Interactive White Boards: Changing Students' Attitudes about Science

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April 23, 2011

Abstract

In recent years Interactive White Boards (IWBs) have been introduced into classrooms and claims have been made these boards increase student motivation. This action research looked into the extent the use of IWBs to deliver British Columbia curriculum changed students' attitudes towards science. The attitudes towards science of two Science and Technology 11 classes at Alberni District Secondary School were measured over a three month period to evaluate the change in attitudes. The data attained shows that when an IWB was used to deliver curriculum there was a statistically positive change in students' attitudes towards science.

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Chapter 1: The Problem Investigated

A. Purpose of the Study

There is a trend in education to incorporate new technology to deliver curriculum in a high school setting. The purpose of this study was to determine if using new technology to deliver curriculum led to a more positive attitude towards science as reported by secondary science students.

B. Justification of the Study

It has been found that the average child aged 12 -18, spends 30 hours a week watching TV and working on computers (Holler et al. 2010) making "technology a stunning reality that has permeated not only our everyday lives but also our mere state of existence" (Harvey-Woodall, 2009, p. 2).

School District #70, in partnership with the British Columbia government, has planned to build a new high school for the city of Port Alberni. This school has been designed to meet the Leeds Gold Standard making it one of the greenest and most technologically advanced schools in the province. State of the art technology has been incorporated into the design of all classrooms, a drastic change from the chalk boards and over head projectors used in the current school.

Staff at Alberni District Secondary School (ADSS), the existing high school in Port Alberni, were not enabled with new technology to deliver curriculum. It was important to expose both staff and students to the new technology present at the new school because "one of the most significant trends in education today is the exploration of new media for teaching and learning" (D'Arcy, Eastburn & Bruce, 2009, p. 56). Many teachers were hesitant about converting from the traditional ways of teaching to

integrating technology into the classroom (Pearlman, 2006) but as Harvey-Woodall (2009) stated "traditional methods of teaching can no longer be utilized to capture the interests of students who are being reared during the rapid growth of the computer age"(p. 3).

One of the new tools being explored for the new high school to deliver curriculum in schools are Interactive White Boards (IWBs). These boards combine a white board with a computer and projector to allow teachers to create compelling lessons that incorporate a variety of learning tools including images, videos and web sites and can be controlled by using a specialized pen, finger or other tactile devices. School District #70 budgeted for 26 IWBs to be installed in the new school replacing the chalkboard and overhead projectors. It was important to establish whether there was a link between the use of IWBs to deliver curriculum and an improvement in students' interest and attitude towards high school classes before the substantial investment in IWBs was made.

Most students who attended ADSS had not been exposed to IWBs and staff was somewhat sceptical that this new technology would improve students' attitude towards learning in the classroom. Jewitt, Moss and Cardini (2007) found that the use of IWBs increased the multimodality, pace and interaction in the high school setting. Jewitt et al. described multimodality as the ability to harness a wider range of resources to facilitate pupil learning and found students responded positively to the interaction with IWBs. Hennessy, Deaney, Ruthven and Winterbottom (2007) stated that in science "dialogic, interactive communication allows teacher and pupils to explore ideas together, pose questions and reconcile scientific ideas" (p. 284) and that IWBs contributed to the creation of a fluid shared communication space where this could happen. Hennessey et al.

found that science classes taught using IWBs showed a more positive classroom climate for active pupil learning through guided participation and collaboration. Wall, Higgins and Smith (2005) also found IWBs useful in elementary school setting. They found the elementary students had a positive response to the IWB saying it was fun, interesting and interactive. Many students commented positively on how the visual displays on the IWB were helpful (Wall et al.).

A critical review of IWB literature conducted by Smith, Higgins, Wall and Miller (2005) suggested that there is much evidence found through informal surveys of teachers and pupils about how perceptions change with IWB use; however, caution that there are few rigorous studies describing the impact of IWB use on learners and little documentation on actual changes in classroom interaction. Smith et al. found that more research is needed to collect better empirical evidence so that the processes of teaching and learning using IWBs can be more fully understood.

Science Troubles in School District #70

According to the School District #70's achievement contract, the district struggled with graduation rates in 2008 with only 68% of students graduating based on the six year dogwood completion rate. This percentage reflects one of the lowest rates in the province with the provincial average being 79% (School District #70, 2009). Only 56% of students who were registered in Grade 10 science in 2008 received a passing mark (School District #70, 2009). In the 2008 satisfaction survey the Grade 12 class reported that only 50% felt prepared by School district #70 to continue on to post secondary education (School District #70, 2009). With only 56% of students passing Grade 10 science in 2008 and only 50% of graduates feeling ready to attend post secondary it was important

to explore how using IWBs to deliver curriculum could increase the positive attitudes of students towards science.

To help those students who struggle with Science School District #70 offers a Science and Technology 11 course. Science and Technology 11 is a course designed by the provincial government in partnership with school districts to benefit students who have not been successful in previous science courses and tend to have a negative disposition towards science. Many of the students who are enrolled in Science and Technology 11 are referred to the course by Alberni District Secondary School counselors so the students can attain their science requirements for graduation. Science and Technology 11 usually consists of the weakest science students in the school and provides the ideal setting to determine the positive effects of using IWBs.

C. Research Question and Hypothesis

The author of this paper asked: to what degree, if any, would the use of an interactive white board to deliver British Columbia curriculum affect the attitudes of students towards Science and Technology 11? The author's hypothesis in the current study was that students' attitudes towards science would be more positive when IWBs were used to deliver curriculum.

D. Definition of Terms

There are key terms from the research question that needed to be defined. For the purpose of this study, attitude was defined as the state of mind developed by individuals which reflects their like or dislike of course material based on the interaction in the classroom. This mental construct which students had about a course may continue to develop over time based on their beliefs, feelings and disposition in the classroom setting.

The British Columbia curriculum is composed of course specific prescribed learning outcomes (PLOs). These PLOs were established by the British Columbia government and are those topics which teachers are required to cover through the course. In some courses a standardized provincial test is used to asses student achievement province wide.

IWBs combine a white board with a computer and projector to allow teachers to create compelling lessons that incorporate a variety of learning tools including images, videos and web sites and can be controlled by using a specialized pen, finger or other tactile devices

E. Brief Overview of the study

The participants of this study were students enrolled in two Science and Technology 11 classes at Alberni District Secondary School. Students were informed about the nature of the current study and consent was attained from those students who wished to participate. Those who agreed to participate were given an attitudinal questionnaire (Appendix A) composed of 8 Likert-style questions anchored by “strongly agree” and “strongly disagree”.

Participants were asked to fill out the questionnaire before any formal curriculum was delivered to assess attitudes about science. The same questionnaire was given to the participants again after six weeks of instruction using traditional teaching techniques. These techniques used only chalk boards and overhead projectors and teacher made handouts. This second round of questions determined the participants’ attitudes towards science after a teacher – student relationship had been established. The IWB was then introduced and used to teach for the second six weeks of the course. The participants

were then asked to complete the questionnaire for the final time. The data was then analyzed to determine if there had been any change in attitude towards science based on the use of IWBs.

Chapter 2: Background and Review of Related Literature

Mohon (2008) investigated how the classroom use of an interactive white board (IWB) can lead to a pedagogical change. She conducted her research from November 2004 to May 2005 and collected data through a teacher reflection journal and student questionnaires (Mohon). The research was conducted in History and English classes years 7-11, in a United Kingdom secondary school. During the study questionnaires were filled out by 35 final year students (Mohon). Over the study's period, Mohon produced 39 lessons of which ten involved tactile student interaction with the IWB. Students reported higher interest in subjects when the IWB was introduced and found the more visual nature of the IWB beneficial to their learning (Mohon). Through reflective journals Mohon found evidence to suggest that IWBs can improve student experience without fundamentally changing a teacher's pedagogical style, and that using IWB increased efficiency of lectures, according to the teachers surveyed (Mohon).

In her study Mohon (2008) was able to triangulate results by analysing both the student questionnaires and teacher reflective journals. In both student questionnaires and reflective journals it was found that the visual component of the white board increased student engagement in learning (Mohon). As well, both students and teachers agreed that the tactile interaction with the white board was not always needed, and in some cases decreased interest due to the fact that only one student could interact with the board at a time (Mohon).

Mohon (2008) acknowledged the fact that her study was relatively small in size with only 35 students taking part in the questionnaire; however, the research failed to indicate the proportion of males to females that participated as this may have added biases to the overall responses. All 80 teacher reflective responses and 39 IWB lessons were composed by the researcher. Mohons' results were purely qualitative and may have contained undocumented biases. Her results seem to rely more heavily on her teacher reflection journal and there are very few quotes or inferences made based on the student questionnaire which may have swayed the final conclusion (Mohon). As only ten of the 39 IWB lessons were interactive, the researcher concluded that the interactive nature of the white board may not be as beneficial as first thought (Mohon). Due to the small sample size and limited diversity, the results are impossible to generalize but do give an in depth perspective by one teacher on the benefits of IWBs in the classroom.

Hennessy, Deaney, Ruthven and Winterbottom (2007) used a case study approach to investigate how teachers were harnessing the IWB technology to foster student participation in science. Hennessy et al. used focus group interviews, lesson observations, and both teacher and pupil interviews to better triangulate their results (Hennessy et al.). Included in their study were participants from ten state-funded science departments in the United Kingdom who were determined to have high quality teaching and integration of information and communication technology (ICT) (Hennessy et al). Focus groups were formed from these departments and interviewed to determine why they had been able to successfully integrate ICT. Three teachers were then invited to participate in lesson observations. Hennessy et al. interviewed both the teacher and a small group of students after each lesson. In total, four interactive lessons were observed during the study

(Hennessy et al.). Hennessy et al. found that teachers used varying strategies to incorporate IWBs in their classroom. In all cases it was found that IWBs are dynamic, interactive objects which foster the cognitive, social and physical participation of learners (Hennessy et al.). Hennessy et al. also concluded that although manipulation of objects on the IWB was desirable to students and teachers, it was constrained by systemic school and subject cultures and curriculum.

Hennessy et al. (2007) triangulated results by using focus groups, teacher and student interviews along with classroom observations to strengthen the conclusion reached. The research method did reveal some limitations in the study. To gather the relevant data the researchers used a very small sample size; only two teachers had their lessons observed and only six students where interviewed after each lesson (Hennessy et al.). Although Hennessy et al. drew conclusions about the benefits of IWBs in the classroom, only a total of four lessons were observed in which IWBs were used. Many of the conclusions reached by Hennessy et al. are based heavily on the two teachers interviewed after their IWB lessons with very little evaluation of the students' views. The teachers in the study admitted that most IWB lessons were their own creations (Hennessy et al.). This may have led to biased answers when they were interviewed on the lessons' success (Hennessy et al.). During focus group questions, Hennessy et al. admitted that the answers given by the teachers during the interviews sometimes were not always what actually happened in the classroom. The conclusions drawn from this research are positive; however, a larger sample size and more classroom observations would be needed to generalize the results.

The study conducted by Wall, Higgins and Smith (2005) investigated how years 5 and 6 English students in the United Kingdom viewed IWB and what impact this new technology had on teaching and learning. The participants were composed of 80 students chosen from a variety of schools in 12 different Local Education Authorities which had been using IWBs for over a year (Wall et al.). Participants in the study included 46 boys and 34 girls aged 10 -11 years old (Wall et al.). Responses to the IWB were recoded using a Bubble Dialogue technique which was based on work by McMohon and O'Neill (1992). Wall et al. found that of the 1568 statements made by the students about the IWB, 883 were positive, 494 were neutral and only 191 were negative. Many of the positive comments centered on facilitation of learning, visual display, and learning styles (Wall et al.). Wall et al. found that the students most commonly associated IWB with visual ways of learning and felt mathematics was most positively impacted by the use of IWB. The negative comments centered mostly on technical difficulties and pupil participation (Wall et al.). Wall et al. concluded that "as IWBs are becoming more and more prevalent in primary schools, the apparent impact on pupils' beliefs about learning and metacognition must be recognised and acted upon" (p. 866).

By using students from a variety of schools, Wall et al. (2005) were able to show generalized trends about students' attitudes after being exposed to IWB lessons. Both qualitative and quantitative analysis of the findings helped support the researchers' claims. Student responses were gathered using both mediated interviews and written responses. Analysis of the student responses were performed using NUDIST (software for qualitative data analysis) and SPSS (a statistics software package for social science researchers) (Wall et al.).

There were also a few limitations to Wall et al.'s study. One of the key sources of evidence in the study was the Bubble Dialogue response by students. The responses were categorized as positive, neutral or negative by the interviewer making the results very subjective and susceptible to biases as no criteria were discussed in the paper (Wall et al.). Wall et al. also stated that results may vary from class to class based on the teacher's level of training and software availability as lessons created by less experienced teachers may not be as effective as those made by teachers with extensive IWB experience. The researchers set out to evaluate the impact of IWBs on metacognition and learning; some may question whether the Bubble Dialogue method used on children aged 10 and 11 could accurately reflect metacognition and learning without major researcher interpretation (Wall et al.).

In his action research project Beeland (2002) investigated how the use of an IWB in the classrooms of Georgia State middle schools affected student engagement. Beeland states that "student engagement is one of the most important factors that affect teaching and student motivation to learn" (p. 1). In his study, Beeland recruited ten teachers who used IWBs for a variety of lessons. After each lesson Beeland distributed a twenty-question, four point Likert scale which he used to determine the engagement of students. In all, 197 surveys were completed and analyzed. Based on the student responses Beeland concluded that the use of IWBs to deliver curriculum did in fact increase student engagement. Of the 197 responses all but one of the students believed that they were able to learn better when an IWB was used in the classroom. Beeland also found that all 197 students from Grades 6 to 9 in the study felt the IWB helped them to pay better attention during class instruction.

The IWBs used in the study were mobile and could be signed out by any teacher within the school (Beeland, 2002). This creates some bias in the results as only teachers interested in the use of technology would access the interactive boards. The students who answered the surveys also had limited prolonged interaction with the IWBs. As with any new technology, students can lose interest. Without sustained use of the IWB over a long period the actual impact on student engagement can not be determined.

"Student engagement is critical to student's motivation during the learning process" (Beeland, 2002 p.2). The more students are motivated to learn the better chance that they will become successful in school (Beeland). Beeland's study does show that student engagement does increase when IWBs are introduced into a classroom setting; however, he admits there are a number of other factors which may influence student motivation more, including parental involvement, teacher motivation and skill and effective use of technology (Beeland).

Kennewell and Beauchamp (2007) investigated the impact of technology on teaching and learning in the classroom with a focus on IWBs as they felt these boards have the most potential to impact learning. There are a number of perceived benefits surrounding the use of IWBs including increased efficiency, versatility, multimodal presentation and interactivity (Kennewell & Beauchamp). Kennewell and Beauchamp used a broad framework to explore how IWBs are exploited by teachers and learners to enhance individual learning. The researchers felt that IWBs do not necessarily replace the more traditional tools and resources such as chalk boards and over head projectors within a classroom, though IWBs do have the potential to incorporate all of them into a single format (Kennewell & Beauchamp).

To study how IWBs were being used in a classroom setting Kennewell and Beauchamp (2007) conducted six single lesson observations. Each participating teacher was interviewed following the lesson to discuss how they felt IWBs affected learning within their classrooms. Upon completion of their research Kennewell and Beauchamp were able to distinguish a common four phase lesson used by the participating teachers when using IWBs. The four phase lesson included an initial phase were the teacher lead a whole class activity centered on the IWB; a secondary phase, which used the IWB to help develop a skills or concepts in such a way that the entire class felt involved; a third phase, which required students to work in groups, individually or collaboratively on activities which practiced the new skills or concepts in more depth without the use of IWBs; and finally a fourth phase, where the teacher used the IWB to revisit key concepts and help students with any difficulties that may have arisen during the lesson.

Overall, the teachers interviewed felt that IWBs were "effective in gaining students' attention, keeping their attention for longer, stimulating thinking and maintaining a focus on the subject matter rather than on the teacher or other students" (Kennewell & Beauchamp, 2007, p.230). Most teachers also felt there was increased sharing of materials between teachers who used IWB's as they were all facing the same challenges of unfamiliar technology (Kennewell & Beauchamp). Although all teachers in the study felt their work load had increased due to the new technology they felt that the use of IWBs in the classroom was valuable to student learning.

Although the findings by Kennewell and Beauchamp (2007) are promising, it is hard to make wide generalizations based on their small sample size of six teachers. Kennewell and Beauchamp's four phase IWB lesson generalization may only be specific

to this school. The teachers interviewed also had limited experience with the IWBs and shared much of their material. With more IWB experience their lesson structure may dramatically change. Also due to the short nature of their study and the introduction of this new technology it has yet to be proven that the benefits of the IWBs are sustainable over time. As with all new technology, students are avid consumers at first but sometimes lose interest over time.

In their study to determine if IWBs can be used as a pedagogic tool to promote interactive forms of learning and teaching, Smith, Hardman and Higgins (2006) observed a total of 184 lessons in United Kingdom Primary Schools over a two year period. Smith et al. tried to determine if it was true that IWBs increase the opportunities for interaction and discussion within a classroom situation. Smith et al. felt that the use of IWBs increased student motivation providing more opportunities for interaction and discussion due to the fact that students enjoy interacting physically with the board manipulating text and images. In 2003, the researchers observed 114 Grade 5 lessons delivered by 30 different teachers (Smith et al.). Most of the teachers had four observations: two lessons where the teacher did not use the IWBs to deliver curriculum and two lessons where IWBs were used. In 2004 another 70 lessons were observed, all of which involved the same 30 teachers from the previous year. All 70 of the lessons observed in 2004 used IWBs to deliver the curriculum. The lesson observations were recorded and analyzed by the Classroom Interaction System which recorded whether a teacher's question was open (where an explanation was needed) or closed (calling for a single response).

Smith et al. (2005) found that IWB lessons contained more whole-class teaching and less group work than non-IWB lessons. This whole-class teaching benefited some

students, though the overall impact was not significant. The researchers also found that the use of IWBs in the classroom lead to significantly more open question answers from students leading to more classroom discussions (Smith et al.). While their findings suggest that IWBs had some impact within the classroom, the extent of the impact is somewhat wide ranging and did not seem to fundamentally change the teachers' underlying pedagogy (Smith et al.). Smith et al. suggested "technology by itself will not bring about fundamental change in the traditional patterns of whole class teaching" (p. 455).

Through their study Smith et al. (2005) found that the pace, flow and interactive nature of IWBs lessons increased as teachers became more familiar with the new technology and admit that in-service training programs are vital in creating effective IWB lessons which engage students. With effective professional development, Smith et al. felt that IWB lessons would continue to evolve, increasing opportunities for extended teacher-pupil interaction and possibly facilitating more active pupil involvement in learning.

The researchers admitted that more extensive research is needed on the long term impact of IWBs in the classroom (Smith et al. 2005). Although the study took place over two years, the amount of IWB teacher training and student exposure varied from one class to another. It is important that the long term benefit of IWBs on student learning be determined.

According to the reviewed literature there is strong evidence linking the use of IWBs to deliver curriculum and increased student interest, engagement and motivation (Mohan, 2008; Wall et al. 2005; Beeland, 2002; Kennewell & Beauchamp 2007).

Although this literature is promising, many of the studies used small sample sizes to make generalizations about the benefits of IWBs (Mohan, 2008; Hennessy et al. 2008; Wall et al. 2005). Much of the research being produced about the effect of IWBs in classrooms was produced in the United Kingdom and United States and little research has been done within the British Columbia context. The researcher of the current study explored how the use of IWBs to deliver British Columbia curriculum in a high school setting affected the attitudes' of students towards Science.

Chapter 3: Procedures & Methods

A. Description of the research design

The purpose of this study was to determine to what degree, if any, would the use of an interactive white board to deliver British Columbia curriculum affect the attitudes of students towards Science and Technology 11. The present study was conducted during the fall semester from September 2010 to February 2011 at Alberni District Secondary School in Port Alberni British Columbia. Two Science and Technology Grade 11 classes were used in the study. Participants were given an attitudinal questionnaire (Appendix A) three times throughout the study: once before the course started, once after traditional teaching techniques were used and once after the implementation and use of an IWB to deliver the British Columbia Science and Technology 11 curriculum. The responses were analyzed by comparing the mean of each question over the three questionnaires and the overall positive, neutral and negative responses were used in excel to create a bar graph to determine changes in participants' attitude over time.

B. Description of the sample

The sample consisted of volunteers recruited from two classes of Science and Technology Grade 11 aged 15-17 attending the fall semester at Alberni District Secondary School in Port Alberni British Columbia. Students in the classes were informed of the purpose, methods and procedure of this study. All were given the option to participate or abstain from the research. The participant pool included both males and females from diverse ethnic backgrounds. Their previous knowledge in science also varied from participant to participant. Some students had not been successful in Grade 10

science but placed in Science and Technology 11 while retaking Science 10. The sample size changed slightly between the three questionnaires as some participants were absent on days when the questionnaire was administered. There were 57 participants in the September round of questionnaires, 53 in the October questionnaire and 47 in the November questionnaire.

C. Description of the instruments

To evaluate the changes in attitude towards Science and Technology 11 a Likert questionnaire (Appendix A) was developed. The questionnaire consisted of a series of 8 statements concerning the students' attitudes towards Science and Technology 11 each on a five point Likert scale anchored with strongly disagree and strongly agree. The survey was given three times during the length of the study and explored the changes in attitude as reported by the participants when different teaching techniques were used to deliver curriculum. The quantitative data was pooled and the mean scores for each of the 8 questions were calculated. The statistical data found was based on scores from 1-5 as the Likert scale used 5 descriptors (Strongly Disagree, Disagree, Undecided, Agree or Strongly Agree), with a 1 indicating a very negative response, a 3 representing a neutral response and a 5 representing a very positive response To better track the change in attitudes over time, all responses from the Likert questionnaires were pooled based on their negative, neutral or positive responses. Answers of "Strongly Agree" and "Agree" were considered positive, and answers of "Strongly Disagree" and "Disagree" were considered negative while an answer in the "Undecided" category was considered a neutral response. For analysis purposes questions asked in negative, Questions 2 and 7, were reverse scored.

D. Explanation of the procedures followed

The current study commenced September 2010 after Vancouver Island University ethics board approval and School District #70 (Alberni) superintendant's acceptance. During the first week of classes in September 2010 the students were informed about the research study and the researchers' goal of understanding how students' attitudes changed when an IWB was used to deliver the Science and Technology 11 curriculum. Those students who chose to participate in the study were given consent forms (Appendix B) which they filled out and signed. The consent forms were stored in Alberni District Secondary School accountant's lock box and only the researcher, school accountant and principal had access to the consent forms.

Once informed consent was attained the participants were given the eight question attitudinal survey (Appendix A). This initial survey established a baseline of attitudes toward science without a student teacher relationship being established. This survey acted as the control from which attitudinal changes throughout the course could be compared. The survey was anonymous and administered by a Vice Principal at Alberni District Secondary School while the researcher was not present. All responses where collected in sealed envelopes and stored in the accountant's lock box.

The Science and Technology curriculum was taught for the first six weeks using traditional teaching techniques. These techniques included a chalkboard, overhead projector and teacher handouts. In the six weeks of instruction a variety of units were taught by the teacher and the student teacher relationship was developed. The same attitudinal survey was again administered by a Vice Principal and the anonymous results were collected in sealed envelops and kept in the accountant's lock box. This second

round of surveys established how the participants felt about Science and Technology 11 after a student teacher relationship had been developed.

For the second six weeks of instruction an IWB was used to deliver the curriculum. Once again throughout the six weeks a variety of units were taught in an effort to avoid unit bias by teacher and students. During the six weeks the chalkboard and overhead projector were never used to deliver any curriculum and teacher hand outs consisted of only the material covered on the IWB. To deliver curriculum using the IWB a variety of software was used which included: RM Easiteach, Memo work pad, Microsoft Word, Microsoft PowerPoint, Science Works, and Physics Write and Touch. The final round of questionnaires were then administered which allowed the researcher to determine if the use of IWBs positively changed students attitudes towards Science and Technology 11 compared to the reported attitudes before and after traditional teaching methods were used. Again the surveys were anonymous and administered by a Vice Principal and collected in sealed envelopes which were stored in the accountant's lock box. Once the study was over and all results analyzed the questionnaires and consent forms were destroyed

E. Discussion of validity

A variety of factors throughout the research project added to the validity of this study. The five point Likert questionnaires were composed of questions which related solely to participant attitudes towards Science and Technology 11. The questionnaire was conducted three times during the length of the project. This allowed the researcher to compare attitudes before the class started to attitudes after traditional teaching methods

were used and after the IWB was used to deliver curriculum. To remove any adverse pressure on the participants the questionnaires were filled out anonymously during a time when the researcher was not present.

F. Description and justification of the statistical techniques

All participants' responses were scored separately using a Likert 5- point scale where 1 was a very negative response and a 5 a very positive response. The responses to each question were then pooled allowing the researcher to determine the group's mean for each of the questions over the three rounds of questionnaires. By calculating the means for each of the questions the researcher was able to identify general attitudinal trends between the three questionnaire periods. All answers to the questionnaire (Appendix A) were then categorized as positive, neutral or negative to determine the overall attitude towards Science and Technology 11 within the participant pool. The pooled results from each survey were displayed on a bar graph showing the percentage of positive, neutral and negative response attained in the three surveys. The graph allowed the researcher to identify attitudinal changes over the length of the study.

Chapter 4: Results

The purpose of this study was to determine if students in two Science and Technology 11 class in Alberni District Secondary developed more positive attitudes towards science when an IWB was used to deliver curriculum. To determine the change in attitude, a 5-point Likert questionnaire (Appendix A) was administered three times during the semester. Two Science and Technology 11 classes were used in this study. Both were taught the same curriculum in the same order by the researcher of this paper. The first questionnaire was completed in September during the students' first class. At that time there were a total of 58 students registered between the two classes and a total of 57 anonymous questionnaires were attained. This first questionnaire identified base line attitudes of the students entering the course. Due to changes in student timetables, the total students registered in the two classes dropped to 55 in October, and 53 questionnaires were attained during the administration of the second questionnaire. The October questionnaire was used to determine students' attitudes towards science after six weeks of traditional instruction. This time period allowed a student teacher relationship to be established. The total number of registered students remained at 55 for the November questionnaire, when 47 questionnaires were attained. This questionnaire was used to determine the change in attitudes after six weeks of instruction using an IWB to deliver curriculum.

Table 4.1 shows the mean scores attained from each of the 8 questions from the three questionnaire periods. The statistical data found in Table 4.1 is based on a score from 1-5 as the Likert scale used 5 descriptors (Strongly Disagree, Disagree, Undecided,

Agree or Strongly Agree), with a 1 indicating a very negative response, a 3 representing a neutral response and a 5 representing a very positive response.

Table 4.1

Mean Participant responses as reported on the three questionnaires

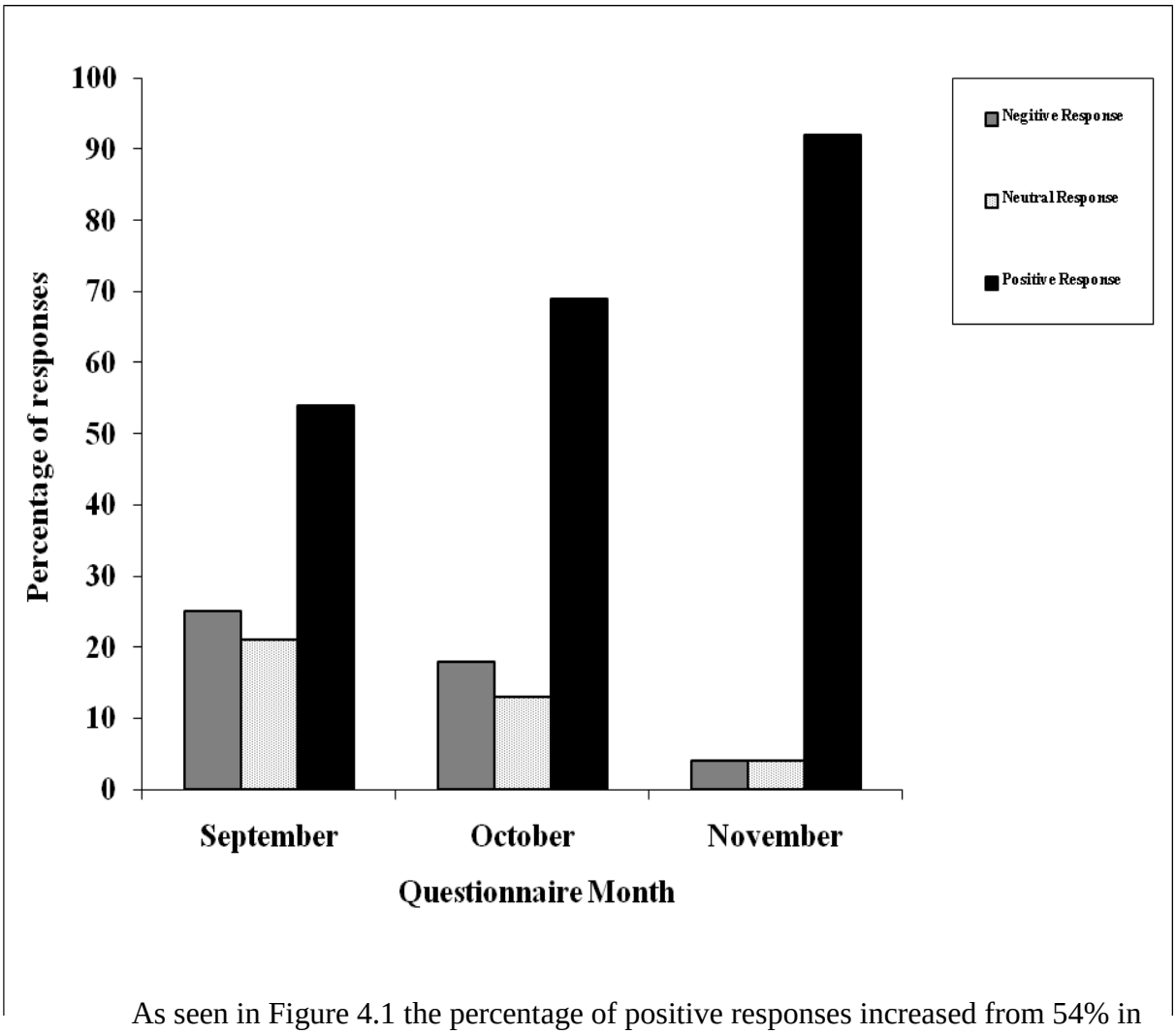
Statement	September 2010 n= 57	October 2010 n= 53	November 2010 n=47
1. Science and Technology 11 is very interesting	3.25	3.55	4.60
2. Science and Technology 11 makes me feel nervous	2.75	2.20	1.49
3. I feel that I am a capable science student	3.36	3.38	4.28
4. I feel that I will do well in Science and Technology 11	3.23	3.98	4.47
5. I feel that the way Science and Technology 11 is taught will allow me to do the best I can in this course	3.63	3.42	4.53
6. I have a good feeling towards Science and Technology 11	3.52	3.77	4.49
7. I do not like Science and Technology 11	2.77	2.19	1.49
8. I feel that after Science and Technology 11 I would like to take additional Science courses	3.18	3.72	3.85

As seen in Table 4.1 means during the first questionnaire period ranged from 2.77 to 3.63 indicating a strong neutral response by the participants to the questions posed. The means increased slightly after the six weeks of traditional teaching and ranged between 2.19 and 3.98 which indicated a more positive class response. Finally after six weeks of using the IWB to deliver curriculum the means calculated ranged between 1.49 and 4.53 which indicated a strong positive response.

To better track the change in attitudes over time, all responses from the Likert questionnaires were pooled based on their negative, neutral or positive responses.

Answers of "Strongly Agree" and "Agree" were considered positive, and answers of "Strongly Disagree" and "Disagree" were considered negative while an answer in the "Undecided" category was considered a neutral response. For analysis purposes questions asked in negative, Questions 2 and 7, were reverse scored. Figure 4.1 shows the changes in positive, neutral and negative responses as reported by the participants in September, October and November 2010.

Figure 4.1 *Percentage of negative, neutral and positive responses as reported by participants over the three questionnaire time periods.*



As seen in Figure 4.1 the percentage of positive responses increased from 54% in September to 69% in October and increased to 92% in November. The neutral responses

made up 21% of all answers in September, only 13% in October and fell to 4% in November. Negative responses were reported in 25% of responses in September, 18% in October and fell to only 4% in November.

Chapter 5: Summary and Conclusions

A. Research Summary

The use of IWBs in British Columbia schools has been on the rise over recent years. The purpose of this study was to determine to what extent the use of an IWB to deliver British Columbia curriculum affected the attitudes of students enrolled in two School District #70 Science and Technology 11 classes. The study was conducted over a three month period (September – November) 2010. During the length of the study an 8 statement Likert questionnaire (Appendix A) was administered three times to determine the general attitudinal trends within the two classes. The first questionnaire was administered during the first instructional period in September and worked to establish the general attitudes of participants entering the course. The questionnaire was again administered after six weeks of traditional teaching and this questionnaire established the general attitudes of participates after a student- teacher relationship had been developed. The final questionnaire was administered to participants in November after six weeks of instruction using the IWB and allowed the researcher to determine the attitudinal changes within the classroom caused by the IWB delivery method.

Responses obtained from the three questionnaires were pooled and the means were calculated on a scale of 1 to 5 for each of the 8 Likert statements for September, October and November as seen in Table 4.1. The overall classroom attitudes were calculated by pooling Positive, Neutral and Negative responses, and Figure 4.1 shows the general attitudinal change over the three questionnaire periods.

The results of the quantitative data statistically showed that there was a statistically positive impact on the participants' reported attitudes towards Science and

Technology 11 when an IWB was used to deliver curriculum. Table 4.1 shows a marked increase in positive responses over all 8 statements within the questionnaire (Appendix A) once the IWB was used to deliver curriculum. During the first questionnaire in September, many of the participants' answers showed a mean close to 3, indicating an undecided attitude towards the course as many had never been exposed to Science and Technology 11 before. Statement 3 (I feel I am a capable Science Student) was used to evaluate the perceived attitudes of participants about their ability in science based on previous experience. A mean of 3.36 was calculated and suggested that many participants were unsure about their ability to do well in the science course. Based on the data attained from Statement 4 (I feel that I will do well in Science and Technology 11) a mean of 3.23 was calculated and showed that many participants were again not overly optimistic about their chances to do well in Science and Technology 11. The attitudes around success in Science and Technology drastically increased after six weeks of IWB lessons were the mean response to Statement 3 rose to 4.28 which proved that many students now felt they were very capable science students. The participants' attitudes around their success in Science and Technology also become much more positive with the mean of Statement 4 improving to 4.47, indicating that most participants now strongly agreed they would do well in the course.

Statement 5 (I feel that the way Science and Technology 11 is taught will allow me to do the best I can in this course) showed an interesting and unexpected trend. It seemed that participants entered the course with a positive feeling about how science and technology would be taught with a class mean of 3.63 as reported on the September questionnaire. The reported average dropped after six weeks of traditional teaching

methods to a mean of 3.42 which indicated the participants did not react in a positive manner to the traditional classroom instructional techniques. The mean rose statistically after six weeks of instruction with the IWB to 4.53. Based on this data, it is clear that participants overwhelmingly felt that instruction delivered using an IWB was a more effective teaching tool and gave participants a better chance of success in the classroom. Although the overall attitude towards Science and Technology 11 was more positive with the introduction of IWB lessons, there seemed to be only a mild change in overall attitudes towards science. When students were asked if they planned to take more science courses after Science and Technology the mean only increased from 3.18 in September to 3.85 in November.

After pooling the positive, neutral and negative responses to all 8 questions, a graph of general attitudes towards Science and Technology 11 was created to show changes in attitude over the length of the study and can be seen in Figure 4.1. In September, of the responses given 54% were positive, 21% neutral and 25% negative based on preconceived ability in science and information about the course. After six weeks of traditional teaching, the general attitude of the participants within the two classrooms became slightly more positive. Of the responses attained 69% were positive, 13% neutral and only 18% negative. Statistically the greatest attitudinal change accompanied the six weeks of instruction using the IWB, where the responses showed a 92% positive rating with only a 4% neutral and 4% negative response rate. It was determined in this study that the use of IWBs to deliver British Columbia curriculum to a Science and Technology 11 class had a positive impact on students' attitudes. The 38% increase of positive responses as attained on the Likert questionnaire proved that students

found learning using an IWB more beneficial to their learning and allowed students to enjoy science more.

B. Implications

Research has shown that using IWBs to deliver curriculum can provide many positive results. IWBs increase motivation, allow for greater opportunity for pupils to participate and collaborate and increase the capacity of teachers to cater to different learning styles (Beauchamp & Parkinson, 2005). The data collected in this study supports the claims that when IWBs are used to deliver curriculum that student motivation is increased.

The technologies that students are exposed to every day have increased drastically over the past few years. Classrooms have not kept pace with the increased technological demands. It is important that classrooms evolve to better maintain and sustain student interest and real-world relevance. The new high school planning committee in School District #70 has stated that the new high school will contain technologically advanced classrooms. It is imperative that IWBs be included in this plan. IWBs allow teachers to create more diverse and interactive lessons which results in more student attention, interest and motivation. In only six weeks the positive attitudes towards the Science and Technology 11 increased by 38% a fact of which teachers and administrators must take note. It is important that students have a positive feeling towards a subject being taught and with the results of this finding teachers and administrators should investigate the possibilities of putting IWBs in the majority of classes. With only a 56% pass rate in Science 10 it is essential that School District #70 look at alternative methods to engage students in learning. Based on the statistical analysis of questionnaire

responses (Table 4.1, Figure 4.1) participants in this study reported that the use of IWBs to deliver curriculum increased their positive feelings towards science. IWBs have the ability to change students' attitudes and it is important that School District #70 look at IWBs as a way to better engage students.

Findings suggest that IWB technology by itself will not bring about fundamental change in the traditional patterns of teaching (Smith et al. 2006). Supporting teachers in their professional development will enhance the effect IWBs have in classroom teaching. IWBs have been used to positively change students' attitudes towards science; however, without significant teacher training the full potential of these amazing instruments may never be realized.

C. Limitations

While the findings suggest that there is a positive correlation between student attitudes in science and the use of IWBs to deliver curriculum, more research is needed. The study was conducted over a short period of time and many of the participants in the study had never been exposed to IWBs before. It is unclear whether the changes in attitude reported are sustainable over time. It is also unclear if the same positive correlation would be reached in a different subject area. As with any attitudinal survey, the time at which the surveys were administered may also have had an effect on answers. While the research was conducted over multiple curricular units the fact remains that some instructional units may be more interesting to students than others.

D. Further Research Discussion:

The findings of this action research have indicated that IWBs do positively influence students' attitudes in a Science and Technology 11 classroom; however, IWBs

have yet to be proven in other subject areas. More research is needed to explore the extent and longevity of this attitudinal change. Once a teacher has exhausted all the IWB routines and the 'wow' factor has passed, do the students revert back to less attentive behaviour? Although IWBs positively affect students' attitudes in the classroom, whether or not this change will lead to greater academic success remains to be seen. The IWB has proven to capture and hold students attentions; however, it has not been proven that IWBs help students to retain the information better than traditional teaching techniques.

The researcher of the current paper had just over six months training and experience with the IWB, and was unsure of the total potential of the IWBs to create the most interactive lessons possible. As teaching training increases on the IWBs, will student interest, motivation and performance increase as well?

E. Conclusion

It seems clear from the evidence and discussion presented in this article that IWBs do have a positive impact on students' attitudes toward Science and Technology 11. It seems that technology increases by leaps and bounds in our modern society and yet in the classroom much of the traditional ways of teaching still predominate. It is important to realize that young adults are the primary consumers of new technology and that the classroom needs to keep pace with the changing reality. IWBs allow teachers to create better multimedia, interactive lessons which can better keep students attention and create a more positive learning environment.

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Appendix A

Date: _____

Science and Technology 11
Research Questionnaire

VANCOUVER ISLAND UNIVERSITY

Please read the following eight statements and indicate on the right, which best represents your feelings towards each statement. When you are finished the questionnaire please place it into the envelope provided and bring it the front of the room. Do not put your name or any other identifying marks on the questionnaire, as responses are to be anonymous.

Statements	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Science and Technology 11 is very interesting					
Science and Technology 11 makes me feel nervous					
I feel that I am a capable science student					
I feel that I will do well in Science and Technology 11					
I feel that the way Science and Technology 11 is taught will allow me to do the best I can in this course					
I have a good feeling towards Science and Technology 11					
I do not like Science and Technology 11					
I feel that after Science and Technology 11 I would like to take additional Science courses					

Appendix B

RESEARCH CONSENT FORM

"Interactive White Boards: Changing Students' Attitudes about Science"
September, 2010

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Harry Janzen, Ph.D., Supervisor
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Vancouver Island University
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I am a student in the master of education program at Vancouver Island University. A requirement of this program is to gain applied experience in designing and conducting action research. As such, I have designed an action research project to study how the use of Interactive White Boards in the classroom affects students' attitudes towards science.

During this study, you will be asked to complete an eight statement questionnaire three times throughout the semester. This questionnaire contains questions which concern your personal thoughts and feelings about Science and Technology 11. Your participation will require approximately 30 minutes of your time, in total.

There are no known harms associated with your participation in this research. Your input may help in identifying benefits of Interactive White Boards in a classroom situation.

All consent forms will be kept strictly confidential; such as only I, the principal, and school accountant will have access to the information. All consent forms and anonymous questionnaires will be stored in a locked filing cabinet located within the accountant's lock box at Alberni District Secondary School in Port Alberni. Consent forms and data will be destroyed by shredding two years after the completion of this project. Any electronic files will also be deleted at that time. Information about the project will not be made public in any way that identifies individual participants.

Your participation is completely voluntary. You do not have to answer any questions on the questionnaires which make you feel uncomfortable. You may withdraw from the research at any time and for any reason without explanation or penalty.

If you have any concerns about your treatment as a research participant in this study please contact the VIU Research Ethics Officer, by telephone at 250-753-3245 (ext, 2665) or by email at reb@viu.ca.

If you have any questions about this research project, or would like more information, please feel free to contact me by phone or e-mail:

Ryan Hall
Masters of Education Student
Vancouver Island University
rhall@sd70.bc.ca
(250) 724 - 6838
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I have read the above form, understand the information read, understand that I can ask questions or withdraw at any time. I consent to participate in this research study.

Participant's name Participant's Signature Date