 47% of teachers used computers for daily planning and teaching in 1998, and this increased to 76% in 2000. The student to computer ratio also has increased. In 1996 it was 10:1, and by 2000 it was 5:1. Numerous government proposals have been the catalyst for technological change in schools. National, state and local curriculum frameworks now include technological standards for teachers and students. Vail (2003) argues that it would be nearly impossible for schools to meet federal requirements without using technology. The No Child Left Behind Act (2001) sets forth numerous mandates relating to technology. One of its goals is to encourage teachers to integrate technology into instruction with the goal of improving student achievement. Another goal is to include high quality professional development programs in the form of technological training for teachers. Recommendations for education also are outlined in the National Education Plan (2004). The plan first involves strengthening leadership, it includes making an investment in developing tech-savvy leaders at all levels of education, improving teacher training to facilitate effective use and encouraging schools to move towards a digital content in the form of multimedia or online information. This plan acknowledges that today’s society functions differently with
technology and it follows that schools should operate another way as well. Also recommended was the moving away from traditional, paper textbooks and a move towards multimedia presentations and/or electronic textbooks. Beneficial results would include decreased costs, enhanced learning capabilities, increased efficiency, improved access, and an opportunity to assess students quickly and efficiently.

Technology Integration

Selection of Equipment

Districts are making the transition to electronic whiteboards in the classroom. There are a large number of companies offering whiteboards with a range of features, software and add on devices like student response devices and remote control tablet style devices. The basic ingredients are a digital projector, input device, (such as an interactive pen) and a computer. One main and important feature of the electronic boards is the projection of images in color. The interactive ability will help maintain the student’s attention. In selecting equipment most districts make the decision and choices based upon sales presentation, rather than on the usability of teachers in the classroom. There are eight companies that were found by the researcher in a basic search for electronic white boards. The top two are Promethean with the Activboard and components based on popularity, such as the Activslate, Activotes and Activexpressions, and the board by Smart Technologies known as the Interwrite board. It easily integrates the software of Exam-View for student assessments through e-clicks, student response devices. The Promethean and Smart Boards
also have the remote control tablet that allows the teacher and student to write or control the board form anywhere in the classroom.

The other manufactures provide a comparable product with similar features. Districts should include teachers in the selection process for the practical user input. In selecting equipment for the classroom, teachers are looking for products that are quite durable. Teachers want mobility in their classroom without losing control. Teachers are looking for more excitement with the materials and skills they are using their in classroom.

Curriculum Integration

Electronic interactive whiteboards can make lessons exciting and interactive. Some of the effective ways of using the whiteboard are to record class notes and homework assignments. For students who are absent from school, a recording of the lesson can be emailed or posted to a class website. Prerecord a daily lesson, in the event a teacher may know in advance that he or she will be absent or at an in-service for training. A connection to the Internet to access websites, content or even web-episodes and research, allows teachers to capture and integrate content into their daily lessons and integrate software programs. Math teachers can download software that emulates a graphing calculator to model for students. Interactive whiteboards can be used independently or combined with other technology, and can enhance any lesson and entice students to learn and actively participate in the classroom.

Liberty Drive Elementary School in Thomasville, North Carolina renovated a 50-year-old building and began to upgrade the schools technology. The
teachers were looking for equipment that was durable, user friendly and easily integrated into the current classroom technology. The school chose sixteen Promethean Boards along with the remote control slate that allows a teacher to operate from anywhere in the classroom, reducing classroom management problems. The learning curve on using this technology can take the average technology user the better part of a year. These teachers produce activities such as writing paragraphs in Language Arts and English, in Math studying coins and bills, moving and counting these images and classifying animals in Science, where teachers drag and drop images into categories for classification (Byrd, 2005).

Fort Worth Independent School District has made the jump into the technology world by committing to put 5000 Promethean Boards into the classrooms over the next two years, 1700 of those will be installed as of the October 15, 2008 press release. Improving technology in classrooms is also a key component of the District’s $593.6 million bond program, approved last year by voters. “These whiteboards will help our teachers meaningfully engage our students and assist in achieving our primary objective: to move Fort Worth ISD from a system of many good and great schools to a great school system,” said Dr. Melody Johnson, FWISD Superintendent, in her recent State of Education speech (Bryan, 2008, p. 1).

The district has also committed to provide training for teachers within two weeks of the boards being installed in their classroom. The initial training is only a part of the professional development plan of the Fort Worth Independent
School District that will follow to ensure that the technology will become an integral part of the classroom instruction package for teachers (Bryan, 2008, p. 1).

Today, whereas chalkboards still exist, they are losing their status as the classroom centerpiece; districts are now investing in technology to modernize classroom displays. The new display boards have come about in an age of emerging technology.

According to the American Academy of Pediatrics, kids in the United States watch an average of four hours of television a day. What’s more, a recent report from the National Academy of Sciences shows that twenty-six percent of US teenagers spend between one and two hours online a day. The statistics indicate that kids prefer to learn in a visual world and like to have information at their fingertips. Across the board, the latest and greatest classroom display products meet these needs. (Villano, 2006, p.19)

Jennings School District in Missouri turned to Smart Technologies’ Smart Boards to increase student involvement. Jennings School District has a student population in which seventy-seven percent of their students qualify for free-lunch programs. The district applied for E-Rate funds to purchase fifty-two Smart Boards for classrooms in grades three through twelve. An inquiry-based approach to learning was launched after the technology was in place. According to the instructional technology specialist, "It has forced students to find answers
for themselves and figure out how to incorporate technology to present those answers to the class” (Villano, 2006, p. 17).

In Willington, Connecticut, classrooms are busy with students engaging in a wide range of subjects ranging from math theories to the literature of William Shakespeare. The classes actively use interactive whiteboards in daily lessons, and use of the Internet in conjunction with the whiteboards has enhanced learning in many subject areas. Students are viewing videos using the whiteboard in English classes and teachers use video clips and short presentations from the web to introduce a topic they are teaching or to summarize a unit. Students are able to trace a drop of blood as it traveled through the circulatory system in science class. The interactive whiteboard allows the entire class to view the collaborative projects with other classes around the country. Students say that the whiteboards draw their attention and help them stay awake and focused in the classroom. Teachers have reported that their students are more willing to present their work to their classmates and that the quality of the projects they present to the class have improved (Hanke, 1997).

Interaction and visual stimulation were the goals set by West Middle School in Tullahoma, Tennessee. In implementing, teachers knew they would have to make adjustments in their teaching. Realizing that changes were necessary they began to seek grants for technology upgrades. After receiving their grant, the teachers chose to install interactive white boards with wireless tablets for several activities. Their activities were polling students, recording data
from students and teachers, manipulating images, solving math problems, highlighting lecture notes and e-mailing notes to students at home that were absent that day. Like other schools around the country, West Middle School discovered that the electronic whiteboard increased student enthusiasm in the classroom and increased participation in class activities (Byrd, 2005, p!1).

Research indicates that the term “Use the Interactive Whiteboard” is a statement that has solicited different responses with types of software or the type of activity. A group of teachers interpreted the phrase in a different way, but all pointed back to the type of software or program. The article then outlines six components that truly make the phrase to “Use the Interactive Whiteboard” valid. The software available varies from manufactures and need; it can be as simple as a web based program, to an installed version that is subject specific or software that demonstrates, models, shares data, guides practice, and has independent student practice components. Demonstration is always part of great teaching strategies, allowing students to see and understand the concept. Next is the modeling step that allows for the discussion of the reasoning process. The guided practice phase allows the student to practice the concepts with teacher review to make corrections and give guidance in the process. The last and final component is the independent practice phase that allows the student to work independently on the assignment, this allows for application and synthesis of the skill (Knight, Pennant, & Piggott, 2004).

Teachers report that the introduction of electronic whiteboards into the classroom does create a steep learning curve, with new software and equipment
teachers had to be able to solve problems as they arose. Introducing technology in schools can occur only with substantial financial investment. Culp, Honey, and Mandinach (2003) provide three arguments for technology investments. Foremost, technology is a tool to address challenges in teaching and learning. These uses include analyzing student data, broadening access to information resources, and encouraging creative means of writing and presenting material (Culp, Honey, & Mandinach, 2003). Subsequently, technology promotes change. It has the capacity to revise teaching styles, enrich content, and engage students. Third, technology is a central force in economic competitiveness. Technology literacy is crucial as students leave the educational system and enter the workforce. As technology integration continues in schools, change in how students are educated is necessitated. Culp et al. (2003) propose many recommendations for technological support and teacher training. In addition, he details the need for further research in this domain. If technology is being used in the classroom, then educators must understand its impact on teaching and learning. Technology integration in schools does not occur overnight; it is a process.

The CEO Forum of Education and Technology (2000) advocates four phases of technology integration for schools, which are similar to a business’ plan. First, schools assess, investigate, and experiment with technology. Second, schools make an initial capital investment. Third, schools readjust to the technology in order to maximize its use and efficiency. This likely is the phase where most schools currently reside. The last phase is the emergence of
network and organization models requiring a new sense of flexibility. The numerous types of technology being integrated in the classroom reside under the general category of Information and Communications Technology (ICT). This involves technology such as computers, e-mail, Internet, CD-ROMS, multimedia presentations, and distance learning. Wiske established three needed conditions for educators who desire technology integration. First, technology must possess significant educational value. Second, technology must be affordable (Wiske, 2000). Lastly, methodological shifts need to occur. This means that technology alone will not alter teaching practices, but teachers must change with the technology.

For technology integration to occur, (Wellington, 1999) identified several key aspects needed to promote ICT use in schools. These include access, technical support, and a positive attitude by the staff. Many teachers are traditionalists and they often are resistant to modifying their methods. As a result, persuading teachers to embrace new technology can pose a particular challenge (Vail, 2003). Zhao and Cziko (2001) studied teachers’ implementation of ICT. They discovered that for teachers to incorporate ICT in the classrooms, they must believe that a piece of technology will be effective at reaching a specified instructional goal and that it will not cause disturbance in the process. Once schools have invested in technology, Zhao and Cziko (2001) found that teachers must grasp onto the technological transformations in order for technology to succeed. Appropriate incorporation of ICT develops the capacity to enhance teaching and learning (Sutherland et al., 2004). Technology by itself
does not improve learning, but it can empower new methods of teaching and learning (Kirkwood & Price, 2005). For this to be accomplished, Furr et al. (2005) argue that technology must be viewed as a means to reach a goal. It is just one of the various tools used in classrooms to enhance instruction. As teachers use ICT they should be realigning and further developing their teaching methods (Sutherland et al., 2004). According to Wheeler (2001), a teacher’s role changes with technology use. As such, teachers cannot maintain status quo with the emerging technologies. A significant reason is that the resources change.

Tools common in today’s classroom, such as blackboards, may soon become obsolete. Wheeler further argues that teachers need to be creative and explore the many uses of ICT because it can transform the knowledge of a teacher’s subject area. For maximum technology effectiveness, Sutherland et al. (2004) also believe that a balance must exist between whole class and individual technology use since it is the individual interaction with technology that energizes students. Successful technology implementation relies on professional development (Venezky, 2004). Iding, Crosby, and Speitel (2002) obtained suggestions from teachers on the school’s role in supporting teacher interest in computer use. The most frequent response was for schools to provide workshops and in-service training. However, in the many schools Venezky researched across the world, he found that professional development often is not budgeted in the schools. The schools that did implement training found it to be successful in promoting technology use by teachers. For example, in one school teachers could schedule assistance from other teachers. At another setting, a
core group of teachers were trained, who then assisted other teachers with technology. Many other schools developed on-the-job staff development. All these programs allowed technology use to flourish as teachers were taught technology skills and methods for integrating technology in pedagogy. These findings were echoed by Pelgrum (2001) as he reported that new technology requires proper training to succeed. Research also has shown that the training needs change as teachers become more proficient with technology. Both technical and instructional support is required as teachers expand technology use in the classroom (White et al., 2002).

The electronic whiteboard has enabled students to experience a large range of examples, both visual and conceptual, during instruction. While considering the educational implications, teachers will need to consider two aspects with regards to creativity. First, how does this technology provide teachers with opportunity to teach creativity and second how does this encourage students to develop creativity?

Technology Perceptions

Students’ perceptions of technology is fundamental in recognizing its role in the educational process, and numerous studies have been completed on this matter. Turman explored the influence of students’ original perceptions of a college course and its instructor according to the level that instructional technology was in use. Instructional technology was manipulated in four conditions: no use, minimal use, moderate use, and complete use during this study (Turman, 2005). The classes with moderate technology integration
received the most positive evaluation by the students. This finding illustrates that, although technology is valued, students still desire face-to-face connections with their classroom teachers. Zhang and Deng (2004) researched college students’ perceptions of learning in a multimedia classroom compared to a traditional classroom. How the students perceived their learning and the instructors’ teaching methods were analyzed by surveys. No difference in the perceptions of achievement was found. However, the researchers did report a significant difference in the students’ perceptions of the instructor’s teaching methods. Students observed the multimedia classrooms to be more student-centered and interactive (Zhang & Deng, 2004). The students also stated that although technology enhanced a class, it still was the instructor who made the substantial difference in their perceptions of overall effectiveness. Butler and Mautz (1996) performed a similar study in researching the effects of multimedia presentations compared to traditional presentations in a more controlled setting. They reported that the multimedia group held more positive attitudes toward the presentation and speaker. Those in the multimedia group also perceived that they were learning more than did the non-media group (Butler & Mautz, 1996). The use of specific presentation multimedia tools, such as PowerPoint, has resulted in multiple studies assessing students’ perceptions and benefits. All of the reported studies have been completed at the college level. Koeber (2005) assessed students’ perceptions of teaching with the use of PowerPoint and a class website. No significant change was observed with student grades, but an effect was observed on the effectiveness and attitudes toward the course with
the technology. Students indicated that the PowerPoint presentations resulted in the teacher appearing organized and prepared. Its use also was viewed as increasing teacher control and assisting student understanding. Koeber concluded that even though technology did not affect grades, it still impacted learning because it improved other important aspects of the learning process. Apperson et al. (2004) also assessed the impact of PowerPoint on students. In their study, students reported that PowerPoint increased their ability to focus and increased their likelihood of learning from class presentations. Although the students indicated that PowerPoint use affected their learning, grades were not significantly different between those who were taught with PowerPoint and those who were taught without it. Similar to Koeber's (2005) study, PowerPoint seemed to result in a better class experience rather than student grade point average gains. Susskind (2005) compared students' perceptions of PowerPoint compared with traditional lecture instruction. He found that students reported a clear preference for PowerPoint presentations because the lectures appeared more organized and were perceived as more interesting and enjoyable. Students viewed themselves as more effective in the class with PowerPoint. However, significant achievement gains were not observed relative to student grades. Students' motivation decreased when the professor moved from using PowerPoint to traditional instruction. PowerPoint's limitations also were measured and students reported a decrease in classroom spontaneity because the lessons seemed more pre-planned than traditional lectures. Nowaczyk et al. (1998) found that questions and discussions may not occur as often when
PowerPoint is used, when compared to the traditional lecture format. Analogous to other studies, Susskind (2005) concluded that the beneficial effects of PowerPoint are relatively subjective, rather than objective (e.g., increase in students’ grades). Frey and Birnbaum (2002) also reported on students’ positive perceptions with the use of PowerPoint. Similar to other studies, students perceived professors who used PowerPoint as more organized. Students believed that PowerPoint presentations helped hold their attention. One trade-off students perceived with PowerPoint’s use was that it may quicken the class’ pace. Overall, Frey and Birnbaum concluded that PowerPoint was a valuable educational tool. Szabo and Hastings reported similar effects with PowerPoint’s use. Students found that lectures utilizing PowerPoint software were more interesting and better structured than lectures without PowerPoint. Again, students perceived that PowerPoint was beneficial to learning, but achievement gains were not established. Szabo and Hastings concluded that PowerPoint often is viewed by students as entertainment rather than as an education tool. They asserted that it should be used as a supplementary medium to improve learning and not as a replacement for the blackboard (Szabo & Hastings, 2000). More specifically, effects on integrating technology into the science classroom have been researched as well. Donaldson studied students’ perspectives in integrated biology classrooms across grade levels. Overall, it was found that student interest in biology increased with technology use (Donaldson, 2001). Pedretti et al. (1998) analyzed the perspectives of teachers and students in technology-enhanced science classrooms. Students in these groups were aware
of the different teaching methods utilized compared to their traditional classes. The value students placed on technology often depended on their previous experiences and personal preferences.

Learning and Instruction

Classroom instruction can be enhanced by the use of interactive electronic white boards. The effect of technology on student learning depends on the teacher, the pedagogical approach adopted by the teacher, the resources employed during the delivery of instruction, and the intended learning outcomes (Cox & Abbot, 2004). Interactive electronic white boards present a multitude of benefits for teaching, learning and assessing students, including efficiency, versatility, multi-mode presentation, and interactivity (Kennewell & Beauchamp, 2007).

Teachers who used interactive electronic white boards realized the benefits for children: image manipulation was just as important to very young students as being able to write or draw on the board; hands-on opportunities provided a quick ego boost to the selected student increasing his motivation, but also cognitively engaging all students who were able to imagine themselves in the place of the student at the board; and the flipchart aspect of interactive electronic white boards allowed each student to have their own page, thus adding the personalization and individualization of the entire learning environment and assessing with student response devices for instant feedback (Kennewell & Beauchamp, 2007).

Using an interactive electronic white board in the classroom provides
collaborative opportunities for reasoning, learning and interpretation. Hennessy et al. (2007) argue that interactive electronic white boards in instruction give the instructor and students opportunities to view and manipulate ideas and materials presented on the large screen, offer their subjective reactions and thoughts, and engage in extensive elaboration and exchange of ideas, leading to development of new meanings and understandings about new concepts. Interactive electronic white boards support very visible activities, shared learning, and potentially support deeper learning. Instructional technology supports speed, automation of routine tasks, range of available resources, the facility to change content, interactivity in the form of the ability to respond repeatedly to user input and storage of large amounts of materials (Kennewell & Beauchamp, 2007).

The interactive electronic white board supports a smooth transition from a prediction activity into instruction through its ability to accommodate a video clip, a focusing tool or a graphic organizer. Science teachers can use the facilities of the interactive electronic white boards to identify gaps in student knowledge. For example, when students in an interactive electronic white boards class were asked to identify distinctive functions of body parts, they were able to re-order items on the board repeatedly until the process of each body part became a certainty in their minds. Such re-ordering and manipulation allows students to move beyond the mental visualization of important concepts, to the actual visualization (Hennessy et al., 2007).

Interactive electronic white boards bring different advantages to different content areas. Students find it particularly effective with math, but also find that...
they pick up technology skills through the interactive electronic white board’s visibility of technological processes. It is less effective in language arts instruction (Moss et al., 2007). Students found the interactive electronic white board added positive aspects to lessons. In particular, the interactive electronic white board adds a sense of realism to instruction and the ability to demonstrate understanding because students can actually see what is happening in the process, rather than having to visualize the teacher’s verbalizations (Wall et al., 2005). The board has some powerful features, the ability to print out the contents of the board and then undo incorrect actions. Printing the displayed material serves as a bridge between the public learning arena and each student’s private learning space in the classroom (Hennessy et al., 2007).

Research on the interactive electronic white board’s impact on student achievement indicates that when technology is used properly, student achievement increases and the value of the interactive electronic white board becomes clearer when one focuses on how it can improve teaching and instruction. Advantages to the whiteboard include the ability to face the class for a longer period of time due to advance preparation of materials (Kelley, Underwood, Potter, Hunter, & Beveridge, 2007). Teachers appear to be more efficient in their instruction, increases bell to bell instruction, the transition is smoother between activities in a lesson; provide more professional delivery of multimedia resources; flow seamlessly from one teaching point to the next; accelerate the pace of lesson; reduce time spent fumbling with multiple resources, and maximize their lesson readiness, where the lesson begins
straightaway, rather than students having to wait for handouts, for the teacher to write on the board, draw charts or tables, and the like (Kelley et al., 2007).

States are successfully utilizing instructional strategies in their integration of technology into instruction. For example, Missouri’s eMINTS program. eMINTS focuses on innovative instructional processes, and supporting elementary teachers to develop student-centered, inquiry-based instructional practices through multimedia and computer technology (eMINTS, 2002, p. 2). Program evaluations involved studies comparing students in eMINTS classrooms with those in non-eMINTS classrooms in the same grade at the same school. The results have revealed statistically significant differences in the performance of eMINTS students to non-eMINTS students across subject areas (eMINTS, 2002, p. 4).

Other states like Michigan’s Freedom to Learn (FTL) program provides laptops for students in a number of the state’s middle schools along with extensive teacher professional development around technology integration and curriculum enhancement. Evaluations show that students participating in Freedom To Learn had significantly higher levels of engagement in their work and in using technology as a learning tool when compared with national averages (Lowther et al., 2005). The results are consistent for school years 2004–2005 and 2005–2006 (Lowther et al., 2007; Ross & Strahl, 2005). In one notable Freedom To Learn school, 8th grade math achievement doubled from 31% to 63% between 2004 and 2005, and science achievement jumped from 68% to 80% between 2003 and 2004. Results like these are making this new
technology more valuable to schools and districts to enhance student learning and teaching.

The Technology Immersion Pilot (TIP) for Texas middle schools showed fewer discipline problems and increases in student technology proficiency and use. As with Freedom To Learn, these results were consistent across school years 2004–2005 and 2005–2006 (Shapley et al., 2006, 2007). Students in a middle school saw their math achievement scores increase by 5% among 6th graders, 42% among 7th graders, and 24% among 8th graders. These results have pointed to the importance of teacher professional development and engagement as key factors influencing these outcomes (Wolf, 2007, p.2).

Students are able to make connections with prior knowledge and assist in building new knowledge with activities on the white board. Most of the Multiple Intelligences can be used and stimulated by the interactive electronic white boards. Teachers can create exciting, interactive activities that include music and videos and use content from packaged curriculum programs. This allows students to follow along during instruction and use web-based programs that are designed to engage students.

Some of these studies have one thing in common, the need for the correct implementation of technology into teaching and learning. Simply purchasing computers and practice software is not enough. Alignment of the software to curricular standards, effective school leadership, and professional development are equally as important.

Correct implementation of education technology is key. The research
demonstrates the need for the correct implementation and use of education technology. ISTE has identified seven factors for successful technology implementation; (a) Effective professional development for teachers in the integration of technology into instruction is necessary to support student learning; (b) Teachers’ direct application of technology must be aligned to local and/or state curriculum standards; (c) Technology must be incorporated into the daily learning schedule (i.e., not as a supplement or after-school tutorial); (d) Programs and applications must provide individualized feedback to students and teachers and must have the ability to tailor lessons to individual student needs; (e) Student collaboration in the use of technology is more effective in influencing student achievement than strictly individual use; (f) Project-based learning and real-world simulations are more effective in changing student motivation and achievement than drill-and-practice applications; and (g) Effective technology integration requires leadership, support, and modeling from teachers, administrators, and the community/parents (Gysbers & Henderson, 2002; Honey, 1999; Mann et al., 1999; and Penuel et al., 2002).

Differentiated Instruction

Differentiation is a complex and sometimes perplexing concept. Tomlinson (1999), the main authority in this field, defines this instructional orientation as follows:

Differentiated instruction is not an instructional strategy or a teaching model. It’s a way of thinking about teaching and learning that advocates beginning where individuals are rather than with a
prescribed plan of action, which ignores student readiness, interest, and learning profile. It is a way of thinking that challenges how educators typically envision assessment, teaching, learning, classroom roles, use of time, and curriculum. (p. 108)

Most classrooms have diverse levels of students learning in the classroom: some are on grade-level; some exceed expectations; there are students that are below grade-level; and some students are extremely below grade-level. Many teachers attempt to meet the needs of all students by differentiating instruction. Differentiated instruction at its most basic level is the effort by the teacher to respond to the variances among learners in the classroom (Tomlison, 2000). Teachers work with individual students, small groups and vary teaching strategies to create the best learning environment possible.

Teachers can differentiate through four classroom elements based on student readiness, interest, or learning profile: (a) content—what the student needs to learn or how the student will get access to the information; (b) process—activities in which the student engages in order to make sense of or master the content; (c) products -culminating projects that ask the student to rehearse, apply, and extend what he or she has learned in a unit; and (d) learning environment—the way the classroom works and feels (Tomlison 2000).

Differentiating content can be better defined with examples at the elementary level, it may include but it not limited to: (a) using reading materials at varying readability levels; (b) putting text materials on tape/cd or ipod; (c) using
spelling or vocabulary lists at readiness levels of students; (d) presenting ideas through both auditory and visual means; (e) using reading partners; and (f) meeting with small groups to re-teach an idea or skill for struggling learners, or to extend the thinking or skills of advanced learners (Tomlison 2000).

The process of differentiating instructional activities at the elementary level can include the following: (a) leveled activities in which all learners work with the same important understandings and skills, but proceed with different levels of support, challenge, or complexity; (b) providing interest centers that encourage students to explore topics of particular interest to them; the centers can be review of previous skills, current skills or skills that need to be remediated; (c) developing task lists written by the teacher and containing both in-common work for the whole class and work that addresses individual needs of learners. Creating contracts in which students agree to complete specific activities for spelling, reading skills and math, these can be completed either during specified time or as students complete other work early; (d) the use of manipulatives or other hands-on materials for students; and (e) varying the length of time or the length of an assignment. Students may be assigned odd/even problems. The focus of learning is quality of the skill, not quantity.

Differentiating products at the elementary level can include the following: (a) giving students options of how to express required learning (e.g., create a puppet show, write a letter, create a power point or develop a mural with labels), usually students will use their main learning style to share information; (b) using rubrics that match and extend students' varied skills levels; (c) allowing students
to work alone or in small groups on their products; and (d) encouraging students to create their own product assignments as long as the assignments contain required elements that match the designed rubrics.

Differentiating the learning environment at the elementary level can include: (a) making sure there are places in the room to work quietly and without distraction, as well as places that invite student collaboration; (b) providing materials that reflect a variety of cultures and home settings; (c) setting out clear guidelines for independent work that matches individual needs; (d) developing consistent routines that allow students to get help when teachers are busy with other students and cannot help them immediately; and (e) helping students understand that some learners need to move around to learn, while others do better sitting quietly (Tomlinson, 1995, 1999; Winebrenner, 1992, 1996).

Successful differentiated instruction varies due to numerous factors. The most important factor is the instruction that teachers differentiate is high-quality curriculum. The curriculum should be clearly focused on the information and understandings in a particular content area. Essential goals and understandings are designed through lessons, activities and products. The materials and tasks are interesting to students and seem relevant to them. The learning is active and there is joy, satisfaction and ownership in learning for each student.

A significant determining factor is flexible grouping of the class. Teachers plan extended periods of instruction so that all students work with a variety of peers over a period of days. Sometimes students work with like-readiness peers, sometimes with mixed-readiness groups, sometimes with students who have
similar interests, sometimes with students who have different interests, sometimes with peers who learn as they do, sometimes randomly, and often with the class as a whole. In addition, teachers can assign students to work groups, or learning partners and sometimes students will select their own work groups. The flexible grouping strategy allows students to see themselves in a wide range of situations and aids the teacher in “auditioning” students in different settings and with different kinds of work (Tomlinson, 1995, 1999).

Another important component of differentiated instruction is assessment. The assessment can be formal with a written form, informal by observation or interview and using a rubric specifically designed to measure a students learning. The assessment should also measure what weakness remains. When assessment is clearly rooted in what is happening in the classroom, the teacher is much more likely to gain a clear and accurate picture of each student’s needs and successes. These assessments are ongoing and occur throughout the learning process. Traditionally, assessment is summative, or given at the end of a unit to find out what the students have and have not learned. In a differentiated classroom, assessment is also formative, or ongoing and diagnostic. This type of assessment gives data on readiness, interests, and learning profiles, allowing the teacher to modify ongoing instruction. This data can come from small group discussions; journal and portfolio entries; interest surveys; skill inventories; pre-tests; and exit cards, to name a few. Summative assessment is still used at benchmark points, such as the end of a unit, to formally record student growth. Even with this more traditional application, assessment can be performed in
varied ways so that students can show their full range of knowledge (Tomlinson, 1999).

The interactive electronic white board can be used to differentiate instruction in the diverse classroom. In whole group instruction, the board can be used to manipulate counters in math, visit exotic locations through websites or participate in a webisode about chemical change. In whole group use, the interactive electronic white board can energize the classroom and encourage students to participate in learning. The board can also be used for small groups to construct a power point of information about the Earths structure, create a paragraph describing the benefits of the rain forest, and model division of whole numbers by decimals with counters. The interactive board can also be used for individual instruction that can be leveled to meet the needs of individual students.

The Sony Play Station and Plato learning has designed a diagnostic and prescriptive program that targets areas of need for each student based on skills. Students progress through a learning game or activity about nouns or verbs. The student reviews an instructional section that identifies nouns or verbs. The student or students then "play" the game while practicing the skill at hand, each level of success relates to mastery of the skill. The white board can serve as a tool for instructing students in whole group, small group or even individual learning.

**Benefits of Educational Technology**

Interactive electronic white board use in the classroom affords many benefits as it creates a rich learning environment (Heide & Henderson, 2001). As
a result of more than a decade of research, The Apple Classrooms of Tomorrow reported multiple benefits of educational technology in the classroom (Apple, 1995). At the end of their first year of research, in the late 1980s, they reported the following outcome measures: students were performing well (or better) on tests, students wrote more effectively, and students finished units of study ahead of schedule. Also, the fear of student isolation that many had expressed regarding technology did not occur with these students. Rather, students collaborated more and remained interested in the technology, even with continued use.

Dwyer (1994) reported a summary of the many lessons learned through the Apple Classrooms of Tomorrow project. Initially, technology impacts learning by encouraging different forms of interactions. The classroom moves from being teacher-centered to being learner-centered, and the student moves from being a listener to being a collaborator. Second, technology engages students to higher-order cognitive tasks. This is accomplished through problem solving activities and real-world projects. To conclude, technology causes teachers to question assumptions of traditional instruction and learning.

Driscoll (2002) suggests four means by which technology can facilitate learning. Primarily, learning occurs in context and computer stimulations can easily provide real world types of situations to promote learning. Next, learning is active and visualization software can substantially enhance this active learning. Furthermore, learning is social. Technology use often requires interaction with others to achieve a prescribed goal. Finally, learning is reflective. As a result,
technology can increase learning by promoting feedback and communication in and outside of the classroom. Multiple studies have demonstrated potential benefits of technology for students and teachers. For example, Rodrigues (2003) completed a study in which ICT was implemented in three modes. For all three methods of integration, students reported increased motivation and interest. They enjoyed working with the multimedia aspects of ICT and found it interesting. The Apple Classrooms of Tomorrow also reported a positive impact on student engagement with the use of technology (White et al., 2002). This was especially true when technology was used as one of the many tools in the classroom.

Technology possesses multiple potential benefits including enlivening class, stimulating learning, and providing student feedback (Furr et al., 2005). Teachers often use technology because they realize the benefits for the learner (Demetriadis et al., 2003). Teachers themselves also may benefit from technology use. It allows the enhancement of instruction, the simplification of administrative tasks, and the promotion of professional growth. Technology use also can result in enhanced classroom performance, and it often increases personal productivity (Teachers and Technology, 1995). The CEO Forum on Education and Technology (2001) also reported that technology alters the process of teaching and learning. In many cases, it improves teacher presentations and practices, and increases teacher and student satisfaction.

Although educational technology holds numerous benefits, it also possesses limitations. White et al. (2002) reported that a lack of technical support is the major barrier with technology use. Wood et al. (2005) researched
teachers’ perceived barriers to effective technology classroom use through surveys and focus group discussions. This was performed by random selection of 144 teachers from a mid-sized Canadian city.

They found that the presence or absence of support was the issue most discussed by secondary level teachers. The needed support included materials, Internet, software, and training. It also included human resources such as technology technicians and librarians. The second most prominent issue discussed by teachers involved pedagogy. The teachers surveyed desired instruction on effectively integrating technology into their teaching methods. The third issue discussed by secondary teachers was student variables such as their motivation, skills, and characteristics. Wood et al. (2005) reported that the observation of another teacher who is knowledgeable and excited about technology can become a catalyst for other teachers to begin incorporating technology into their own classrooms. In sum, training key teachers in technology use would be one avenue of reducing the barriers of use. Similar to the technological limitations reported by Wood et al. (2005), Iding et al. (2002) reported from their survey that many teachers were unaware of software’s availability, and others were concerned with the time required to manage it properly. They indicated that technology, such as creating websites or PowerPoint, involves a substantial amount of time by most teachers. However, many teachers report that the initial time is worth the investment since technology use becomes easier with time (DenBeste, 2003). Wellington (1999a) indicated similar responses from chemistry teachers who were questioned about
barriers in implementing multimedia technology. These included lack of technical support, lack of facilities, technical problems, lack of teacher confidence, and time. In short, teacher training is the main limitation to technology, and this can be overcome with apt professional development and teacher collaboration.

The literature can be categorized as selection of technology, choosing from the eight or nine equipment providers that range with a variety of equipment and packages that meet the many needs of varying educational settings. The largest component is the curriculum integration of the technology, the variety of levels range from the use as glorified overhead projector to a pure tool of learning, allowing students to interact and manipulate data to enhance the learning environment. The elements of student response and assessment make the electronic whiteboard a tool of instant feedback that can be used to check for understanding, mastery of skills and concepts. The students’ increased enthusiasm of focusing on the lessons presented and the increased interaction of students where they are encouraged to pose questions, identify problems, application and synthesis skills make the electronic whiteboard a useful instrument in educating students in this electronic world. The largest challenge of using an electronic whiteboard will be the total shift in the way that teachers think about teaching and learning in the classroom and the learning curve of the technology itself.

The study will be instrumental in gathering data to determine whether there is a relationship between the use of interactive electronic whiteboards and student success in 5th grade classes. The study will compare the test data
(MCT, current grades, CBT) with 5th grade classrooms that do not use interactive electronic whiteboards.

Summary

The research conducted on the use of interactive electronic whiteboards technology in education is relatively new. Interactive electronic white boards are a topic at the forefront of educational issues. Specifically the accountability of student performance and teachers recognizing that interactive electronic white boards are an important resource and should be a priority for all stakeholders in education.

Professional development for teachers will give the much needed support and guidance to gain the confidence to make technology a regular component of their curriculum. Research regarding teacher perceptions on the implementation of technology indicates that teachers must have a positive attitude approaching technology in the classroom. This will make this method of learning exciting for students in the classroom. Some students in elementary school, as well as older students, have more knowledge about technology than some teachers. By involving them in planning and using the interactive electronic white boards in the classroom, student leadership among students is also promoted (Middleton & Murray, 1999).

Challenges in securing funding to implement this technology does present issues especially in the current economic times. The benefits of this technology is important for meeting the requirements of No Child Left Behind and raising the levels of student achievement. The new federal economic stimulus plan has
made the funding for technology projects more accessible to districts and teachers.

The availability of this new advanced technology is making students active learners and engaging them in content as they gain deeper knowledge of curriculum, which is measured in classroom and standardized assessments. Technology is proving to be a valuable resource in meeting the requirements outlined in No Child Left Behind. Teachers are realizing it offers innovative methods and this technology is transforming how teachers teach and how students learn.
CHAPTER III
METHODOLOGY

Introduction

The methodology section includes information about the design of the study. Included in this section is the participant’s background detailing the demographics of each district. The researcher is providing a detailed description of the procedures that were followed while conducting the study. The details include the rationale and types of tests that were used to examine the data collected and a discussion of the manner in which to draw conclusions from the data.

The purpose of this study was to determine the effect of interactive electronic white boards, an advanced technology, on the academic performance of kindergarten through fifth grade elementary students. The participants in the study were asked to gather student data by term/semester. Teachers were given a questionnaire that requested data about demographics, education, professional development, technology perception and interactive electronic whiteboard use. The results of the study are available to all participants upon request now that the final written document of the results of the study has been prepared. The time frame for this study is one year from the approval of this study from the Internal Review Board. This research will provide educators with important information on how to effectively integrate technology to increase student success.
Research Design

The design of this study was causal-comparative research. The study was designed to examine the following independent variables and the impact or effect it has on students’ achievement in a Kindergarten through fifth grade elementary classroom. The independent variables were as follows: level of degree the teacher holds, national board certification of the teacher, the time spent actively using the board in the classroom, and use of student response devices. The independent variables also investigated the teacher's perception about ease of use of an interactive electronic white board in the classroom, and administrator and teacher perception of student participation and enthusiasm.

The dependent variables collected were term grades and content by term grade or nine weeks test for available terms. These grades were collected from each teacher, based on general subjects, such as math, language and reading. Some teachers’ instructional responsibilities were for a single subject, two subjects or as a self-contained teacher responsible for all subjects.

Participants

Participants of the study were kindergarten through fifth grade teachers from sixteen urban school districts in a southern state, they received a questionnaire and data sheets. The number of participants was approximately 650 teachers of about 15,300 students. All teachers in the seven districts that participated in the study were teaching kindergarten through fifth grade students in self-contained, teams or departmentalized situations.

Permission was obtained from the university Internal Review Board
(Appendix A). Permission letters were sent to each district’s superintendent (Appendix B) to gain permission to conduct the study. Once the superintendents’ permissions were granted (Appendix C), questionnaires designed (Appendix D) specifically for this study were distributed to all kindergarten through fifth grade teachers. Questionnaires were mailed or hand delivered by the researcher. Along with the questionnaires, the following documentation also accompanied the information: (a) letter to the director or principal of the elementary schools (Appendix E) describing the study and its purpose and (b) a participant information letter (Appendix F) and self-addressed envelope for return of the questionnaires. All individuals were informed they are free not to participate or to terminate their participation at any time without penalty. When questionnaires were returned, the researcher entered the data gathered from the questions into SPSS software program. The data will be held for a time period necessary for all data to be entered. The questionnaires were held in a secured lock box in the researcher’s home. After the period necessary to input all of the data into the SPSS program, the questionnaires were destroyed. The researcher analyzed the data within SPSS and wrote the results of the study into document form. The results of the study are available to all participants upon request. The time frame for this study should be one year from the approval of this study from the university Internal Review Board.

District 1 had 1,438 elementary students of which 57.6% were classified as socio-economic status, which qualified students for free or reduced lunch. The ethnic data for district 1 was White 92.4% and Black .05%. District 2 had 1,434
elementary students of which 47.4% were classified as socio-economic status, and the ethnic data for district 2 is White 66.9% and Black 26.0%. District 3 had 2,145 elementary students of which 36.5% were classified as socio-economic status, and the ethnic data for district 3 is White 85.7% and Black 8.1%. District 4 had 1,871 elementary students of which 71.8% were classified as socio-economic status, and the ethnic data for district 4 is White 26.1% and Black 72.6%. District 5 had 584 elementary students of which 21.3% were classified as socio-economic status, and the ethnic data for district 5 is White 81.5% and Black 10.9%. District 6 had 3,710 elementary students of which 62.1% were classified as socio-economic status, and the ethnic data for district 6 is White 42.1%, Hispanic 10% and Black 46.5%. District 7 had 2,090 elementary students of which 49.4% were classified as socio-economic status, and the ethnic data for district 7 is White 88.3% and Black 10.1%.

The sample size was selected from a southern geographic area in which the researcher resided and had reasonable general access to the districts and personnel.

Instrumentation

The researcher used a self-designed instrument (Appendix D) that sought information about interactive electronic whiteboards use in the classroom, teacher certification, time spent using the interactive electronic white boards, student response devices, teacher and student perceptions of interactive electronic white boards use. The instrument inquired about information that is qualitative in nature through a variety of questions that included basic
demographic information. The instrument asked the participants to collect student data from term test and term grades. The instrument contained open-ended questions designed to collect multiple amounts of information.

The instrument was designed with three sections. Section 1 required demographic information with five questions about the participants. Teacher, trainers and administrators gender, teaching experience, degree level, certification and area of certification, and National Board Certification.

Section 2: Interactive Electronic White Boards Data gathered information about use of the interactive electronic white board in the classroom by the teacher with six questions. Technology in the past has been directed at the students. These boards directly support teachers in the act of teaching (Synder, 2006). Questions in this section were about type of board used, programs used, use of Internet web-based programs and sites, number of minutes used in the classroom and use of and type of student response devices. This section includes the Likert Scale to gather information about participant perception of the interactive electronic white board. The scale is friendly and easy to understand, it is also flexible, economical and easy to construct. There are 16 Likert Scale questions that teachers, trainers and administrators will use to translate and measure perception of student engagement, ease of use, and perceived attitudes about the board. The scale is a five-point scale with strongly agree represented by five and strongly disagree represented by one.

Section 3 contained the student data information sheet. Teachers listed requested data that includes, gender, ethnicity, term and semester grades for
Language, Reading, and Math, as well as the nine weeks or term grades for term 1 and 2.

The questionnaire collected data that assisted in determining the relationship of the interactive electronic white board to perceptions of change in student performance (questions 3 and 8) perceptions of effective delivery tools questions (2, 5 and 10). The perception of student engagement was associated with, questions (1, 4, 6, 7, and 9). The perception of levels of teacher and trainer satisfaction, questions (11, 12, 13, 14, 15, and 16). The utilization of white board for delivery of course content, questions; electronic white board, question 6. The perception of teacher attitudes and the change in student performance; questions (4, 5, 6, 7, and 9). The level of degree certification and the effect on student success, question: teacher data 4. National Board Teacher Certification’s effects on student achievement, question: teacher data question 5. Professional development effect’s on student success in the classroom electronic white board, question: 4. Perception of student achievement increased time in use of interactive electronic white board.

The physical appearance of the questionnaire is clean and sleek, the layout was done in Survey Monkey, a web-based survey program that allowed the instrument to be four pages with a total 29 questions. The development of the questionnaire resulted from research into the use of interactive electronic white boards as an instructional tool for teachers in the classroom as well as a personal aspect, The researcher has used an interactive electronic white board in the classroom for the last four years and has experienced the impact that the
board has had on student learning and instruction. In serving as a trainer for this technology, the researcher has assisted teachers with integrating curriculum to enhance student learning. The researcher enjoys discovering new ways to make connections to prior knowledge while introducing and mastering new skills, utilizing technology to assess students with student response devices to instantly check for mastery or to assist in developing a remediation plan for students that do not meet mastery.

A group was selected to review the instrument with most of the members holding advanced degrees in education, and one being a recent graduate holding a Ph.D., in Leadership and Research. The group considered each of the stems for accuracy, structure and design. The group determined that each question measured attributes of the study. To assist in validity of the instrument and ensure that a participate does not just fill in a column. Each statement in the perception section was reviewed for being written in the reverse format.

A pilot test was conducted at a local elementary school to help determine the reliability and validity of measurement. A Cronbach’s alpha was conducted to test/determine internal consistency of the questionnaire with a reliability of .871.

The goal was to construct a questionnaire that was simple to use and understand. The questionnaire was created with the understanding that mistakes in the format and questions can affect the validity and reliability. The reliability ensured the instrument was stable, consistent, and uniform in yielding results. Reliability was supported by validity, the appraisal of the instrument to measure what it is intended for.
An effective survey relies on high response rates, low response rates can hinder the credibility of the result because it does not represent the target population. A major reason of failure to respond to the questionnaire is time. To help ensure that response to the survey is accurate, the questionnaire was designed with questions that are clear and concise. Question formats were consistent and remained consistent with directions that were explicit and easily understood. The instrument was designed with a pleasing aesthetic that is consistent throughout the document. Another step to help increase return rates was to contact participants through an email and inform them of the pending arrival of the questionnaire.

**Procedures**

After obtaining permission from the Internal Review Board (Appendix A), a permission letter to each district’s superintendent (Appendix B) was sent to gain permission to conduct the study. Once the superintendents’ permissions were granted, (Appendix C) questionnaires designed (Appendix D) specifically for this study were distributed to all kindergarten through fifth grade teachers in the seven urban school districts in a southern state. Questionnaires were mailed or hand delivered by the researcher, along with the following documentation: (a) A copy of the superintendent’s letter with permission form (Appendix B); (b) A letter to the director or principal of the elementary schools describing the study and its purpose (Appendix E); and (c) A self-addressed envelope for return of the questionnaires. All individuals are free not to participate or to terminate their participation at any time without penalty. In the informed consent letter (Appendix
F), the researcher stated that the questionnaire was voluntary and kept confidential. The questionnaire did not have any questions asking for the individual(s) to reveal his or her name. An explanation of the procedures and purpose, a description of any benefits that could reasonably be expected from participating, an offer to respond to inquiries regarding procedures, and instruction on the right to refuse to participate or to discontinue participation at any time without prejudice were provided. Any concerns a teacher might have had with respect to providing information was taken into consideration.

The researcher asked the principal to distribute the questionnaires to the kindergarten through fifth grade teachers. They also designated a return date so that the questionnaires were collected and returned in a timely manner. The participant used the supplied mailing envelope or made contact by phone to personally retrieve the instrument and data.

As the questionnaires were returned, the researcher entered data gathered from the surveys into SPSS software program. The data was held for a time period necessary for all data to be entered. The questionnaires were held in a secured lock box in the researcher’s home. After the period necessary to input all of the data into the SPSS program, the questionnaires were destroyed. The researcher began the analysis of data within SPSS and formulated the results of the study into document form. The results of the study are available to all participants upon request.

Data Analysis

The researcher entered the data into PSAW and recode the data to
represent numeric values; then descriptive statistics were calculated for all of the variables and discuss any areas that contained abnormal data or outliers. The descriptive statistics allowed the researcher and readers to examine information pertaining to the study participants. The researcher and the reader determined how many participants possess national board certification advanced and determined the length of time that an interactive electronic whiteboard was used in a classroom.

The data analysis for this causal-comparative study used an inferential statistic design of a t-test. The independent t-test was used to test the significance of a difference between the means of the experimental and control groups in the study. An independent sample t-test was conducted to determine if the targeted variables have a statistically significant impact on student learning and achievement. An ANOVA was performed with the data, a Tukeys multiple comparison also was calculated to determine the relationship to student success and the amount of time that an interactive electronic white board was used during instruction. If the results were statically significant, district and school leaders would possess valuable information to determine the financial investments that the districts will have to make.

Summary

The researcher followed the guidelines for conducting the study and worked to ensure that all participants experienced a high level of security and confidentiality. Descriptive statistics provided the reader with information pertaining to the participants in the study. The independent sample t-test
provided the researcher with an understanding of the effect of the target variables on the impact of student achievement.

This study was aimed at determining if advanced technology impacts student academic performance. Research has supported the positive impact of advanced technology on instruction, as well as teacher perception, attitudes, and achievement. The data collection included administrators' views on the impact of technology as well as teacher perceptions and student engagement. Student scores were also collected, focusing on changes in levels of performance with the interactive electronic white boards as compared to levels of performance without.

Teachers and administrators were directly contacted for permission to participate in the study. Their test scores were obtained through the participating school administration and teachers. The goal of the study was to determine if advanced technology is worth the financial input and staff development hours of teachers. The findings of this study can be used in making important decisions concerning future investments in technology.
CHAPTER IV
RESULTS

Introduction

The study investigated the use of electronic interactive white boards on the academic performance of kindergarten through fifth grade elementary students. The data collected was the demographic data of teachers by gender, age, years of experience, years in current position, and level of certification including Nation Board Certified Teacher. The teachers provided student data for math, reading and language arts for semester one as well as term test grades for terms one and two. Teachers and administrators also answered questions regarding their perception of the use of interactive electronic white boards in instruction.

The data was collected from seven school districts from a southern state, with 27 elementary schools that instructs kindergarten to fifth grade students. The instructional environments were self-contained, team teaching or departmentalized situation. The researcher distributed 675 questionnaires and collected 260 with a return rate of 39%, 48 questionnaires were returned with no student data attached, 35 were kindergarten teachers that assess by benchmarks and do not give grades, the remaining 13 did not complete the student data section for unknown reasons.

Descriptive Data

The Descriptive statistics for the data collected during this research study is as follows:
### Table 1

*Gender*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>239</td>
<td>92.6</td>
</tr>
<tr>
<td>Male</td>
<td>19</td>
<td>7.4</td>
</tr>
</tbody>
</table>

### Table 2

*Years of Teaching Experience*

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>25</td>
<td>9.7</td>
</tr>
<tr>
<td>6-10 years</td>
<td>43</td>
<td>16.7</td>
</tr>
<tr>
<td>11-15 years</td>
<td>71</td>
<td>27.5</td>
</tr>
<tr>
<td>16-20 years</td>
<td>50</td>
<td>19.4</td>
</tr>
<tr>
<td>Over 20 years</td>
<td>69</td>
<td>26.7</td>
</tr>
<tr>
<td>Total</td>
<td>258</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Table 3

*Years in Teaching Assignment*

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>103</td>
<td>39.9</td>
</tr>
<tr>
<td>6-10 years</td>
<td>69</td>
<td>26.7</td>
</tr>
<tr>
<td>11-15 years</td>
<td>39</td>
<td>15.1</td>
</tr>
</tbody>
</table>
Table 3 (continued).

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-20 years</td>
<td>16 6.2</td>
</tr>
<tr>
<td>Over 20</td>
<td>31 12.0</td>
</tr>
<tr>
<td>Total</td>
<td>258 100.0</td>
</tr>
</tbody>
</table>

Table 4

National Board Certification

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>43 16.7</td>
</tr>
<tr>
<td>No</td>
<td>215 83.3</td>
</tr>
<tr>
<td>Total</td>
<td>258 100</td>
</tr>
</tbody>
</table>

Table 5

Level of Degree Held

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelors</td>
<td>91 35.3</td>
</tr>
<tr>
<td>Advanced Degrees</td>
<td>167 64.7</td>
</tr>
<tr>
<td>Total</td>
<td>258 100.0</td>
</tr>
</tbody>
</table>

The data indicated that a majority of teachers had 11 or more years of instruction experience in the classroom. The number of years in current teaching assignment reported that 39.9% of teachers had been in the current assignment
for less than five years, and 26.7% have been their assignment for six to ten years. Additional descriptive statistics and frequencies for the data collected during this research study are presented in the tables below. Each table contains the frequency and percentage for the participants who held a particular type of certification.

Research question number one and ten ask, “Is there a change in student performance data following classroom use of interactive electronic white boards?” and “Does student achievement increase with increased time in use of electronic white board?” The semester average for Math, Language Arts, and Reading were tested with a Oneway Anova ANOVA with Tukey’s Post hoc test with data collected from question three of the Electronic white board section. The descriptive statistics are listed in Table 6.

Table 6

*Electronic White Board Use Means and Standard Deviation*

<table>
<thead>
<tr>
<th>Semester</th>
<th>Subject</th>
<th>Time Interval</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 1</td>
<td>Math</td>
<td>0-60 minutes</td>
<td>50</td>
<td>87.22</td>
<td>5.77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>61-120 minutes</td>
<td>59</td>
<td>88.73</td>
<td>4.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>121-180 minutes</td>
<td>61</td>
<td>92.54</td>
<td>3.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>181-240 minutes</td>
<td>16</td>
<td>92.75</td>
<td>3.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>over 240 minutes</td>
<td>4</td>
<td>90.50</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>190</td>
<td>89.93</td>
<td>4.86</td>
</tr>
<tr>
<td>Semester 1</td>
<td>Reading</td>
<td>0-60 minutes</td>
<td>46</td>
<td>84.85</td>
<td>6.33</td>
</tr>
<tr>
<td>Time Interval</td>
<td>n</td>
<td>Mean</td>
<td>Std. Deviation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>----</td>
<td>------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61-120 minutes</td>
<td>45</td>
<td>87.36</td>
<td>5.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>121-180 minutes</td>
<td>56</td>
<td>90.27</td>
<td>3.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>181-240 minutes</td>
<td>15</td>
<td>90.40</td>
<td>4.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>over 240 minutes</td>
<td>4</td>
<td>93.00</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>166</td>
<td>88.05</td>
<td>5.48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 1 Language Arts</td>
<td>0-60 minutes</td>
<td>41</td>
<td>86.88</td>
</tr>
<tr>
<td>61-120 minutes</td>
<td>46</td>
<td>87.98</td>
<td>4.22</td>
</tr>
<tr>
<td>121-180 minutes</td>
<td>55</td>
<td>91.29</td>
<td>2.79</td>
</tr>
<tr>
<td>181-240 minutes</td>
<td>15</td>
<td>92.20</td>
<td>3.28</td>
</tr>
<tr>
<td>over 240 minutes</td>
<td>4</td>
<td>95.75</td>
<td>2.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>161</td>
<td>89.42</td>
<td>4.68</td>
</tr>
</tbody>
</table>

The results for the ANOVA are, Semester 1 Math $F(4,189) = 13.28$, $p<.001$, Semester 1 Reading $F(4,161) = 9.469$, $<.001$ and Semester 1 Language Arts $F(4,156) = 12.122$, $p = <.001$. The Tukey for semester 1 Math were significant and indicates that 121-240 minutes of interactive electronic white board instruction is better than 0-120 minutes of instruction. The semester 1 scores for Reading were significant as also, it shows that 121-240 minutes of interactive electronic white board instruction is better than 0-120 minutes of instruction. The semester 1 Language Arts scores show significance, as well,
that 121-240 minutes of interactive electronic white board instruction is better than 0-120 minutes of instruction. The results indicate that when instruction with an electronic white board occurs for more than 120 minutes in the classroom, there is a positive relationship to student learning and success. The descriptive data in table 6 shows that the mean of a classroom is higher when instruction occurs for more than 120 minutes each day. In a Tukey HSD, Multiple Comparisons for scores of semester one mean indicates that when electronic white boards are used consistently for 0-120 the student are less likely to be successful than in classrooms that use the electronic white boards for 121-240 minutes.

Research questions two, "Do administrators, teachers, and trainers view interactive electronic white boards as effective lesson delivery tools?" Were addressed by the following perception statements:

2. Use of the interactive electronic white board has improved student behavior during class.
5. Student participation increases student achievement.
10. Students are exposed to a wider variety of instructional strategies through the interactive electronic white board.

Question three, "Does interactive electronic white boards impact student engagement?" was addressed by the following perceptions statements:

1. Use of the interactive electronic white board has improved student engagement during class.
4. Use of the interactive electronic white board has improved student attentiveness.

6. More students raise their hands to participate during instruction on the interactive electronic white board.

7. Students are more willing to come to the interactive electronic white board compared to coming to the chalkboard or dry erase board.

9. Students are eager to complete self-directed lessons on the interactive electronic white board.

Question four, "What are the levels of teacher and trainer satisfaction relative to white board usage?" was addressed by the following perception statements:

11. I do think that it takes a longer amount of time to teach I use a white board.

12. I enjoy teaching with a whiteboard interactive electronic white board.

13. I believe that it is important for me to learn how to use a white board.


15. Using an interactive electronic white board does make me nervous and is frustrating.

16. Interactive electronic white boards are difficult to use.

Question six “What are teacher attitudes and perceptions on the change in student performance with use of an interactive electronic white board in their classrooms?” was addressed by perception statements:

4. Use of the interactive electronic white board has improved student attentiveness.
5. Student participation increases student achievement.
6. More students raise their hands to participate during instruction on the interactive electronic white board.
7. Students are more willing to come to the interactive electronic white board compared to coming to the chalkboard or dry erase board.
9. Students are eager to complete self-directed lessons on the interactive electronic white board.

All of the questions related to a teacher/administrator’s perception of electronic white boards use in the classroom, student’s success and student engagement yielded a positive perception as indicated by the data in Table 7 for questions one through 16, the means ranged from 2.04 to 4.51, the Likert scale was 1 as strongly disagree and 5 as strongly agree.

Table 7
Teacher Perceptions

<table>
<thead>
<tr>
<th>Question</th>
<th>SD</th>
<th>S</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use of the interactive electronic whiteboard has improved student engagement during class.</td>
<td>1 5 15 78 159</td>
<td>4.51</td>
<td>.729</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7 (continued).

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>S</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Use of the interactive electronic whiteboard has improved student behavior during class.</td>
<td>1</td>
<td>17</td>
<td>64</td>
<td>126</td>
<td>50</td>
<td>3.80</td>
<td>.839</td>
</tr>
<tr>
<td>3. Use of the interactive electronic whiteboard has improved student learning in class.</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>159</td>
<td>73</td>
<td>4.18</td>
<td>.604</td>
</tr>
<tr>
<td>4. Use of the interactive electronic whiteboard has improved student attentiveness</td>
<td>0</td>
<td>6</td>
<td>16</td>
<td>153</td>
<td>83</td>
<td>4.21</td>
<td>.658</td>
</tr>
<tr>
<td>5. Student participation increases student achievement.</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>96</td>
<td>142</td>
<td>4.47</td>
<td>.637</td>
</tr>
<tr>
<td>6. More students raise their hands to participate during instruction on the interactive electronic whiteboard.</td>
<td>0</td>
<td>11</td>
<td>35</td>
<td>117</td>
<td>95</td>
<td>4.15</td>
<td>.809</td>
</tr>
</tbody>
</table>
Table 7 (continued).

<table>
<thead>
<tr>
<th></th>
<th>SD</th>
<th>S</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Students are more willing to come to the interactive electronic white board compared to coming to the chalkboard or dry erase board.</td>
<td>2</td>
<td>18</td>
<td>37</td>
<td>114</td>
<td>87</td>
<td>4.03</td>
<td>.912</td>
</tr>
<tr>
<td>8. Students master objectives more quickly when instruction is on the interactive electronic white board.</td>
<td>1</td>
<td>17</td>
<td>63</td>
<td>133</td>
<td>44</td>
<td>3.78</td>
<td>.818</td>
</tr>
<tr>
<td>9. Students are eager to complete self-directed lessons on the interactive electronic white board.</td>
<td>0</td>
<td>6</td>
<td>47</td>
<td>129</td>
<td>76</td>
<td>4.07</td>
<td>.753</td>
</tr>
<tr>
<td>10. Students are exposed to a wider variety of instructional strategies through the interactive electronic white board.</td>
<td>0</td>
<td>8</td>
<td>19</td>
<td>130</td>
<td>101</td>
<td>4.26</td>
<td>.725</td>
</tr>
</tbody>
</table>
Table 7 (continued).

<table>
<thead>
<tr>
<th></th>
<th>SD</th>
<th>S</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. I do think that it takes a longer amount of time to teach when I use a whiteboard.</td>
<td>12</td>
<td>116</td>
<td>46</td>
<td>57</td>
<td>27</td>
<td>2.89</td>
<td>1.126</td>
</tr>
<tr>
<td>12. I enjoy teaching with an interactive electronic white board.</td>
<td>0</td>
<td>6</td>
<td>23</td>
<td>96</td>
<td>133</td>
<td>4.38</td>
<td>.745</td>
</tr>
<tr>
<td>13. I believe that it is important for me to learn how to use a white board.</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>134</td>
<td>118</td>
<td>4.43</td>
<td>.569</td>
</tr>
<tr>
<td>14. I feel comfortable using a white board.</td>
<td>5</td>
<td>15</td>
<td>24</td>
<td>92</td>
<td>122</td>
<td>4.21</td>
<td>.967</td>
</tr>
<tr>
<td>15. Using an interactive electronic white board does make me nervous and is frustrating.</td>
<td>91</td>
<td>98</td>
<td>27</td>
<td>30</td>
<td>12</td>
<td>2.12</td>
<td>1.154</td>
</tr>
<tr>
<td>16. Interactive electronic white boards are difficult to use.</td>
<td>93</td>
<td>101</td>
<td>32</td>
<td>25</td>
<td>7</td>
<td>2.04</td>
<td>1.058</td>
</tr>
</tbody>
</table>

Note. Scale = 1=strongly disagree, 2=agree, 3=neutral, 4=agree, 5=strongly agree.
Research question five “How are interactive electronic white board utilized for delivery of course content?” was tested with electronic white board question six “At what level do you feel that you use the Interactive Electronic White Board?”

- Beginner/Novice-use the board as an overhead, basic projection of worksheets.
- Intermediate/Transitional-use the board as presentation station, writes or types information, projects websites for class use.
- Advanced/Complex-use the board with interactive student response devices, programs that are interactive for students, portable slates.

These levels indicated some basic uses for delivery of instruction in the classroom, more than 70% of instruction was delivered at intermediate to advanced levels. Electronic white board question six, a teacher’s personal self-confidence level as a beginner, intermediate or advanced user of the electronic white board, indicated that 27.8% considered themselves to be a beginning or novice user, 59.7% of the teachers considered themselves to be an intermediate user. The 12.5% considered themselves to be an advanced user. 71.3% of users indicated that they felt confident in their ability to use the electronic white board in delivering instruction in the classroom as indicated in Table 8.
Table 8

**Self-Confidence Level of Teachers**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginner</td>
<td>71</td>
<td>27.8</td>
</tr>
<tr>
<td>Intermediate</td>
<td>154</td>
<td>59.7</td>
</tr>
<tr>
<td>Advanced</td>
<td>33</td>
<td>12.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>258</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Research question seven “Did teacher level of degree certification effect student success?” was asked in the teacher data section question four. The data was grouped by subject the mean reported in Table 9 showed the differences in the mean for math and language arts were minor and the mean for reading was only showed a 2.16 positive difference.

Table 9

**Semester by Advanced Degree**

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 bachelors</td>
<td>64</td>
<td>89.95</td>
<td>4.42</td>
</tr>
<tr>
<td>2 masters or higher</td>
<td>126</td>
<td>89.92</td>
<td>5.09</td>
</tr>
<tr>
<td>Reading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 bachelors</td>
<td>61</td>
<td>86.69</td>
<td>5.38</td>
</tr>
<tr>
<td>2 masters or higher</td>
<td>105</td>
<td>88.85</td>
<td>5.43</td>
</tr>
<tr>
<td>Lang. Arts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 bachelors</td>
<td>57</td>
<td>89.37</td>
<td>4.93</td>
</tr>
<tr>
<td>2 masters or higher</td>
<td>104</td>
<td>89.44</td>
<td>4.55</td>
</tr>
</tbody>
</table>
The independent samples t test results were, semester 1 Math, \( t(188), = .043 \) \( p = .965 \). Semester 1 Reading, \( t(164), = -2.159 \) \( p = .014 \), semester 1 Language Arts, \( t(159), = - .096 \) \( p = .924 \). The data indicates that teachers that held an advanced degree had an effect only on the semester average for reading.

Question number eight “Does National Board Teacher Certification effect student achievement?” was asked in the teacher data section question five, “Are you National Board Certified?” the results are reported in Table 10.

Table 10

<table>
<thead>
<tr>
<th>National Board Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

An independent t-test showed significance to National Board Certification and student success. The data for Semester 1 Math is \( t(188) = -.619, p = .537 \), Semester 1 Reading is \( t(164) = -.132, p = .895 \) and Semester 1 Language Arts is \( t(159) = -1.049, p = .296 \). The results were negative and indicates that a teacher that holds National Board Certification does not influence student success. Table 11 contains the statistical data for electronic whiteboard use in the classroom with teachers that hold Nation Board Certification by semester, in relation to student success.
### Table 11

**Semester by National Board Certification**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Subject</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 1</td>
<td>Math</td>
<td>1</td>
<td>yes</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no</td>
<td>157</td>
</tr>
<tr>
<td>Semester 1</td>
<td>Reading</td>
<td>1</td>
<td>yes</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no</td>
<td>140</td>
</tr>
<tr>
<td>Semester 1</td>
<td>Lang. Arts</td>
<td>1</td>
<td>yes</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>no</td>
<td>134</td>
</tr>
</tbody>
</table>

Question nine “Does professional development effect student success in the classroom?” was addressed by electronic white board question four, “How many professional development class(es) have you had related to the interactive electronic white board? Table 12 shows the number of professional development classes teachers had attended for training on use of the interactive electronic white boards.

### Table 12

**Semester by Professional Development Classes**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Subject</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 1</td>
<td>Math</td>
<td>1</td>
<td>0-5</td>
<td>151</td>
</tr>
</tbody>
</table>
The results for semester mean are reported as semester 1 Math, $t(188) = -3.045$, $p = .003$, semester 1 Reading $t(164) = -2.256$, $p = .003$ and semester 1 Language Arts, $t(159) = -1.329$, $p = .003$. The data showed significance for semester one math, reading and language arts scores. The majority of the teachers had zero to five professional development classes for using the interactive white boards. The mean in table 12 does show that a teacher that attended 6-10 professional increased mean in student scores. The largest increase of 2.60 was in math, 2.31 in reading, and language arts did show an increase of 1.18.

The teacher perception section of the questionnaire asked the respondents to rank the following statements on a Likert scale. The results are reported in Table 7 below with the mean and standard deviation statistics. The scale is strongly disagree as 1 to strongly agree as 5. Table 7, indicated that the perception of teacher and administrators strongly supported and favored instructional delivery with the interactive electronic white boards. The means
ranged from 2.04 to 4.51 also indicates the strong support for this method of instructional delivery.

Summary

The 10 research questions that were addressed with the research project indicated a strong relationship to student success and use of the electronic white board as extended time of use. The other areas that showed significant data was for semester one math. National Board Certification did not indicate any significance or effect on student success. A teacher’s advanced degree does show a significance effect on student success. Teacher’s and administrator’s perception did indicate strong positive support for use of electronic white board in the delivery of instruction.
CHAPTER V

CONCLUSIONS AND DISCUSSION

The purpose of this study was to determine the effect of interactive electronic white boards, an advanced technology, on the academic performance of kindergarten through fifth grade elementary students. The participants in the study were asked to gather student data by term/semester. Teachers were given a questionnaire that gathered data about demographics, education, professional development, technology perception and interactive electronic whiteboard use.

The results of the study are available in a final written document, it has been prepared to be disseminated to all participants upon request. The time frame for this study is one year from the approval of this study from the Internal Review Board. The research will provide educators with important information on how to effectively integrate technology to increase student success while balancing budgetary issues in today’s economy.

The collected demographic data of teachers was by gender, age, years of experience, years in current position and level of certification including National Board Certification. The teacher and administrators answered questions regarding their perception regarding the use of interactive electronic white boards use in instruction were also evaluated.

The data was collected from five school districts from a southern state, with 27 elementary schools that instructs kindergarten to fifth grade students. The sample represented approximately 2,500 students and 675 teachers,
trainers and administrators. The instructional environments were self-contained, team teaching or departmentalized situation.

Descriptive statistics for the data collected reported that two hundred forty-one teachers were female and nineteen were male. This indicates that elementary teachers are predominately female. One hundred ninety-one teachers have taught for 11 to 20 years, it indicates that a majority of teachers have consistently been teaching and delivering instruction in a classroom environment. Experience in the classroom allows teachers to refine best practices each year to meet the needs of their students. These best practices and classroom management can be incorporated into the use of electronic white boards.

The number of years in the current teaching assignment showed that 103 teachers have been in their current grade level assignment for less than five years, 69 teachers for six to 10 years, 55 for 11 to 20 years and 31 for over 20 years. These results indicate that a majority of teachers are in an assignment for less than five years. These teachers are in the mastery mode of curriculum; at this level, teachers are learning the curriculum and methods for teaching in their current assignment.

The data reported that teachers held degrees of various levels, 91 held bachelors, 156 held masters, eight held a specialist and three held a doctorate. A master's degree was held by more teachers than any other level. Research from Dr. Robert Marzano (Marzano, 2009) indicated that teachers that had the most success with electronic white boards held a minimum of a master's degree.
Achieving a master’s degree indicates a commitment to a career in education and student learning.

Research question number one, "Is there a change in student performance data following classroom use of interactive electronic white boards?" The semester averages for Math, Language Arts, and Reading were tested with an One way Anova. The descriptive data indicated that when the electronic white board was used for more than one hundred twenty minutes daily for instruction in the classroom the mean of the data showed an increase of the mean for Math by three points, Reading by three points and the greatest gain was in Language Arts with five points. These increased mean support the research conducted by Clemens, Moore and Nelson (2001). They reported that researchers and educators agree that interactive whiteboards can improve a student’s ability to retain and recall information presented in an interactive-whiteboard lesson activity. Both student and teacher experience the heightened engagement in such lessons.

Research questions two, "Do administrators, teachers, and trainers view interactive electronic white boards as effective lesson delivery tools?"

Question four, “What are the levels of teacher and trainer satisfaction relative to white board usage?” and question six “What are teacher attitudes and perceptions on the change in student performance with use of an interactive electronic white board in their classrooms?” related to a teacher/administrator’s perception of electronic white boards use in the classroom, student’s success and student engagement yielded a positive perception as indicated by the data
for questions one through sixteen, the increased mean indicated that teachers, trainers and administrators strongly agreed that the use of electronic white boards as a delivery tool had a positive effect on student success. Research by Middleton and Murray (1999) regarding teacher perceptions on the implementation of technology indicates that teachers must have a positive attitude approaching technology in the classroom, this will make this method of learning exciting for students in the classroom. Research states that classroom instruction can be enhanced by the use of interactive electronic white boards, the effect of technology on student learning depends on the teacher, the pedagogical approach adopted by the teacher, the resources employed during the delivery of instruction, and the intended learning outcomes (Cox & Abbot, 2004). Interactive electronic white boards present a multitude of benefits for teaching, learning and assessing students, including efficiency, versatility, multi-mode presentation, and interactivity (Kennewell & Beauchamp, 2007).

Question three, “Does interactive electronic white boards impact student engagement?” was directly addressed with the perceptions of the teachers, administrators and trainers. The perceptions were marked as a positive affect on student engagement. The literature connection indicates that recent qualitative research and field research confirms that instruction with interactive electronic white boards has positive effects on student engagement and teacher attitudes. These positive effects motivate teachers to include a wider variety of modalities for student learning (Snyder, 2006). The approach for this research study will measure the amount of time of use of interactive electronic white board, attitudes
of teachers, and performance of students. Interactive electronic white board’s support effective classroom practices by offering tools that enhance teaching and support instruction. Research has found that classrooms that use interactive electronic white board’s experience the following: (a) Teachers use an interactive electronic white board and the class to collaboratively produced a graphic organizer about cause and effect themes from a literature selection, effectively conducting an instructional conversation and keeping everyone involved; (b) Teachers use an interactive electronic white board to attach real world context in the classroom and provide important background knowledge for a science, language arts or math lesson; (c) Teacher creates a classroom discussion by using social studies and past events to engage students in making decisions guided by historical events; and (d) Teachers models his/her own construction of a graph on an interactive electronic white board and demonstrates a step-by-step process, then invites a students to come up to construct graphs (Snyder, 2006).

Interactive electronic whiteboards offer programs that improve learning by placing the knowledge in the hands of the students. Students take ownership of their own learning. Teachers and students are empowered, as teaching and learning is enhanced in innovative new ways. The gains that students showed when exposed to the electronic white boards does show that engagements has increased, there is a direct relationship between student success and the active engagement of student in the learning process.

Research question five “How are interactive electronic white board utilized for delivery of course content?” was tested with electronic white board question
six “At what level do you feel that you use the Interactive Electronic White Board?” These levels were indicated by some basic uses for delivery of instruction in the classroom, with Beginner/Novice as the use the board as an overhead, basic projection of worksheets. Seventy-one teachers indicated their self-confidence at this level. One hundred fifty-four chose the Intermediate/Transitional as the use the board as presentation station, writes or types information and projects websites for class use. Thirty considered themselves to be at the Advanced/Complex level as the use the board with interactive student response devices, programs that are interactive for students, portable slates. There were also some of the perception questions searched for information to the ability and confidence in use of the board for delivery of content. As the overall mean of the perception questions indicated the positive influence was noted by the respondents. Research by Dr. Robert Marzano, connected the fact that a teacher’s confidence level is part of the formula for student success.

The study conclusion states:

The meta-analytic findings suggest relatively large percentile gains in student achievement under the following conditions: the teacher has ten years or more of teaching experience, the teacher has used the technology for two years or more, the teacher uses the technology between seventy-five and eighty percent of the time in his or her classroom, the teacher has high confidence in his or her ability to use the technology. (Marzano, 2009, p. 7)
Research question seven “Did teacher level of degree certification effect student success?” was asked in the teacher data section question four. The data reported that 91 teachers held bachelors and the largest group was the certification of master's with 156 teachers. The advanced degrees of specialist and doctorate revealed a small number, so the degrees above bachelors were combined to be an advanced degree with a total of 167 teachers. Data for teachers with advanced degrees indicated that teachers with advanced degrees had students that were more successful than student of teachers that did not have an advanced degree, so there was significance in relation to student success and a teachers advanced degree. Teachers perusing advanced degrees indicate a commitment to student learning by becoming a practitioner of best practices.

Question number eight “Does National Board Teacher Certification effect student achievement?” was asked in the teacher data section question five, “Are you National Board Certified?” Forty-three teachers held National Board Certification, the t-test revealed that a teacher holding NBCT did not have and effect on student success. Teachers that achieve certification have performed at an increased level of teaching in order to obtain this certification, most of their students perform successfully and the influence of the electronic interactive white board may be negligible.

Question nine “Does professional development effect student success in the classroom?” was addressed by electronic white board question four, “How many professional development class(es) have you had related to the interactive
electronic white board? The results for semester mean did not indicate any affect on the level of student success. Although research indicates that creating a professional development plan that will instruct teachers on use and classroom integration of the interactive electronic white boards, can have a positive affect on student success and learning, some limitations may be a teachers knowledge and use of technology, as well as self confidence component of using this new technology. The results of this study may have been affected by the fact of recent acquisition of a large number of boards and not having appropriate levels of training for teachers.

Question ten, “Does student achievement increase with increased time in use of electronic white board?,” in a multiple comparison student achievement based on semester scores, indicated that when instruction is delivered with an interactive electronic white board for more than one hundred twenty minutes, student success is increased. Marzano’s (2009) research into student success and interactive electronic white boards again indicates that incredible results of findings suggest relatively large percentile gains in student achievement under the following conditions: the teacher has 10 years or more of teaching experience, the teacher has used the technology for two years or more, the teacher uses the technology between 75 and 80% of the time in his or her classroom, the teacher has high confidence in his or her ability to use the technology (Marzano, 2009). Research on the interactive electronic white board’s impact on student achievement indicates that when technology is used properly, student achievement increase and the value of the interactive electronic white
board becomes clearer when one focuses on how it can improve teaching and instruction. Advantages to the whiteboard include the ability to face the class for a longer period of time due to advance preparation of materials (Kelley, Underwood, Potter, Hunter, & Beveridge, 2007). Teachers appear to be more efficient in their classroom instruction, with increased bell-to-bell instruction the transitions are smoother between activities. There is an increased ability to provide more professional delivery of multimedia resources that flow seamlessly from one teaching point to the next with an accelerated pace of the lessons. There is reduced time spent fumbling with multiple resources, and teachers maximize their lesson readiness, where the lesson begins straightaway, rather than students having to wait for handouts, for the teacher to write on the board, draw charts or tables, and the like (Kelley et al., 2007). The overall hypothesis and premise of this study was that increased time of use of interactive electronic white boards does have a positive effect on student success.

Limitations

The researcher acknowledges the limitations about the study. The frame of mind of the administrators, trainers, and teachers when they completed surveys affected how they responded and may have had an influence on the study results. The difference in individual teaching preferences, strengths, and weaknesses affected how they responded. The difference in individual learning and instructional preferences also may have affected responses. Participant’s limited experience with advanced technology may have affected their perceptions and therefore their responses. The respondents’ levels of confidence and
knowledge of using the technology may have also be an influence in determining the effectiveness of the boards. The study was used to determine participant's perceptions on how interactive electronic white boards influence student participation and performance.

Term test, 9-week test, mid-term test and content-by-term test are just some of the names that refer to assessments constructed by local districts. These efforts are focused in creating test that mirror the Mississippi Curriculum Test II, in order to prepare students for state assessments. These efforts are also designed to ensure that students are learning a continuous rigorous curriculum throughout each district. In designing the assessments, questions and questions banks are being created by teachers, instructional coaches, lead teachers and trainers. The MCT II is a newly designed assessment, with an increased level of rigor. Proficiency Level Descriptors (PLD) detail the level at which skills and objectives should be mastered by students.

Limitations may have existed in assessment design due to several factors, the levels of education by participants, district expectations, access to material to model the structure of question design and the level of rigor at which the question was designed. The limitation may also have continued to test administration, test security, grading and scale of grades associated with the assessments. Levels of variability may have existed from district to district, school site to school site and even classroom to classroom. In conducting this study, these factors were considered while evaluating the data.
Recommendations for Policy and Practice

The results of the study indicated that increased time in use of electronic white boards in the classroom as a delivery instruction device has a positive affect on student success. Current and published research supports these findings. This information can be used in the decision making process of purchasing equipment, training teachers for technology, and creating best practices for implementation of curriculum in this format. This study also revealed the perception of trainers, administrators and teachers to be positive in the use of the interactive electronic white boards, in the use of engaging students, and in the delivery of instructional objectives.

The information obtained in this study can help districts in making decisions for purchasing interactive electronic white boards. The data indicates that use of this advanced technology does have a positive effect on student success in the classroom if the board is used for more than 120 minutes. School boards, superintendents and principals can use this information in selecting and purchasing equipment for their districts as well creating professional development for staff. The selection of training that will help teacher’s skills and knowledge of the interactive electronic white boards develop to select and use the best practices for their grade and subject area. Combinations of proficiency of board use and best practices will translate into student’s excitement and participation in class as active learners. The positive perceptions of trainers, teachers and administrators of interactive electronic white boards as instructional devices may make the transition from traditional chalkboards and whiteboard to
the interactive electronic white boards easier.

The data indicated that the teacher’s perceptions of affects on behavior were lower than most other perceptions. The interactive electronic white board is not designed as a behavior tool. Teachers stand at the board, usually with their back to the classroom, which in turn reduces supervision within a classroom. The teacher loses proximity to the students by constantly engaging at the board. The best practice to integrating the board as part of the classroom behavior plan would be to use a slate or other peripheral that allows the teacher to circulate through the classroom. These investments would help to reduce idle time as well as interruptions to the learning environment because of behavior or off task students.

The researcher discovered that it seems more experienced teachers use the technology better than teachers that are less experienced in making connections to student engagement. The data may be supported by several factors. Experienced teachers have more knowledge in best practices that encourage student engagement. These teachers have been through the trail and error process of using technology. They plan in advance that reduces idle time during instruction, and perhaps manage students at a more proficient level.

There is an enigma with younger teachers and technology, the younger, less experienced teacher is part of the digital generation, these teachers email, text, tweet, use iPods, and Google on a daily basis, so you would assume that they would have a better grasp on using the technology in the classroom. Though these teachers have practical experience, they lack application
experience. These teachers would greatly benefit from several strategies that will help integrate technology into the classroom with best practices, professional development that focuses on engaging students, perhaps even paring them with an experience mentor teacher or implementing a professional learning community that encourages sharing of strategies and best practices.

Another thought about teacher experience, a more experienced teacher may be more settled in their family life, engaged in a career, and raising a family. These commitments act as a driving factor for an experienced teachers to be more successful in their classroom, by using the tools available, engaging students and ensuring that the students are learning. A less experienced teacher may not have the motivation factors of family and career. They may experience it as the first real job and have a week-end driven outlook, but the most prevalent factor may still be the lack of experience in engaging students.

Recommendations for Future Research

A future long-term study is needed to determine if there is a novelty effect associated with interactive electronic white boards. The interactive electronic white board is subject to an examination as any new resource. As the focus of this study, consideration must be made for the possibility there is a novelty effect with interactive electronic white boards, and that student engagement, teacher enthusiasm and motivation eventually decline over time. If the novelty effect is indeed a factor, researchers must determine at which point an interactive electronic white boards loses its effect, so that teachers can be aware of it. Hennessy et al. (2007) raise concerns that teachers might come to rely upon the
interactive electronic white boards ability to capture and engage students. In turn, this has the potential to create classrooms in which teachers depend on the whiteboards to manage their classrooms and to serve as the sole means of creative presentation and explanation. The authors worry that this interactive electronic white board dependence could stifle teacher ingenuity in crafting lessons and pursuance of the professional development that leads to mastery of content. Based upon the data gathered during this study, teachers should indeed heed the precaution that they could be using the interactive electronic white boards as a substitute teaching authority. Teachers should seek to develop and implement strategies to both yield attention to and regain attention from the interactive electronic white boards as needed and not imagine that the interactive electronic white boards is the most interesting resource in their classroom. Teachers rely upon their peers as a means of learning how to use technology, including the interactive electronic white boards, and they further rely upon their peers to share teacher-created materials. Kennewell and Beauchamp (2007) arrived at the similar conclusion that teachers do not mind sharing the resources they created for use with interactive electronic white boards, but raise an additional question. Do teachers who share have a reciprocal expectation in terms of sharing from other teachers? What are teacher attitudes toward sharing teacher-created materials? This is an important area for further study because Moss et al. (2007) revealed that one drawback to widespread use of the interactive electronic white boards is the amount of time it takes for teachers to learn the software and create their own materials. Will the willingness of teachers
to share their materials affect the future deployment of interactive electronic white boards in the classroom? If further studies determine that interactive electronic white boards do indeed result in student achievement, a reluctance to share materials could have negative impact on student learning. School and district leadership who encourage sharing and provide opportunities through district pow-wow and team meetings are an important factor in the successful integration of interactive electronic white boards.

A question arose during the study, Does experience relate to more use of interactive electronic white boards? This is an area of future study, the data collected provided limited information about board use and about making a direct correlation to the use of interactive electronic white boards. The study collected data about teacher experience and board use, but there should be more in-depth data that details years of experience and use of boards.

The purpose of this study was to determine the effect of interactive electronic white boards, an advanced technology, on the academic performance of kindergarten through fifth grade elementary students. The participants represent seven local school districts with approximately 700 teachers instructing 16,421 students.

The researcher gathered data from the teachers through a questionnaire designed by the researcher. Student data was also gathered as well as perceptions of trainers, teachers and administrators.

The study design to examined the following independent variables and the impact or effect it has on students’ achievement in a kindergarten through fifth
grade elementary classroom. The independent variables are level of degree, national board certification, active use of the board in the classroom, and use of student response devices. The other independent variables were the teacher’s perception about ease of use of an interactive electronic white board in the classroom and administrator and teacher perception of student participation and enthusiasm. The dependent variables were term grades and content by term grade or nine weeks test for available by terms. The data was analyzed in SPSS with an ANOVA and t-test, as well as a Tukey multiple comparison analysis.

The data of the study revealed that teachers that use the interactive electronic white boards for 120 minutes or more per day had students that show better scores than if the interactive electronic white boards less than 120 minutes a day. The research also showed that trainers, teachers and administrators had positive perceptions and views of the interactive electronic white boards as instructional tool.

The recommendation for policy and practice is for teachers to increase the use of interactive electronic white boards as instructional tools in the classroom on a daily basis. It is also recommended that administrators provide professional development to assist teachers in developing best practices for the use of interactive electronic white boards in the classroom.

Future research should be designed to consider if there is a novelty effect associated with interactive electronic white boards. The interactive electronic white board is subject to an examination as any new resource. As the focus of this study, consideration must be made for the possibility there is a novelty effect
with interactive electronic white boards, and that student engagement, teacher enthusiasm and motivation eventually decline over time. If the novelty effect is indeed a factor, researchers must determine at which point an interactive electronic white boards loses its effect so that teachers can be aware of it.
APPENDIX A

HUMAN SUBJECTS REVIEW COMMITTEE APPROVAL

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: R29032420
PROJECT TITLE: Is There a Relationship Between Electronic Whiteboards Usage and Student Learning?
PROPOSED PROJECT DATES: 11/01/2010 to 12/31/2011
PROJECT TYPE: Previously Approved Project
PRINCIPAL INVESTIGATORS: John Joseph Mundy
COLLEGE/DIVISION: College of Education & Psychology
DEPARTMENT: Educational Leadership & Research
FUNDING AGENCY: NIA
HSPRC COMMITTEE ACTION: Exempt Approval
PERIOD OF APPROVAL: 02/07/2011 to 02/06/2012

Lawrence A. Hosman, Ph.D. Date
HSPRC Chair
September 20, 2010

Dear Superintendent,

My name is John J. Mundy and I am a candidate for a Doctoral degree at the University of Southern Mississippi, currently working on my dissertation project. My research study is to determine whether there is a relationship between the use of interactive electronic white boards and student success in kindergarten through fifth grade classes. The study will compare the test data of current grades and district assessment data in kindergarten through fifth grade classrooms that do not use interactive electronic whiteboards.

I am writing to request permission to conduct this research as it relates to your district. The study will be done through the aid of a questionnaire. Kindergarten through fifth grade teachers from selected schools will be asked to complete the questionnaire during a team meeting or planning time. It should take no more than 15-20 minutes of your teacher’s time to complete the questionnaire. I have enclosed a copy of the questionnaire for your review.

All responses will be completely anonymous and confidential. Each questionnaire contains a school’s number for tracking the rate of return. No individual responses will be identified and no scores will be reported to individual schools.

This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820.

Thank you for your time and cooperation. Please sign and return the enclosed form in the self addressed stamped envelope giving your approval for this study.

Sincerely,

John J. Mundy
Doctoral Candidate
The University of Southern Mississippi
APPENDIX C

REQUEST FOR RESEARCH PERMISSION

October 27, 2010
RE: Research Permissions

Dear [Name],

Request for Research Permission

Currently I am completing my Doctoral Degree in Educational Leadership and Research at the University of Southern Mississippi. To fulfill my graduate requirements, I will be conducting research for the dissertation. The title of my research project is, “Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?”

I am requesting permission to conduct my research in your district. Following the conclusion of my research, all results will be shared with you. If you have any questions regarding my research, please feel free to call me at ctwoteach@gmail.com or 228.806.6364. Your consideration and time in this matter is greatly appreciated.

Sincerely,

John J Mundy

[Signature]

[Redacted] give permission for
John J Mundy to conduct research in as pertaining to the study of electronic white boards
entitled, “Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?” in [Redacted]
October 27, 2010
RE: Research Permissions

Dear [Name],

Request for Research Permission

Currently I am completing my Doctoral Degree in Educational Leadership and Research at the University of Southern Mississippi. To fulfill my graduate requirements, I will be conducting research for the dissertation. The title of my research project is, “Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?”

I am requesting permission to conduct my research in your district. Following the conclusion of my research, all results will be shared with you. If you have any questions regarding my research, please feel free to call me at otwoteach@gmail.com or 228.806.6364. Your consideration and time in this matter is greatly appreciated.

Sincerely,

John J Mundy

I, [Name], hereby give permission for John J Mundy to conduct research in as pertaining to the study of electronic white boards entitled, “Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?”
October 27, 2010
RE: Research Permissions

Dear [Name],

Request for Research Permission

Currently I am completing my Doctoral Degree in Educational Leadership and Research at the University of Southern Mississippi. To fulfill my graduate requirements, I will be conducting research for the dissertation. The title of my research project is, "Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?"

I am requesting permission to conduct my research in your district. Following the conclusion of my research, all results will be shared with you. If you have any questions regarding my research, please feel free to call me at otwoteach@gmail.com or 228.806.6164. Your consideration and time in this matter is greatly appreciated.

Sincerely,

John J. Mundy

I give permission for John J. Mundy to conduct research in [district] pertaining to the study of electronic whiteboards entitled, "Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?"
October 27, 2010
RE: Research Permissions

Dear [Name],

Request for Research Permission

Currently I am completing my Doctoral Degree in Educational Leadership and Research at the University of Southern Mississippi. To fulfill my graduate requirements, I will be conducting research for the dissertation. The title of my research project is, "Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?"

I am requesting permission to conduct my research in your district. Following the conclusion of my research, all results will be shared with you. If you have any questions regarding my research, please feel free to call me at otvtouch@gmail.com or 228.806.5364. Your consideration and time in this matter is greatly appreciated.

Sincerely,

John J. Mundy

I __________________________
give permission for
John J. Mundy to conduct research in as pertaining to the study of electronic white boards entitled, "Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?"
February 10, 2011
RE: Research Permissions

Dear [Name]

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I ___________________________ give permission for John J Mundy to conduct research in as pertaining to the study of electronic white boards entitled, "Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?"
October 27, 2010
RE: Research Permissions

Dear [Name],

Request for Research Permission

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John J. Mundy

I [Name] give permission for John J Mundy to conduct research in as pertaining to the study of electronic white boards entitled, "Is There a Relationship Between Electronic White Board Usage and Improved Student Learning?"
APPENDIX D

RESEARCH INSTRUMENT

Is There a Relationship Between Electronic Whiteboards Usage and

1. Teacher Demographic Data

1. Gender
   - Female
   - Male

2. How many years have you been teaching?
   - 0-5
   - 6-10
   - 11-15
   - 16-20
   - over 20

3. How many years have you been teaching in your current assignment?
   - 0-5
   - 6-10
   - 11-15
   - 16-20
   - over 20

4. What is the highest level of degree you hold?
   - Bachelors
   - Masters
   - Specialist
   - Doctorate

5. Are you National Board Certified?
   - Yes
   - No

   If yes, area of certification(s)
Is There a Relationship Between Electronic Whiteboards Usage and

2. Electronic Whiteboard Data

1. Do you have an interactive electronic whiteboard in your classroom?
   - [ ] Yes
   - [ ] No

2. Please complete the statement:
   “I have used an Interactive Electronic Whiteboard for _______ (time period)”
   - [ ] 0-5 yrs
   - [ ] 6-10 yrs
   - [ ] 11-15 yrs

3. How many minutes a day do you use the electronic whiteboard in your classroom?
   - [ ] 0-60
   - [ ] 61-120
   - [ ] 121-180
   - [ ] 181-240
   - [ ] over 240

4. How many professional development class(es) have you had related to the interactive electronic whiteboard?
   - [ ] 0-5
   - [ ] 6-10
   - [ ] 11-15
   - [ ] 16-20
   - [ ] over 20

5. Do you use student response devices?
   - [ ] Yes
   - [ ] No

   If Yes, please list - i.e., Activotes, CPS paddles, Activexpressions

6. Self-Evaluation: At what level do you feel that you use the Interactive Electronic Whiteboard?
   - [ ] Beginner/Novice - use the board as an overhead, basic projection of worksheets.
   - [ ] Intermediate/Transitional - use the board as presentation station, writes or types information. Projects websites for class use.
   - [ ] Advanced/Complex - use the board with interactive student response devices, programs that are interactive for students, portable states.
### 3. Student Data

Collection of Student Data: Please complete a section for each class you teach.

List student's data that is requested. Please use the following for ethnicity:

W-White, B-Black, H-Hispanic, A-Asian, O-Other

<table>
<thead>
<tr>
<th>Student</th>
<th>Math Grade Semester 1</th>
<th>Reading Grade Semester 1</th>
<th>Language Arts Grade Semester 1</th>
<th>Math Term 1 Test</th>
<th>Math Term 2 Test</th>
<th>Reading Term 1 Test</th>
<th>Reading Term 2 Test</th>
<th>Language Arts Term 1 Test</th>
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<td>Use of the interactive electronic whiteboard has improved student engagement during class.</td>
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<td>Use of the interactive electronic whiteboard has improved student behavior during class.</td>
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<td>Use of the interactive electronic whiteboard has improved student learning in class.</td>
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<td>Use of the interactive electronic whiteboard has improved student attentiveness.</td>
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<td>Student participation increases student achievement.</td>
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<td>More students raise their hands to participate during instruction on the interactive electronic whiteboard.</td>
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<td>Students are more willing to come to the interactive electronic whiteboard compared to coming to the chalkboard or dry erase board.</td>
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<td>Students master objectives more quickly when instruction is on the interactive electronic whiteboard.</td>
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<td>Students are eager to complete self-directed lessons on the interactive electronic whiteboard.</td>
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<td>Students are exposed to a wider variety of instructional strategies through the interactive electronic whiteboard.</td>
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<td>I do think that it takes a longer amount of time to teach I use a whiteboard.</td>
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<td>I enjoy teaching with a whiteboard interactive electronic whiteboard.</td>
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<td>I believe that it is important for me to learn how to use a whiteboard.</td>
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<td>I feel comfortable using a whiteboard.</td>
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<td>Using a interactive electronic whiteboard does make me nervous and is frustrating.</td>
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<td>Interactive electronic whiteboards are difficult to use.</td>
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September 20, 2010

Dear Principal,

My name is John J. Mundy and I am a candidate for a Doctoral degree at the University of Southern Mississippi, currently working on a research project. My research is to determine whether there is a relationship between the use of interactive electronic white boards and student success in kindergarten through fifth grade classes. The study will compare the data of current grades and district assessment data in kindergarten through fifth grade classrooms that do not use interactive electronic whiteboards.

I am writing to request permissions to conduct this research as it relates to your school. The study will be done through the aid of a questionnaire. Kindergarten through fifth grade teachers from your school have been selected, and will be asked to complete the questionnaire during a team meeting or planning time. It should take no more than 15-20 minutes of your teacher’s time to complete the questionnaire. I have enclosed a copy of the questionnaire for your review.

All responses will be completely anonymous and confidential. Each questionnaire contains a schools number for tracking the rate of return. No individual responses will be identified and no scores will be reported to individual schools.

This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS  39406-0001, (601) 266-6820.

Thank you for your time and cooperation. Please sign and return the enclosed form in the self addressed stamped envelope giving your approval for this study.

Sincerely,

John J. Mundy
Doctoral Candidate
The University of Southern Mississippi
Dear Participating Educator,

My name is John J. Mundy and I am candidate for a Doctoral degree at the University of Southern Mississippi, currently working on research my dissertation. I have completed my coursework and am beginning the research for the project. The topic I have chosen is My research study is to determine whether there is a relationship between the use of interactive electronic white boards and student success in kindergarten through fifth grade classes. The study will compare the test data of current grades and district assessment data in kindergarten through fifth grade classrooms that do not use interactive electronic whiteboards.

The attached questionnaire is concerned with these dimensions and should take approximately twenty minutes to complete. I am quite aware of the demands on your time and would greatly appreciate you completing this instrument. Your building administrator has an envelope for you to use in returning the completed questionnaire to me.

Your participation is completely voluntary and I want you to feel free to decline participation or to discontinue participation at any point. All data collected will be completely anonymous. For this reason, I ask that you put no identifying information on the questionnaire. Any information inadvertently obtained during the course of this study will remain completely confidential. Following data analysis, questionnaires will be destroyed by shredding.

By participating in this study you will help us determine the relationship between electronic whiteboard use and student success. It is hoped that this study will be of practical as well as theoretical benefit. The results of this study may be useful, for example, in allocating funding for technology equipment purchases. This in turn could benefit both students and society in general as well as classroom teachers. I would anticipate presenting the aggregated results of this study at a professional conference and publishing them in an appropriate refereed journal. Neither you, your department, nor the school will be identifiable within these published findings.

By completing and returning the attached questionnaire you are granting permission for this anonymous and confidential data to be used for the purposes described above.

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If you have any questions concerning this survey research project, please feel free to contact one of the members of the research team listed below. Thank you for considering helping us with this research. Thank you for your time and cooperation.

Sincerely,

John J. Mundy
Doctoral Candidate
The University of Southern Mississippi
REFERENCES


