

Study of Promethean Interactive Whiteboards in Classrooms

REPORT OF FINDINGS: FALL 2007

Henrico County Schools engaged in a study to determine if interactive whiteboards have a positive impact on the teaching/learning process. The study was designed to determine if:

- *The use of the interactive whiteboards with responder technology would increase student engagement in their learning.*
- *The use of the interactive whiteboards with responder software would allow for more frequent monitoring of student learning and allow for quick adjustments to the teaching process based on this monitoring.*
- *The use of interactive whiteboards with responder technology would be used as an information/communication tool and would raise the level of technology use/integration as a 21st century skill.*
- *The use of the interactive boards with responders would enhance student acquisition of content, concepts and skills taught using this technology.*

STUDY METHOD

Participants

Interactive whiteboards and responder technology were provided to twenty selected classrooms across the school division representing elementary, middle, and high school instruction and a variety of subject areas. See table 1 below for the location and target subject area for each interactive board.

Table 1. Schools and Subject Areas Receiving an Interactive Board for the Study

| School | Subject Area of Focus |
|-----------------------------|---|
| Fair Oaks Elementary School | Math Grade 3, (two teachers) |
| Lakeside Elementary School | Math Grade 4, Math Grade 5 |
| Ratcliff Elementary School | Math Grade 5, Science Grade 5 |
| Ward Elementary School | Reading Grade 1, (two teachers) |
| Rolfe Middle School | Social Studies 6, Social Studies 7, Math 8, English 8 |
| Wilder Middle School | Math 6, Math 7, English 8, Social Studies 6 |
| Hermitage High School | Geometry, Algebra I, English 11 (S), Chemistry (C) |

For each classroom assigned, a matching classroom within the school was identified. Matching classrooms did not have an interactive whiteboard. Classrooms and teachers were “matched” using the following attributes:

1. Grade level
2. Content area
3. Class size

4. Student assignment (collaborative classes, gifted classes, S-level classes)
5. Teacher skill level as documented by the school administrative team
6. Teacher disposition to the use of technology as documented by the school administrative team
7. Teacher disposition to “student centered” learning as documented by the school administrative team.

Data Collection

Prior to the implementation of the interactive whiteboards, all teachers participating in the study completed a survey measuring their perception of the current level of student engagement, their monitoring of student learning and adjustment of instruction, and their integration of 21st century skills into the core content. These perceptual data were used as the baseline from which to measure change (Appendix A). In addition, each teacher receiving an interactive board was observed and data collected about his or her instruction in relation to the study’s questions as additional baseline data from which to measure change.

Following in Tables 2a- 2c is a description of the observational data gathered and the method for collecting these data. The appendices indicated on the table are samples of each data collection tool. These tools were used for all observations, including collection of baseline data.

Table 2a. Data collection to answer study question: Will the use of the interactive whiteboards with responder technology increase student engagement in their learning?

| Data Points | Data Collection Tools (Appendix B) |
|---|--|
| Number of students fully engaged in the instructional activities using the agreed upon descriptors for “engagement” (found in Appendix C) | Six Observations: Count of students engaged within set time periods. |
| Evidence of “student centered” as compared to “teacher directed” learning using agreed upon descriptors (found in appendix B and C with levels one and two being teacher directed and three and four being student centered). | Six Observations: Count of opportunities and description of “student centered” learning based on rubric included on the data collection tool |

Table 2b. Data collection to answer the study question: Will use of the interactive whiteboards with responder software allow for more frequent monitoring of student learning and quick adjustments to the teaching process based on this monitoring?

| Data Points | Data Collection Tools (Appendix D) |
|--|---|
| Number of times the teacher tracks student learning through questioning as compared to the number of times observed in the match classroom | Six observations using a protocol to determine type and level of “monitoring.” |
| Number of times the teacher “adjusts” instruction based on the monitoring as compared to the match classroom | Six observations using a protocol to record adjustments in instruction based on monitoring. |

Table 2c. Data collection to answer the study question: Will the use of interactive whiteboards with responder technology be used as an information/communication tool and will it raise the level of technology use/integration as a 21st century skill?

| Data Points | Data Collection Tools (Appendix E) |
|---|--|
| <p>The frequency with which the interactive board is being used for each of the following 21st century skills:</p> <ol style="list-style-type: none"> 1. Thinking and problem solving 2. Information and communication 3. Interpersonal self-direction skills | <p>Lesson plans of the teachers using the boards will be examined weekly to determine the type of use under the three categories.</p> <p>Six classroom observations will record the category of use of the interactive whiteboards and any other technology as compared to the match classrooms.</p> |

In addition to the perception surveys and classroom observations, an analysis of student achievement as measured by the Standards of Learning Tests and the Henrico Achievement Tests for students participating in the study was performed. Following in Table 3 is a description of how these data were collected:

Table 3. Data collection to answer the question: Will the use of the interactive boards with responders enhance student acquisition of content, concepts and skills taught using this technology?

| Data Points | Data Collection Tools |
|---|--|
| Number of students (percent) who display mastery of specific skills, content, and concepts taught using technology as compared to students taught the same skills, content, and concepts NOT using the | Analysis of student learning as measured by specific item (descriptors) on the Standards of Learning assessments. The skills, content, concepts to be measured will be identified through analysis of lesson |

| Data Points | Data Collection Tools |
|-------------|--|
| technology. | <p>plans. The Student performance by Question Report will be used to complete this analysis.</p> <p>**While the data structures are established to collect these data, specific item descriptors from the SOL tests were not yet available at the time of analysis. Instead, total pass rates for the board and match teachers were compared.</p> |

At the conclusion of the study period, teachers again took the survey to determine if their perception changed regarding the current level of student engagement, monitoring of student learning and adjustment of instruction, and the integration of 21st century skills into the core content.

Finally, teachers receiving the interactive board participated in a focus group interview using a semi-structured interview protocol (Appendix F).

Training for Teachers and Observers

A study team was assembled and training was provided on the various data gathering tools and observation protocols (See Appendix G for list of observers). The observers practiced applying the protocols on a series of observations to work toward maximum inter-rater reliability.

All teachers who received an interactive board were observed during instruction in each of the classrooms at least one time prior to implementation of the interactive boards and training. This established a baseline “typical” of the teaching/learning process from which to measure change.

Teachers with interactive boards received ongoing training on the use of the boards to enhance instruction (See Appendix H for the training plan). As part of the training, teachers received a template for lesson planning that they were asked to use. These lesson plans were used to identify specific skills, content, and concepts for which the interactive whiteboard was an integral part of the teaching/learning process as well as the 21st century skill focus.

Teachers in the match classes received training on 21st century skills, student engagement, and monitoring of student learning. Teachers in the match classrooms were also asked to use the lesson planning template to report when and how they taught the specific target skills as a point of comparison. (See Appendix I for the lesson-planning template).

Conducting Observations to Collect Data

The study team members began their six classroom observations within the first month of implementation. The observation schedule was established following a review of the lessons for the week. All observations were unannounced. The observations in the match classrooms were scheduled to coincide with the teaching of the same skill, content, and concept observed in the interactive board classrooms. All observations were conducted by teams of two evaluators with the goal of improving reliability of the data. Observation data were recorded on the prescribed protocols.

Analysis of Data

Classroom observation data

The data from each of the six observations were analyzed by individual teacher and individual observation as well as in aggregate according to interactive board teacher group and match teacher group. Tests were run using SPSS (statistical software) to determine statistical significance between the two groups. In addition, a comparison of the baseline data gathered from the interactive board teachers with the aggregated data from the six observations using the interactive board for each teacher was made.

Survey data

Surveys were administered electronically using Survey Maker. Data of the teachers' perceptions were analyzed in aggregate to determine a mean rating for each survey response. The mean response was compared from the pre and post-survey.

Focus group interview data

Each interview was transcribed and organized by study question and sub-themes under each study question. Incidences of interview statements related to the study questions as compared to the number of teachers participating in the interviews are reported. In addition, significant interview text is reported as related to each study question.

Student learning data

Average pass rates for students in interactive board and match classrooms on the Standards of Learning tests were compared. An analysis of students pass advance and pass proficient was also conducted.

STUDY FINDINGS

Will the use of the interactive whiteboards with responder technology increase student engagement in their learning?

Students were found to be more engaged in classes with teachers using interactive whiteboards when compared to their match classes. The difference in the level of engagement was found to be statistically significant at the $p < .05$ level (Table 4a). In addition, it was determined that when board teachers instructed at Level two or three of the rubric (Appendix A), more students were engaged (Table 4B). This finding was also statistically significant at $p < .05$ level. Teachers in classrooms with interactive whiteboards consistently engaged students in student-centered learning activities as measured by the observation rubric. While both board and match teachers engaged students in “student-centered learning” at levels three and four of the rubric, the board teachers instructed at these levels more often (Table 4c).

Table 4a. Percent of students engaged in learning over six observations for board and match teachers.

| Teacher Group | Percent of Students Engaged | Statistical Significance |
|----------------------------|-----------------------------|--------------------------|
| Interactive Board Teachers | 51.4988 % | P=.040 |
| Match Teachers | 41.2236 % | |

Table 4b. Percent of students engaged at each level of instruction from level one (1) most teacher directed to level four (4) most student-centered instruction.

| Teacher Group | Percent of Students Engaged at Level 1 | Percent of Students Engaged at Level 2 | Percent of Students Engaged at Level 3 | Percent of Students Engaged at Level 4 |
|----------------|--|--|--|--|
| Board Teachers | 50.8907% | 65.6806% | 69.0407% | 16.233% |
| Match Teachers | 57.1222% | 62.0944% | 37.6454% | 8.0324% |

Table 4c. Number of Times over six observations teachers moved to instructional level three or four of “student-centered” instruction as measured by the observation rubric.

| Number of <i>times</i> each teacher used a “student-centered” instructional approach over the six observations | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--|---|---|---|---|---|---|---|---|---|---|
| Board Teacher Observations | 0 | 0 | 1 | 2 | 1 | 4 | 4 | 4 | 2 | 1 |
| Match Teacher Observations | 2 | 1 | 4 | 5 | 5 | 1 | 1 | 2 | 0 | 0 |

Board Teachers also *perceive* students to be more engaged in their learning since the use of interactive whiteboards. There was an increase of 13 percentage points from the baseline survey to the post-study survey when teachers were asked the percent of time they believe ALL students in their class were engaged in instruction. The increase from the baseline for teachers not using board was three percent. Board teachers also reported a nine-point increase in the percent of time that students were engaged in “student-centered” instructional activities as compared to a decrease of two percent for the match teachers. Full survey results are found in Appendix A.1.

Transcripts from the focus group interviews also indicate that teachers using the interactive whiteboards identified student engagement as a major benefit of the technology. When asked in the focus group interview to simply talk about their experience with the interactive whiteboard, all 19 teachers interviewed *began* by talking about how the technology had improved student engagement. Overall, for this study topic, there were 25 comments made about student engagement. These comments were offered without any prompt from the interviewer about student engagement. Table 4d details the themes of the comments related to increased student engagement and the number of comments made around each theme. The focus group interview protocol is found in Appendix F and full text organized by research question of the teacher comments can be found in Appendix F.1.

Table 4d. Number of comments organized by theme made by teachers in the focus group interview related to perceptions of increased student engagement attributed to use of the interactive whiteboards.

| Themes identified in transcripts related to increased student engagement | Number of comments made by teachers attributed to each theme |
|---|--|
| 1. The interactive board focused students on the learning task and supported classroom management | Eight (8) comments made by teachers |
| 2. Students found the board visually stimulating | Three (3) comments made by teachers |
| 3. Students were anxious to use the board | Six (6) comments made by teachers |
| 4. The board allowed for more “hands on” instruction | Two (2) comments made by teachers |
| 5. Students would be more willing to answer questions and think deeper using the board | Five (5) comments made by teachers |

Teacher’s Voices:

“The whiteboard is actually something that was interactive, it hit them where they really are. I mean these kids are the kids who are in front of the TV and in front of the video games constantly so for us to put something in front of them that was like that I think that just really helped them connect. And it made such a difference. I mean I think it made more of a difference than if we had just the overhead or paper and pencil because it was interactive and they were actually able to get up there and do it, which is the same thing they’re doing at home on a daily basis.”

“I absolutely loved it and I know that my students really enjoyed working with it, too. They were actually engaged and very excited about having the board. They couldn’t wait for the board to get there and once it got there it exceeded their expectations of what I had described to them.”

Will use of the interactive whiteboards with responder software allow for more frequent monitoring of student learning and quick adjustments to the teaching process based on this monitoring?

Teachers in classrooms with an interactive whiteboard were found to monitor student learning by asking questions more frequently than their match classroom. They also were able to simultaneously monitor the learning of all students in the classroom more frequently than their match teacher (Table 5a). This finding was statistically significant at $p < .05$ level. Additionally, teachers using interactive whiteboards were found to test student learning at higher levels of understanding by asking more questions at the analysis and application level. The match teachers were found to use primarily knowledge and comprehension level questions to monitor student learning (Table 5b).

Table 5a The average number of questions asked by the board teachers over six observations to monitor instruction of individual students, several students, and the entire class as compared to the match teachers.

| Teacher Group | Questions asked to monitor learning of one student | Questions asked to monitor learning of several students | Questions asked to monitor learning of the entire class |
|--------------------------|--|---|---|
| Board Teachers | 75.8 | 42.4 | 33.5 |
| Match Teachers | 60.2 | 31.5 | 18.6 |
| Statistical Significance | | | P= .009 |

Table 5b. The average number of questions asked to monitor the depth of learning at each level of Bloom’s taxonomy over six observations.

| Teacher Group | Knowledge | Comprehension | Application | Analysis | Synthesis | Evaluation |
|--------------------------|-----------|---------------|-------------|----------|-----------|------------|
| Board Teachers | 56.8 | 47.5 | 23.2 | 14.6 | 5.6 | 3.9 |
| Match Teachers | 57.6 | 33.8 | 12.9 | 4.4 | .9 | .8 |
| Statistical Significance | | P=.044 | P=.009 | P=.01 | P=.003 | P=.027 |

Board teachers also *perceive* that they were better able to monitor student learning with the interactive whiteboard. There was an increase of 15 percentage points from the baseline survey to the post-study survey when teachers were asked the percent of each day that they actively monitored student learning in their class. The increase from the baseline for teachers not using board was ten percent. Full survey results are found in Appendix A.1.

Transcripts from the focus group interviews also indicate that teachers using the interactive whiteboards identified the ability to quickly monitor student learning as a major benefit of the technology. Overall, for this study topic, there were 17 comments made about monitoring student learning. Of these comments, 14 were offered without any prompt from the interviewer and three were responses to a specific prompt about monitoring student learning. Table 5c details the themes of the comments related to monitoring student learning and the number of comments made around each theme. The focus group interview protocol is found in Appendix F and full text organized by research question of the teacher comments can be found in Appendix F.1.

Table 5c. Number of comments made by teachers in the focus group interview related to perceptions of monitoring student learning attributed to use of the interactive whiteboards organized by theme.

| Themes identified in transcripts related to increased student engagement | Number of comments made by teachers attributed to each theme |
|---|--|
| 1. The activote system use with the interactive board makes it easy to get instant feedback on learning. * “Activote” is a hand held responder used by students to “vote” on their answer to questions. It is also referred to as “clickers” or “eggs” by teachers in the focus group interview transcript data. | Four (4) comments made by teachers |
| 2. Teachers used the interactive board and | Five (5) comments made by teachers |

| | |
|--|-------------------------------------|
| activote system with SOL release test items for test prep activities- and students were more involved. | |
| 3. Students were more self-directed about monitoring their learning because they could see the result with the activote. | Four (4) comments made by teachers |
| 4. The activotes and the board helped teachers identify who had not mastered the learning and allowed for differentiation of instruction | Three (3) comments made by teachers |

Teacher’s Voices:

“I think that being able to pace and assess smaller chunks of learning, I think it reinforced it with the children because they were saying, “Oooo, we just voted and we all got it correct.” And my class it got to the place where we have got to get five tally marks where everyone gets it right before we can cheer because they wanted to just jump up and cheer after every time!”

“The kids really loved the Activote (interactive board responders) and I did too because I could tell right away who understood something and who didn’t. And also they got to be pretty competitive with answering things quickly and working problems quickly and I’d like to see the involvement and interaction it made with them.”

Will the use of interactive whiteboards with responder technology be used as an information/communication tool and will it raise the level of technology use/integration as a 21st century skill?

Teachers with interactive whiteboards were found to incorporate 21st century skills in the area of communication, problem solving, and collaboration more often than their match teachers. The difference was statistically significant at the $p < .05$ level (table 6a). Students in the classrooms with interactive boards were found to be engaged in use of 21st century skills more than their peers in the match classrooms. This finding was also significant at the $p < .05$ level (Table 6b).

Table 6a. The average percent of time teachers with an interactive whiteboard spent incorporating 21st century skills into instruction across six observations.

| Teacher Group | Percent of Time Incorporating 21 st Century Skill | Statistical Significance |
|----------------------------|--|--------------------------|
| Interactive Board Teachers | 20.3095% | P=.022 |
| Match Teachers | 12.3728% | |

6b. The average percent of time students spent engaged in the use of 21st century skills over six observations as compared to the match students.

| Student Group | Percent of Time Students Used 21 st Century Skills | Statistical Significance |
|---------------------------------------|---|--------------------------|
| Student Groups with Interactive Board | 6.1722% | P=.028 |
| Match Student Groups | 3.4726% | |

Board teachers also *perceive* that they are better able to incorporate 21st century skills into their instruction. There was an increase of sixteen percentage points from the baseline survey to the post-study survey when teachers were asked the percent of time each day that they actively facilitate students working collaboratively. The increase from the baseline for match teachers was six percent. There was also a seven percent increase for board teachers from the baseline survey on the amount of time students spend in meaningful problem solving activities. There was an increase of one percent for the match teachers. Full survey results are found in Appendix A.1.

Transcripts from the focus group interviews also indicate that teachers are using interactive whiteboards in ways connected to 21st century skills. Board teachers offered Seventeen (17) comments related to 21st century skills during the focus group interview. Table 6c details the themes of the comments related to using the interactive board to incorporate 21st century skills. The focus group interview protocol is found in Appendix F and full text organized by research question of the teacher comments can be found in appendix F.1.

Table 6c. Number of comments made by teachers in the focus group interview related to use of the interactive whiteboards to incorporate 21st century skills organized by theme.

| Themes identified in transcripts related to 21 st century skills | Number of comments made by teachers attributed to each theme |
|---|--|
| 1. The board allows for connections to be made with information outside of the classroom. | Seven (7) comments made by teachers |
| 2. The board facilitates student interaction and collaboration with each other. | Three (3) comments made by teachers |
| 3. The board allows easy incorporation of different technologies into instruction. | Seven (7) comments made by teachers |

Teacher's Voices

"I liked the overlay feature, too, because we use a lot with United Streaming and with a lot of the videos that I use with United Streaming the overlay component made it a lot easier, especially if I stopped the clip and I wanted to actually teach. As long as the overlay was up, I was able to actually teach right on it and then keep going. Where before I would have to stop the VCR or stop the DVD player and then pull it and make sure the overhead was up; with this, everything was right there and it made it a whole lot easier."

"I liked how you could expand if you were on a subject. You could even go up to Google while you were on there and pull up Google and say, "Well let's look at this further," and bring in websites and other resources, too."

"I found the students were more interactive with each other. I can look at today; we were videotaped today and one thing I noticed was, if the students got something wrong there was always someone there willing to say, "Ok, this is why you did it." Or if I asked them what they were thinking about or how they got it, there was always another student there who was willing to say, "OK, let me show you how to do it." They were more willing to help each other out and collaborate. They didn't rely on me; they were willing to help each other solve problems and there was more engagement amongst the students."

Will the use of the interactive boards with responders enhance student acquisition of content, concepts and skills taught using this technology?

Students in the classrooms with the interactive white boards had an average pass rate of 75% on the Standards of Learning tests as compared to a pass rate of 73.4% percent for the match classrooms. The advanced pass rate for classrooms with interactive whiteboards was 19.2% as compared to the advanced pass rate in match classroom with 14.2% (Appendix J).

Transcripts from the focus group interviews also indicate that teachers identified student learning as an outcome of the use of interactive whiteboards. There were six comments made by teachers after prompting with a specific question about their perception of student learning related to use of the board. Two of the six comments contained specific examples of how students outperformed expectations on standard assessments. The other four comments pertained the perception that the interactive boards fostered deeper learning and students taking greater responsibility for their learning. The focus group interview protocol is found in Appendix F and full text organized by research question of the teacher comments can be found in Appendix F.1.

Teacher Voices

"I had two classes of exactly the same level with approximately the same test scores and approximately the same number. And my second period class and my seventh period class; the only thing that was different is that there were more boys in my seventh period

class which was the one I chose to do the board with because I thought it would be more active and they have a lot of activity issues already. And with the SOL scores (we already have our scores because we did them online) only one person failed in my seventh and five failed in my fifth. I saw better scores.”

“Kids that weren’t interested in reading before and weren’t scoring high in comprehension were scoring 10 to 20 points higher on tests and, like I said, I can’t explain it except just the interest level in taking quizzes and using the board. It was just a big thing for them.”

“I really felt like I got to spend more time asking them to tell me why or how they knew something was true which is truly how you acquire new knowledge and because they were able to explain it to their classmates on the same kind of level, I felt like they just absorbed so much more than they would have and I spent so much less time dealing with all those discipline issues which allowed for the time to deal with actual learning.

ADDITIONAL FINDINGS

Three of the teachers indicated in the focus group interview that the interactive whiteboard was a factor keeping them in their current placement. They did not want to transfer to another school or leave their classroom because of their access to the interactive whiteboard. Below are the three quotes from the interview transcript:

“I think we should really go ahead and buy one for every classroom. I know that I would think long and hard about getting a different job because it would mean I’d have to leave mine behind. “

“We (the board teacher) talked and said you can do whatever just don’t move our classrooms.”

“I’ll be in this school and this classroom for the next 27 years (because of my interactive board)!

STUDY CONCLUSIONS

According to the results of the survey, the boards did have a positive impact on student engagement in instruction. Additionally, there is some indication that it deepens the level of learning of the students. Students were engaged in more “student-centered” learning activities and teachers monitored their learning more frequently and at deeper levels of understanding. This may account for the higher “pass advanced” rate among students in classrooms with interactive boards.

Teachers who had the opportunity to use the interactive whiteboards had very positive perceptions of their effect on student engagement and learning. All teachers in the study have become strong advocates for the use of the boards. They believe that the most important aspect of the use of the interactive boards is the increase in student

engagement. This quote from one of the teachers during the focus group interview is a good indicator of their perception of the board:

“I think any time they (students) are more engaged then they pick up on things quicker, they participate more in class. There was a lot more volunteering of answers because they wanted to come up to the board, they wanted to use the tools, so that participation, I think, really helped and I think that always helps learning. And also just getting the feedback from me so quickly helps them learn and correct their mistakes.”

There are limitations to this study. This research took place in a short time period with data gathered over a twelve- week period. It began in March and concluded in May. Most of the instructional time in classrooms in late April and throughout May is spent reviewing and preparing for the Standards of Learning tests. In addition, the sample size for this study is relatively small with twenty teachers receiving an interactive board and nineteen match teachers. In spite of these limitations, benefits of the use of interactive whiteboards, as listed above, were found.

