Utilizing Interactive Whiteboards in the Classroom

Jeffrey Decker
St. John Fisher College

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Utilizing Interactive Whiteboards in the Classroom

Abstract
Using interactive white boards in the classroom has been determined as one of the means in which an increase in student achievement and motivation. This study aimed to investigate the relationship between the integration of interactive white boards and student achievement in different content areas. Six high school level classrooms with varying content areas and their use of interactive white board technology were utilized in this study. Information on individual student motivation compared among different classrooms, both with and without interactive whiteboards, qualitative survey responses from instructors' and students' views, as well as looking at different student assessments compared to those in a classroom with and without interactive whiteboards. An analysis of the data displayed a correlation between the improvement of both student motivation and achievement when a student participated in a highly interactive class utilizing an interactive white board. Students in the classroom that utilized the technology in an interactive way performed higher academically and demonstrated more favorable views of their content areas and the interactive white board.

Document Type
Thesis

Degree Name
MS in Mathematics, Science, and Technology Education

First Supervisor
Diane Barrett

Second Supervisor
Bernard Ricca

This thesis is available at Fisher Digital Publications: https://fisherpub.sjfc.edu/mathcs_etd_masters/98
Utilizing Interactive Whiteboards in the Classroom

By

Jeffrey Decker

Submitted in partial fulfillment of the requirements for the degree
M.S. Mathematics, Science and Technology Education

Supervised by
Dr. Diane Barrett and Dr. Bernard Ricca

School of Arts and Sciences
St. John Fisher College

April 2010
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Abstract

Using interactive whiteboards in the classroom has been determined as one of the means in which an increase in student achievement and motivation. This study aimed to investigate the relationship between the integration of interactive whiteboards and student achievement in different content areas. Six high school level classrooms with varying content areas and their use of interactive whiteboard technology were utilized in this study. Information on individual student motivation compared among different classrooms, both with and without interactive whiteboards, qualitative survey responses from instructors’ and students’ views, as well as looking at different student assessments compared to those in a classroom with and without interactive whiteboards. An analysis of the data displayed a correlation between the improvement of both student motivation and achievement when a student participated in a highly interactive class utilizing an interactive whiteboard. Students in the classroom that utilized the technology in an interactive way performed higher academically and demonstrated more favorable views of their content areas and the interactive whiteboard.
Dedication

This research project is dedicated to my most influential teachers, my mother and father. As one of my most influential teachers, despite my father's passing, he is still providing guidance and support during difficult times. My mother, who demonstrates every day, that willingness and determination will keep one moving forward to become successful.
Acknowledgements

I would like to thank my wife Anne, who has supported me in everything that I do, I owe her much more than I have to offer. A special thanks to Dr. Diane Barrett and Dr. Bernard Ricca. They have provided a high-quality, authentic and invigorating learning environment at St. John Fisher College. Their guidance and true appreciation for education has been the cornerstone of my Master’s Degree.
Utilizing Interactive Whiteboards in the Classroom

Teachers have always been trying to develop new, innovative, meaningful, and authentic lessons that will impact the students they are trying to educate. These range from using the students to develop lessons, to creating a problem solving activity, to incorporating the gadgets students use on a daily basis. Educators are striving to keep students motivated and engulfed in their lessons, yet still trying to meet the high standards being set every day. Without a willingness to step outside their comfort zone, teachers’ lessons will continue to keep student achievement at a plateau. With a growing number of new teachers each year filling retirement positions, there is an opportunity for someone to change the way lessons have been presented.

With new information readily available at the students’ fingertips, it is reaching students at a lightning fast speed via the Internet and other multimedia resources. Wood and Ashfield (2008) contended that this speed and immediacy creates a time of unprecedented change within education. The educational system needs to keep up with the evolving technology in order to motivate and engage students, as well as to help prepare students for their future in which this technology will become the norm. It is a rebirth for students to get involved with the instruction using technology. It is a chance for students to enjoy learning. With the utilization of educational technology in each classroom, students have the opportunity to influence their own learning.

By increasing the amount of technology in each classroom, whether it’s a kindergarten classroom or a high school biology lab, using interactive
communication technology has come to the forefront of educational technological literacy. Glover, Miller, Averis and Door (2007) have shown that interactive whiteboard use in both primary and secondary schools promotes pupil interest, more sustained concentration, and more effective learning where teachers are aware of the ways in which such technology can be used to support a variety of learning styles. Through interactive lessons, there exists a higher quality connection between the instructor and the pupils. This interactivity is believed to lead to higher levels of classroom participation and provide an increased academic performance (Smith, Hardman, & Higgins, 2006). The interactive whiteboard is a key component in this theory of engulfing all types of learners into a hands-on invigorating classroom experience. The goal of this research is to determine how successful and fulfilling interactive whiteboards and communication technology are at improving student achievement in a classroom setting.
Review of Literature

In order to determine the effect of integrating more technology into a classroom, such as an interactive whiteboard, research that interactive whiteboards increase student performance needs to be analyzed. An analysis of how the interactive whiteboard is utilized to increase student performance will also play a vital role. Students’ perspectives on the use of an interactive whiteboard will also be reviewed during this research.

The literature review encompasses research about the findings of utilizing interactive instructional technology in the classroom. The review of literature will then explore the research of the pros and cons of incorporating more instructional technology in the classroom. The literature review will then explore the components of an interactive whiteboard system, but also how students and teachers utilize it effectively in the classroom.

*Use of Instructional Technology*

With technology evolving so quickly, it makes sense to provide students with the latest advances in audio and visual communications to provide stimulation to new concepts and ideas. With this new technology in the classroom comes a necessary pedagogical change. According to Lewin, Somekh, and Steadman (2008), as technology increased in classrooms, available to use whenever they wished to do so, there was a huge increase in teachers’ information and communication technology skills over a two year period. There was also an observable process of eagerly continuing professional development to enhance their technological literacy for instruction. The new information and communication technology has opened
classrooms to the world. “The use of multimedia can create a classroom without walls” (Hall & Higgins, 2005).

Glover, Miller, Averis, and Door (2007) identified three teaching approaches in classrooms equipped with an interactive whiteboard. Of the observed lessons, Glover et al. (2007) found that teachers used a supported didactic approach, using the board as a visual aid, in 14 lessons, an interactive approach, using the board as a visual, verbal, and kinesthetic aid, in 15 lessons, and an enhanced interactivity approach in 21 of the lessons. Wood and Ashfield (2008) point out that interactive whiteboards promote more direct teaching techniques such as "explaining, modeling, directing, and instructing." While the boards can promote new teaching and learning opportunities, Wood and Ashfield (2008) also point out that a teacher's perception, understanding, and interpretation of teaching and learning have a more significant impact on student learning, rather than the tools being used or not used. "As with any resource, it is perhaps the context and the purpose that remain the most influential factors with regard to developing children's learning" (Wood & Ashfield, 2008). Other research has concluded that "the most effective designs for learning adapt to include a variety of media, combinations of modalities, levels of interactivity, learner characteristics, and pedagogy based on a complex set of circumstances" (Metili Group, 2008, p. 14).

Pros and Cons of Interactive Whiteboards

Student engagement is critical to student motivation during the learning process. The more students are motivated to learn, the more likely it is that they will be successful in their efforts. According to Joselowsky (2007), it is also increasingly
clear that learning to high standards cannot take place where students are bored, or have no opportunities for experiential learning. Interactive whiteboards help provided experiences allowing students to become engaged. Because Vygotsky’s theory of education focused on providing students with authentic situations and interaction with manipulatives, multimedia use in the classroom is in line with educational theory (Hall & Higgins, 2005).

Evidence suggests that use of interactive whiteboards can have positive effects on teaching and learning. Glover and Miller (2001) have shown that interactive whiteboard use in both primary and secondary schools promotes pupil interest, more sustained concentration, and more effective learning where teachers are aware of the ways in which such technology can be used to support a variety of learning styles.

Numerous factors influence student motivation including parental involvement, teacher motivation and skills, and effective use of technology. Technology can be utilized to create a motivating classroom environment where students are engaged in learning. An environment where technology is used in innovative ways leads to improved learning and teaching (Wishart & Blease, 1999). Classroom learning is also enhanced through the use of visuals. Visuals promote a student’s ability to organize and process information (McKendrick & Bowden, 1999). Visuals can also be utilized to challenge students to think on levels that require higher order thinking skills (Smith & Blankinship, 2000). Finally, technology provides opportunities for teachers to meet the needs of students with various learning styles through the use of multiple media (Barnes, 2008).
Students are excited about the new capabilities the interactive whiteboard brings to the classroom (Hall & Higgins, 2005). Student responses in Hall & Higgins’ (2005) study indicated that students feel interactive whiteboards make lessons more fun and enjoyable. According to Schmid (2008), students felt the interactive whiteboard helped them to focus more during lessons. This increased focus came from the attractiveness and visual conceptualization of the interactive whiteboard. Schmid (2008) also found students believed the interactive whiteboard helped them understand lessons better through hands-on experiences. A response to a survey conducted by Wood and Ashfield (2008) stated that “it does not matter if you make a mistake on the interactive whiteboard because you can just undo it.” This demonstrates willingness of students to take risks in their learning knowing that errors can easily be erased with the interactive whiteboard.

Although there is little research discouraging the use of interactive whiteboards in the classroom, some feel that consequences do exist. Despite the many benefits of using an interactive whiteboard in educational settings, there has been little research demonstrating their effect on test scores and student learning. A 2-year study conducted for the United Kingdom’s Primary National Strategy pilot program "Embedding Information Communication Technology" did not find any significant differences in test scores between schools with interactive whiteboards and those without interactive whiteboards (Higgins, Beauchamp, & Miller, 2007). Glover et al. (2007) argue that "it is still the quality of the teaching that ensures progress; the interactive whiteboard alone does not guarantee it.”
As with many new technologies, there is an initial period of excitement that can quickly disappear unless both policymakers and educators invest in professional development so users are technologically and pedagogically proficient so that learning and teaching goals are more likely to be achieved. According to Higgins et al. (2007), "as teachers become more fluent in their use of IWB and as they recognize the link to pedagogical change, the IWB becomes a potential catalyst for further change."

With new technology and classroom equipment comes training and professional development for the instructors who not only need to know how to use the equipment, but need to ensure they are effectively using the equipment. Traditional models of professional development, such as workshops and courses, have not been particularly successful in helping teachers to find ways to integrate technology into their teaching (Jacobsen, Clifford, & Friesen, 2002). Faculty members and classroom teachers are not comfortable with this state of affairs. They often feel bad about not knowing how to use technology for teaching and learning. During Jacobsen’s study, instructors often made comments like “technopeasant,” “technophobe,” “resident luddite,” or “stupid about computers” to describe their technological literacy. Constant professional development in the use of the interactive whiteboards keeps instruction for student learning authentic and modern (Jacobsen, 2002).

*Interactive Whiteboard Components*

While several models of interactive whiteboards are available, each has the potential to be a robust, media-rich teaching tool. According to Kaufman (2009), the
Utilizing Interactive Whiteboards

Whiteboards are used in conjunction with a computer, desktop or laptop, and a projector, and although various board sizes exist, they can be permanently mounted on a wall or installed on a mobile stand. Many whiteboard systems are also equipped with audio systems and short throw projectors, which help minimize shadows and allow the boards to be installed in smaller spaces. Essentially, the boards, when used with the interactive board software, are large electronic platforms that allow users to manipulate text, images, files, and other programs with the use of an electronic pen or simply by the touch of a finger (Kaufman, 2009).

Because manufacturers market their own proprietary software with each model of interactive whiteboard, some of the common tools among manufacturers include several interactive tools throughout the software. Some of these software tools includes but is not limited to electronic highlighters and pens, countdown clocks, calculators, and rulers, in addition to functions that make it possible to link and embed other file types. The range of possible activities and uses is immeasurable, as the board’s full potential has yet to be realized in educational settings.

The distance between users and the board can also be extended with the use of "wands," wireless slates, tablets, or other proprietary input devices, which allow the user to move around the classroom while still having the ability to interact with the board and the class. In addition to these add-ons, various types of handheld individual response systems allow teachers to poll and assess students through varying types of assessment and game-related activities (Whiting, 2005).

Another device in conjunction with the interactive whiteboard system is an audience response system. It allows the pupils to listen, yet participate actively in
lessons. Many instructors often agree that students were often not engaged during their lectures. According to Barnes (2008), he found that students who had a personal remote device that could tabulate statistics based on real-time results, students would actively participate more in biology lessons.

*Effective use of the interactive whiteboard*

In order to determine if the learning process is effective, an analysis of the strategies most influential on retention during an interactive lesson must be examined. With several training workshops on the use of interactive whiteboards, according to Kaufman (2009) a foreign language teacher estimated that in the past, only about 40% of the students passed a quiz on commands. However, after using this activity the teacher created at the intermediate/advanced workshop as part of a review, nearly 95% of the students passed the quiz this year. "I believe students enjoy it [the board] more because they think of it as a video game. They are able to easily manipulate words and images, like they are playing a game. (Kaufman, 2009)"

Hodge and Anderson (2007) concluded that the subject in their study "reminded herself of the need to integrate visual material with active learning activities that optimize the power of the interactive whiteboard to engage the learners yet retain pedagogical approaches that facilitate learning." Changing the way a teacher instructs is a long process to overcome.

For educators who may be uncomfortable or lack basic technology skills, the interactive whiteboard can be a hindrance to their teaching and classroom management (Kaufman, 2009). Policymakers and other administrators must realize, however, that is a long-term process in which users need time to reflect on,
experiment, and produce lessons that incorporate even the most basic functions of interactive whiteboards. However, in order for technology in general to become an integral part of education, "there may need to be a new wave of professional development in information and communications technology (ICT) which takes account of the extended list of ICT's features and the need to embed them in teachers' pedagogical knowledge and reasoning" (Kennewell & Beauchamp, 2007)
Methodology

With the idea that increasing student interactivity in the classroom promotes a stronger bond to not only the content, but with a higher level of understanding, students play a role in how they obtain their knowledge. According to Lewin et al. (2008), increasing educational technology has come to the forefront of educational theory. Utilizing interactive whiteboards in a classroom means a stronger level of cognition, with students retaining more information; with research pointing towards the use of interactive whiteboards in the classroom as a catalyst for this increase. Research shows that students who are engaged in an interactive lesson are extremely motivated. Not only are students motivated, but teachers, administrators and parents can see positive influences with the use of technology in the classroom. (Blanton, 2008).

Interactive whiteboards are a relatively new technology at Kendall Junior / Senior High School. The data collection varies due to differing levels of technology use and skill level of the instructors, providing results from a mixed cohort. To obtain a holistic view of how and why the interactive whiteboards are used in the classroom, surveys and informal discussions with instructors provided relevant data for this study. Data collected from department-wide tests were also utilized in this research. Not only were test scores compared, but student and instructor responses to surveys were qualitatively analyzed in respect for student motivation and achievement within content areas.

Student and instructor surveys gathered qualitative data for the study, allowing students to express their thoughts and experiences of the use of or lack of
interactive whiteboards in their classrooms. The surveys provided to the instructors (Appendix C), reviewed the instructor’s background, knowledge and use of the interactive whiteboards within their classroom, and rating themselves on their effectiveness of the interactive whiteboards. By providing instructor surveys, the teachers then provide reasoning.

Presenting teachers the resources to create effective interactive lessons requires more than placing new technology into their classrooms. Professional development in the effective use of educational technology needs to be implemented so that students are not just passively listening to a lecture, but rather actively participating with a lesson. The instructor surveys also reviewed the kind of professional development that has been provided by the school district aimed at the use of interactive whiteboards.

Participants

A total of 124 students from the Kendall Junior/ Senior High School in Kendall, New York were selected for this study. Each class ranged in size from fourteen to twenty-seven students in three different content areas. Students’ grade levels ranged from ninth through twelfth grades. The 124 pupils made up a total of six classes. Two mathematics classes, one with an interactive whiteboard and properly trained teacher, one without the interactive whiteboard, comprised fifty-four of the subjects tested. Two biology classes, one with an interactive whiteboard and properly trained teacher, and one without the interactive whiteboard, comprised forty-two of the subjects tested. Two technology classes, one with an interactive whiteboard and properly trained teacher, and one without the
interactive whiteboard, comprised of the remaining twenty-eight subjects tested. Students with Individualized Education Plans (IEPs), varied from classroom to classroom.

Each classroom was selected to participate based on the availability of an interactive whiteboard and also on the extent of the instructor's training. Mathematics Classroom A did not have an interactive whiteboard. Mathematics Classroom B did have an interactive whiteboard that was utilizing to allow student navigation and direction of each lesson. Biology Classroom C did not have an interactive whiteboard. Biology Classroom D had an instructor very comfortable with training other teachers in the use of interactivity. Biology Classroom D required students to manipulate the audio and visual content presented to them. Technology Classroom E, Principles of Engineering (POE) course, did not have the use of an interactive whiteboard. Technology Classroom F, also a POE course, had students complete demonstrations in front of the class to provide for critique, discussions, and group analysis of systems.

Instruments and Materials

Before the start of the study, subjects were provided the Interactive Whiteboard (Appendix A) and Content Area (Appendix B) surveys. Instructors were provided a survey assessing their own use of the interactive whiteboards (Appendix C). The Interactive Whiteboard survey asked students questions regarding their use and preferences of the interactive whiteboards in their classrooms. Students were asked what they liked and did not like about the interactive whiteboard. Students were also asked how they would utilize the interactive whiteboard if they were the
teacher. To help compare the training of instructors, students were also asked how their teacher used the interactive whiteboard.

The Content Area survey looked into the students’ perceived learning preferences for the course as well as what they liked and disliked about that particular course. The survey focused on grades, types of assessments, and how hands-on the class was perceived to be. To compare results, the Content Area survey, along with the Interactive Whiteboard survey, was then given at the end of twenty school days. This provided for an effective sampling of data.

Depending upon the instructor and content area of the course different simulations, technical drawing software, and mathematics academic suite were utilized in the study. These tools included V-Crash (Appendix D) which created an environment for students to reconstruct accidents through the manipulation of many variables. The biology classroom utilized dissection software, web quests, and online simulations (Appendix E) to incorporate student interactivity into the instructor’s lessons.

PowerPoint presentations were also included throughout the study in the classrooms making use of an interactive whiteboard. The presentations ranged from basic lecture style presentations to interactive games in which students controlled the lesson. The instructors used the PowerPoint presentations on the interactive whiteboard to open up dialogue and discuss topics specific to the content area; whether it was technology, biology, or mathematics.
**Data Collection**

In order to gather information from the students, both students and teachers received surveys at the beginning of the study regarding their views of using an interactive whiteboard during class. Surveys from instructors provided valuable data for this study. The surveys aimed at different perceptions the teachers and students had based on their experiences with the interactive whiteboard. The administration of the Instructor’s Interactive Whiteboard survey (Appendix C) also included a brief informal discussion with the teacher, reiterating thoughts and opinions provided on the survey. Students were also asked to provide insight about what they enjoyed most about using interactive whiteboards in the classroom, as well as what they enjoyed the least (Appendix A).

**Procedures**

This study occurred over a five-week period in which teachers of these six classrooms were instructed to continue teaching using the methods they typically used. The instructors provided permission regarding a study occurring within their classroom; however, instructors were not informed of any specific details pertaining to the study. This prevented the study from changing the teaching and instructional habits of the teachers.

When the students received the surveys, appendices A and B, the surveys were submitted back to the study in a sealed envelope. With the intention that the instruction should not be disrupted based on the survey, instructors were encouraged to evaluate their perception of student achievement based on the incorporation of interactive whiteboards into their lessons. Since the interactive
whiteboards are relatively new, the instructors using the technology have been asked to reflect on student achievement, active participation, and whether they believe student achievement has changed since they have received training with the whiteboard.
Results

Data for this study was collected over a period of twenty five school days, or five weeks. Each subject area of the study included one classroom with an interactive whiteboard and one classroom without an interactive whiteboard. Therefore, a t-test was conducted using test scores to determine whether the interactive whiteboard had significance on the test scores of the students participating within the study. This information is on table two, table three and table four. Scores from unit tests common in each content area were compared to another class within the same content area that did not have access to the interactive whiteboard. Various activities, based on the instructor’s discretion, were used to incorporate technology and interactivity in their lesson. These activities influenced the students’ perspectives on motivation and achievement.

Student Surveys

Students were provided surveys regarding their thoughts and opinions about the use of an interactive whiteboard in their class. The students were only to relate their survey responses based on the current course they were participating in at that moment.

Interactive whiteboard survey. One Principles of Engineering class, one Biology class, and one Algebra class participated in the Student Interactive Whiteboard Survey. These classes contained a range from fourteen students to twenty seven students. Students who responded to these surveys often commented on how they felt more involved with a lesson that required them to use the interactive whiteboard. With the interactivity incorporated into a lesson, some
students even commented on the notion that they felt like they were playing, and actually enjoyed what they were working on in the classroom. A small number of students did not like using the interactive whiteboards in class, due to a feeling of anxiety if they answered a question incorrectly in front of the class. It is apparent that these students were self-conscious about becoming involved with the lesson through inquiry-based simulations. One student who responded to the question “What don’t you like about using the Promethean board?” said in the survey (Appendix A), “I always feel like I am being put on the spot in front of everyone. I see kids laughing at other kids up at the board when they make a mistake.” Students who actively participated in the lessons that incorporated an interactive whiteboard commented on their ability to manipulate the environment they were working in, especially with simulations. One student commented on using a car crash simulator in a Principles of Engineering class in which variables could be changed with a class discussion. The student replied “Being able to change all the setting and variables that can affect the outcome of a car crash really made me think about the many other variables involved. I liked being the leader of the class, getting my peers to walk me through to our final conclusion.” A student-run discussion allowed students to try and recreate an actual car accident with evidence from a visiting New York State Police accident reconstruction expert.

When asked how students would use the interactive whiteboard if they were the teacher, twenty seven students out of the fifty-eight surveyed mentioned the use of the Activote learner response system that integrates with the Promethean interactive whiteboard. The students who commented on this system said they
would use the Activote system more often because it engaged them in so many discussions. One student, whose response in the student survey (Appendix A) was similar to others said, “I would use the Activotes more often because I was always paying attention. I could submit my answers anonymously and see where I compare with my classmates.” Eighteen of twenty-one students from the biology class also mentioned the use of the Activote system as being their favorite aspect of the interactivity of the lesson. This large percentage of students from the biology class who commented about the use of Activote was a direct result of having an instructor who used the system on a regular basis as part of the instructor’s assessment of their students. The biology teacher indicated on the instructor survey (Appendix C) that they noticed an increase in participation since they began executing the use of the Activote system.

It was also noted that students who participated in the Algebra class with the interactive whiteboard commented more on the use of the interactive whiteboard for presentation purposes. When asked how their teacher uses the Promethean board in the Algebra class, eighteen out of nineteen students had similar responses. Eighty-nine percent of Algebra students said their teacher used it for note taking, or presentations only. The students in the Algebra class said they would improve the lessons by making them more interactive, indicating that the instructor was using the board for more note taking and presenting, rather than for simulations, problem solving, and interactivity.

**Student Content Area Survey.** The purpose of this survey was to demonstrate the motivation that individual students had for a particular class whether the
students had access to an interactive whiteboard or not. All six classrooms utilized in this study participated in this survey (Appendix B). Students were asked about the learning environment for that particular content area, the importance of hands-on activities, the effect technology had on their learning, self motivation, the use of the Internet in class, the importance of grades, as well as the students’ rating of the different types of assessment for their grades.

A total of 117 students participated in this survey, providing a wide range of responses. Seven students were not present in class the day these surveys were distributed. This cohort of students includes students with Individualized Educational Plans (IEPs), students with 504 plans, as well as general education students. When compared with the classroom containing an interactive whiteboard, the students who did not have access to an interactive whiteboard responded with a lower average to the question “What is your ability to learn in this environment?” With a 1 ranked as the lowest score, and a 5 being the highest score, students with the interactive whiteboard responded with an average of 4.40, while students who did not have access to an interactive whiteboard responded with a slightly lower score with an average of the responses being 3.92 (Table 5). According to a t-test, table five also indicates whether the interactive whiteboards had significant roles within each question of the content area survey. While both groups of students had similar responses to the importance of hands-on activities, students without technology integration did not feel as confident in their ability to learn in that particular environment.
The importance of Internet access for students within a class was high across all content areas, both with and without interactive whiteboards. There were no significant differences among the two groups. With exposure to the Internet in most classes already occurring, this may have influenced the way students answered this question on the survey.

When asked about how much more students will learn if the instructor uses technology, again the average for both groups of students were not significant. Most students felt that technology was necessary for them to become more involved in their own learning process. The survey results (Table 5) compare students who had access to an interactive whiteboard to those students who did not have interactive whiteboards. These results help indicate whether the teacher was using technology or not. According to student responses, students feel that an increase in the use of technology will enhance their learning.

Students were asked to rate their motivation for real-world problems in their particular content area. Students who used the interactive whiteboards rated their motivation higher on average to learn about real-world problems than students who were not using an interactive whiteboard. Based on the content area survey results (Table 5), students who participated in an interactive whiteboard class did have higher motivation than those students who were not in an interactive whiteboard class. A similar trend was visible when students were asked “How important is it that you get the notes from the class time that you missed?” There was a significant difference in the students’ motivation between groups. Again, students who participated in a class with an interactive whiteboard present displayed a higher
chance of obtaining any missed work as a result of being absent. This result substantiates the notion that with interactivity within a classroom, students will be more motivated towards that particular class.

Students also documented their concern for their grades on the Student Content Area Survey. Students who participated in an interactive whiteboard class also had a higher concern for their grades. This was significantly higher than the students who did not have interactive lessons (Table 5). Having concern for grades also helps demonstrate a student’s motivation towards a class.

Because student motivation involves so many factors, class enjoyment was also recorded as part of the Student Content Area Survey (Table 5). Students in an interactive whiteboard classroom showed more enjoyment for the class than those students who were not in an interactive whiteboard classroom.

Instructor Surveys.

Surveys completed by all five teachers of the study probed into their teaching styles, methods of assessment, use of the interactive whiteboard, if applicable, and their opinions of student achievement in their classes. The three teachers who utilized interactive whiteboards into their curriculum were asked to respond regarding their likes and dislikes of the Promethean interactive whiteboards. The biology teacher responded by saying that “the Promethean provided a broader scope of the content for the students. With different simulations, websites and software, students can make changes to the virtual environments and see the results through interaction.” On the instructor survey (Appendix C), the biology teacher also commented about the difficulty for the technology to remain stable throughout
the day. “At least once a day, the computer and Promethean board would freeze, causing a delay in instruction.” The instructor also commented on the limited resource library for the biology field, indicating that the instructor made most of the interactive lessons from scratch. The technology teacher who taught Principles of Engineering indicated that their use of other interactive software, and computer aided design type programs, provided their students the opportunity to interact with different elements. Since this technology teacher also taught this course in another classroom with an interactive whiteboard, the instructor was able to compare the different learning styles of the classes. The instructor preferred to use the interactive whiteboard versus not using one with this type of class.

Student engagement was also evaluated by each instructor. Blanton (2008) found positive effects associated with the interactive whiteboard which included improved attitudes toward learning and an engagement. The instructors who had used an interactive whiteboard in their room reflected on their classrooms before interactive whiteboards. One teacher even commented “I enjoy having more students asking higher level questions because they follow along with the discussions.” The three teachers with an interactive whiteboard all described how student achievement was much higher as a result of becoming involved with the class. The teacher who did not have interactive whiteboards described achievement and motivation to be mediocre. Those teachers also commented within the survey that they would like to see an increase in the motivation of students in their classes.

All instructors were surveyed (Appendix C) about how they engaged students in their classes. The teachers with the interactive whiteboards provided a
greater number of visual and audio simulations, videos, and problem solving activities; while the instructors who did not have an interactive whiteboard utilized overhead projectors, or they created more handouts during lectures. These teachers also described their lectures as more question and answer based discussion. They followed a textbook and used chalk boards for visual aids.

**Student Test Scores**

Depending upon the course involved, students participated in mid-term exams, New York State Regents Exams, or simulated NYS Regents exams. These scores were used in correlation with this study, comparing the students who had access to interactive whiteboards, and those who did not. Biology and Algebra students participated in mock Regents exams as part of a class mid-term, while Principles of Engineering students took part in a Car Crash simulation.

The biology instructors administered a mock NYS Biology Regents exam as part of the students’ midterm grades. Table three shows the test scores based on the number of correct responses to the exam. A significance test was used to analyze the results to determine the impact the interactive whiteboards may have had on the students’ achievement in Biology. An independent-samples t-test was conducted to compare the students’ midterm scores against students who took the same midterm. The main differentiating variable in this t-test was that the interactive whiteboard was present in one biology class and not the other biology class. The average score for the class that used the interactive whiteboard was 90.4% with 21 students participating in the exam. The class without the interactive whiteboard had an average of 84.3%, also with 21 students partaking in the exam. A t-test indicated
a significant difference (p<0.05) between the two groups showing that the technology used in the classroom has a positive impact academically (Table 3).

The technology instructor experienced similar results in both Principles of Engineering classes. The students participated in a crash simulation quiz in which students applied physics formulas to real crash data. The class with the Promethean Board was able to experiment with a crash forensics simulator, as well as utilize computers that included the software for this simulator. The section without access to computers or a Promethean board utilized a projector and one laptop for the entire class. The results from the quiz indicated there was a noteworthy impact on test scores. As with the biology instructors, the technology teacher who taught both sections of Principles of Engineering saw a significant difference with the two sections (Table 4). The average percentage score for the Principles of Engineering class with access to an interactive whiteboard was 90.2% with thirteen students participating in the quiz. The class that did not have access to the interactive whiteboard scored an average 84.2%, again with thirteen students participating in the quiz (Table 4). An independent-samples t-test was conducted to compare students’ quiz scores that had access to a Promethean Board to students that did not have access to a Promethean Board. The t-test result being 0.04811 indicated there was a significant difference between the two groups of students. These results suggest that the activity leading up to the quiz did have an impact on the students academically.

A different pattern occurred in the Algebra section of the study as far as mock regents exam scores. The class average score with utilization of the interactive
whiteboard in class was 88.2% while the class that did not use the interactive whiteboard in class scored an average of 82.8% (Table 2). The mean scores of each class suggested that the class utilizing the Promethean board did perform better on the midterm. With a t-test result of 0.0899, this number indicated that there was not a significant different between the two groups of students partaking in the Algebra mock regents exam.
Discussion

The results of the research from this study were not as consistent with the literature. Overall, students who were in the Principles of Engineering and Biology classrooms utilizing the interactive whiteboards performed at a higher level academically. Algebra students who participated within the study did not show a significant relationship between motivation and academic performance in either classroom. It was also noted that student motivation was higher as a result an incorporation of interactivity into different lessons from instructors’ perspectives as well as the comparison from the Student Content Area Survey (Table 5). Student responses to the survey questions indicated a greater motivation to learn as well as a greater understanding of how the interactive whiteboards can be utilized to benefit their education.

The main outcome of this study was to establish a positive correlation between the incorporation of interactive whiteboards and an increase in student achievement as well as overall student motivation. As the results of this study conclude, there were significant variables that allowed for students to have a higher motivation. In two out of the three sections studied, there was a higher student academic performance indicated. The algebra sections, which did not show any significance, may have had some influences based on the instructor’s performance of interactive whiteboard utilization. The instructor’s lack of training, professional development, and teaching level probably had a noteworthy impact on the result for that class.
Many variables in an educational setting impact results. Students come from different backgrounds, having different socio-economic statuses. With the experience from the study, an examination of the socio-economic backgrounds of students in different classrooms will be included to indicate if some type of connection exists. Students coming from a higher class may perform differently than students who come from less fortunate families. Also, an examination of the motivation and achievement among genders may or may not have a correlation within the data.

Like the students, the teachers of this study come from different backgrounds and experiences. This impacts their instruction, how it is implemented and the types of students who achieve from their teaching style. Having differing abilities and experiences, teachers can sometimes feel overwhelmed as a result of the many tasks they are responsible for, negatively impacting their own progression as a teacher. This means that those teachers who are struggling would treat interactive whiteboards simply as an overhead projector or non-interactive whiteboard. Therefore, educational leaders should have provided more assistance for the instructors who did not feel qualified to utilize more technology. Increased professional development in specific uses of the interactive whiteboard would have provided a stronger understanding of the impact that technology could have on pupils.

While the results for the sections of students involved in the study included only one exam, there was some indication that the classes with more interactivity incorporated into lessons did achieve higher academically than students who did
not have exposure to an interactive whiteboard and its accessories. Many uncontrollable factors may have impacted the data within this study. The technology incorporation at this school was not well-planned. There was a lack of support for the instructors, teachers came into the school year at different times, there were a variety of individual teaching styles, but also a variety of the class compositions. The sizes of the classes varied, while other classes contained non-traditional students who were participating in the class a second time, or students who changed school districts during the school year. The aforementioned variables are all reasons that can influence results. More research into the specific uses of interactive technology needs to be conducted to determine what types of interactivity and the amount that will increase student achievement. The development of inquiry-based interactive hands-on resources designed specifically for interactive whiteboards would greatly enhance both learning and instruction. Databases full of ideas would thoroughly benefit multiple content areas in need of increased achievement, especially in high-needs areas.
Conclusion

The mere presence of interactive whiteboards in a classroom is not enough to make a difference in student achievement. Highly trained instructors who understand the importance of interactivity, with several options for training and professional development, will be the significant factor at increasing not only achievement, but also motivation.

The mere placing of an interactive whiteboard into a classroom will not guarantee results; motivated teachers will motivate students. When teachers effectively utilize the whiteboard’s interactively in their lessons, this generates circumstances in which the students take control of their own learning. Without the use of technology in a classroom, students will not prepare for their future as educators would like them to prepare. Students can thrive in an interactive environment if it is differentiated, captivating, and each individual contributes to their role. The community, administrators, teachers, and students all collaboratively work towards constructing an interactive environment.
References


Joselowsky, F. (2007). Youth Engagement, High School Reform, and Improved...


Appendix A
Student Interactive whiteboard Survey

Name __________________________ Date _______________ Class: ____________________

Directions: Answer the questions below about your experiences with the Promethean Boards used in this classroom.

1. What do you like about using the Promethean Boards?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

2. What don’t you like about using the Promethean Boards?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

3. What would make the Promethean Board even better?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

4. If you were the teacher, what would you use the Promethean Board for?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

5. How does your teacher currently use the Promethean Board?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
Appendix B
Student Content Area Survey

Name ___________________________ Date ______________ Class: ________________

Is there a Promethean Board (interactive whiteboard) present? Y N

For each question, use the scale of 1-5 with 1 being “low”, 3 being “medium” and 5 being “high” to answer each question.

1. What is your ability to learn in this classroom environment?
   1  2  3  4  5

2. How important is the use of hands-on activities to your learning needs?
   1  2  3  4  5

3. If teachers are using technology to teach a lesson, how much more do you learn?
   1  2  3  4  5

4. How motivated are you to learn about real life problems in this class?
   1  2  3  4  5

5. How important is it to have use of the Internet in this classroom?
   1  2  3  4  5

6. How important is it that you get the notes from the class time that you missed?
   1  2  3  4  5

7. How important are grades to you?
   1  2  3  4  5

8. How much do you like paper pencil tests?
   1  2  3  4  5

9. Are different types of assessment beneficial to you?
   1  2  3  4  5

10. How much do you enjoy attending this class on a daily basis?
    1  2  3  4  5
Appendix C
Interactive whiteboard survey (Instructors only)

Subject Area: ____________________________________________

Teaching Experience (years): ____________________________________________

Do you have a Promethean Board in your classroom?   Y     N

1. What do you like about using the Promethean Boards (if you have access to one)?
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

2. How do you make lesson more engaging for students?
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

3. How do you assess students on a day to day basis?
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

4. How does student achievement affect your teaching methods?
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

5. How do you think your teaching methods affect student achievement?
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

6. In your opinion, do you feel all students are engaged in your lessons? Explain.
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
Appendix D

Virtual Crash Simulation Software used in the Technology Class F (Principles of Engineering)
Appendix E
Eating and Exercise Simulation used in Biology Class D
### Appendix F

Tables and Figures

#### Table 1

*Unit Exam Mean Scores in Percent*

<table>
<thead>
<tr>
<th></th>
<th>With Interactive Whiteboard</th>
<th>Without Interactive Whiteboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>90.4</td>
<td>84.3</td>
</tr>
<tr>
<td>Algebra</td>
<td>88.2</td>
<td>82.8</td>
</tr>
<tr>
<td>Principles of Engineering</td>
<td>90.2</td>
<td>84.2</td>
</tr>
</tbody>
</table>
Table 2

*Significance of Interactive Whiteboards in Algebra Classrooms A and B*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classroom A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without interactive whiteboard</td>
<td>82.8</td>
<td>0.0899</td>
</tr>
<tr>
<td><strong>Classroom B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With interactive whiteboard</td>
<td>88.2</td>
<td></td>
</tr>
</tbody>
</table>
Table 3

*Significance of Interactive Whiteboards in Biology Classrooms C and D*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom C</td>
<td>84.3</td>
<td>0.043</td>
</tr>
<tr>
<td>Without interactive whiteboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom D</td>
<td>90.4</td>
<td></td>
</tr>
<tr>
<td>With interactive whiteboard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4

*Significance of Interactive Whiteboards in Technology Classrooms E and F*

<table>
<thead>
<tr>
<th>Classroom</th>
<th>Mean</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom E</td>
<td>84.2</td>
<td>0.048</td>
</tr>
<tr>
<td>Without</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classroom F</td>
<td>90.2</td>
<td></td>
</tr>
<tr>
<td>With</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Utilizing Interactive Whiteboards

Table 5

*Student Responses to Content Area Survey*

<table>
<thead>
<tr>
<th></th>
<th>With Interactive Whiteboard</th>
<th>Without Interactive Whiteboard</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability to learn in this environment</td>
<td>4.40</td>
<td>3.92</td>
<td>0.003</td>
</tr>
<tr>
<td>2. Importance of hands-on activities</td>
<td>4.72</td>
<td>4.65</td>
<td>0.585</td>
</tr>
<tr>
<td>3. Learning with use of technology</td>
<td>4.35</td>
<td>4.63</td>
<td>0.083</td>
</tr>
<tr>
<td>4. Motivation in this class</td>
<td>4.74</td>
<td>3.87</td>
<td>0.000</td>
</tr>
<tr>
<td>5. Internet in this class</td>
<td>4.31</td>
<td>4.49</td>
<td>0.242</td>
</tr>
<tr>
<td>6. Obtaining missed work for this class</td>
<td>4.46</td>
<td>3.42</td>
<td>0.000</td>
</tr>
<tr>
<td>7. Importance of grades</td>
<td>4.51</td>
<td>3.84</td>
<td>0.000</td>
</tr>
<tr>
<td>8. Paper and pencil tests</td>
<td>3.69</td>
<td>3.23</td>
<td>0.035</td>
</tr>
<tr>
<td>9. Different types of assessment</td>
<td>4.42</td>
<td>4.25</td>
<td>0.339</td>
</tr>
<tr>
<td>10. Enjoy attending this class</td>
<td>4.82</td>
<td>3.46</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: All scores are mean scores with sixty-two students who participated had the use of an interactive whiteboard, and sixty-two students who participated in the survey did not have use of an interactive whiteboard. For each question, the students used the scale of 1-5 with 1 being "low", 3 being "medium" and 5 being "high" to answer each question.