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Teacher and Student Attitudes Towards the Use of Interactive Whiteboards in Two Australian Primary Schools: Factors Influencing Their Use

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Statement of Original Authorship

The work contained in this thesis has not been submitted previously for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

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Statement of Copyright

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ABSTRACT

Technology is an integral part of all our lives. As educators, we must embrace new technologies as our students grow and develop around them. Current technologies allow us to communicate, record and engage more effectively. One such technology allowing us to do this is the interactive whiteboard (IWB). IWBs are quickly being introduced into schools across the nation and worldwide and, as such, educators need to explore the implications of having them in the classroom. It is also important to explore student attitudes to IWBs. As attitudes play an important part in student interest and engagement levels, it is important to determine current attitudes towards IWB use in the classroom and explore links between background factors and attitudes.

Through a mixed methods approach, the current study used questionnaires to ascertain current attitudes towards IWBs and classroom observations were used to measure student engagement and teacher approaches. Students' attitudes towards IWBs are positive and can be positively linked to student engagement. Contrary to initial expectations, one type of IWB use was not more effective in terms of engagement than another. However, what proved to be most effective in terms of student engagement occurred when teachers alternated between teacher-centred approaches and student-centred approaches.

IWBs can be used to engage students in learning and the findings of the study indicate that teachers should alternate between student-centred and teacher-centred approaches in short clumps of time, thereby facilitating student interaction and high engagement levels.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 ~

INTRODUCTION

The immersion of students in rich learning environments, that effectively engage them, is important (NSW Department of Education and Training, 2003). One teaching tool that fosters the facilitation of rich learning environments is the interactive whiteboard (IWB).

In many New South Wales public schools today, IWBs are being used as the primary classroom teaching tool. Teachers are using these tools for classroom lessons involving a wide range of strategies for the delivery of information and the facilitation of learning. By exploring how teacher and student attitudes impact the use of IWBs, this study will build upon current research to extend our understanding of the pedagogical uses of IWBs.

Background

IWBs can be used to create rich learning environments (Baker, 2009). The effectiveness of them however largely depends upon teachers' skills (Jones & Vincent, 2006). IWBs are used mostly as a teacher-centred delivery mechanism that involves very little direct student-involvement (BECTA, 2001; Knight, Pennant & Piggott, 2005). Considerable funding has been spent in equipping Australian schools with IWBs (Jones & Vincent, 2006). If these funds are to be well-spent, and if IWBs are to be used to their maximum potential as the hub of student-centred learning where critical thinking and problem solving becomes the focus, then information

pertaining to current usage as it impacts on student learning and teacher and student attitudes toward their use should be gathered.

Student and teacher attitudes play an important role in the achievement of students (Nasr, Booth & Gillett, 1996; Rumberger & Palardy, 2008). Similarly, positive student attitudes towards the use of IWBs are directly linked to their academic achievement (Murcia & McKenzie, 2008; Li, 2007).

Significance and Aims of the Study

The purpose of this study is to explore links between the ways in which teachers use IWBs in the classroom and how their use affects student attitudes towards IWBs and student engagement in learning. The study documents the use of IWBs in two schools in which there is an IWB in almost every classroom. Findings from the study will provide information about the pedagogy of their use and about teacher and student attitudes toward the IWB. Based on these findings, the study will make recommendations about the use IWBs in ways that promote effective student-centred learning. This study will build upon recent research, particularly in Australia, that deals with pedagogical uses of IWBs in NSW schools (Baker, 2009).

Research Questions

This study seeks to explore the use of IWBs in the classroom. In particular the specific research question it addresses is: What are student attitudes to the use of IWBs in the classroom and what factors impact on the effective use of IWBs?

The study also attempts to answer these ancillary questions:

- How are IWBs used in classrooms?
- What are the teacher attitudes towards IWBs?
- Does the degree of student-centredness in classroom lessons impact on students' levels of engagement?

Overview of Research Methodology

This study is designed as a mixed method investigation into the attitudes of students and teachers towards IWBs. Two Australian primary schools were selected for the study where interactive whiteboards were used in almost every classroom. Teachers from the selected schools were asked to complete a questionnaire that focused on their attitudes towards interactive whiteboards in the classroom. They were also asked to report on their use of IWBs and how they perceived the effectiveness of the IWB in teaching and learning.

Students were also asked to complete a questionnaire that focused on their attitudes to IWBs. The questionnaire also asked students to report their background variables, previous experience using IWBs and how students perceived the effectiveness of IWBs in the classroom.

During the course of this study, three classrooms in one school were observed on two occasions each, with observations spaced at least three weeks apart. These observations took place, with the permission of the teacher, and were unobtrusive to the students. Observations were used to determine pedagogical uses of IWBs and how

this affected student engagement levels. That is, how it affects students' on-task behaviour.

Structure of the Thesis

This thesis is structured so as to clearly present the methodology, results and conclusions. Chapter 2 presents a review of the present literature relating to this study. Chapter 3 outlines the research methodology, discussing the instruments used and also the methods used for data collection. Chapter 4 presents the results obtained from the research, with Chapter 5 discussing these results, comparing, contrasting and noticing clear trends. The thesis concludes with the final summary and recommendations in Chapter 6.

CHAPTER 2 ~

LITERATURE REVIEW

Introduction

Technology is changing the way we live our lives. We interact with it every day and need it to communicate and function. Technology is being integrated into every facet of our lives, including education. A new and exciting technology, which is being implemented into the educational setting, is the interactive whiteboard.

Interactive Whiteboards in Education

Technology can provide new opportunities to deal with age-old challenges in teaching and learning. The implementation of technology in the classroom has been a well-researched area. There is a growing body of evidence that suggests the increasing level of technology used in schools today can have a positive effect on students' learning in subjects such as English, Mathematics and Science (BECTA, 2001; Shelly, Gunter & Gunter, 2010, p. 2). One piece of technology that has entered classrooms recently is the interactive whiteboard.

The interactive whiteboard, or IWB, is a large touch screen board that allows teachers and students to manipulate, create, analyse and share learning resources (Bennett & Lockyer, 2008). IWBs allow the user to implement computer-based programs without having to use a keyboard or mouse as the board is touch sensitive. The IWB was invented at Xerox in the early 1990s (Schroeder, 2007) and was initially developed for presentations in office settings. However, it was soon introduced into educational

settings. As a result, the IWB has slowly begun to take over the role of the traditional chalkboard or whiteboard in teacher-centred teaching (Gillen, Staarman, Littleton, Mercer & Twiner, 2007). With the IWB being utilised in many classrooms, some even being used as the primary teacher tool, it is important to properly understand its use so that educators are able to determine whether the board is as valuable as its marketers declare it to be.

Interactive Whiteboards in the Classroom

Early research on the IWB is comprised mainly of personal anecdotes and recorded feelings about the IWB, and is largely descriptive in nature (Hall & Higgins, 2005). There has recently been an increasing number of studies carried out, particularly in the UK and Australia, which detail the specific effects of the implementation of IWBs in the classroom. This research shows that the IWB can be used to create rich learning environments (Thomas & Jones, 2010). However, the effectiveness of usage depends largely upon teachers' skills (Baker, 2009).

There are both advantages and disadvantages to employing IWBs in the classroom (Bennett & Lockyer, 2008). The benefits of the implementation of IWBs in the classroom seem to outweigh the disadvantages. Such benefits explain that the IWB is well adapted to whole-class teaching (Glover & Miller, 2001) in terms of developing more effective demonstrations (Stephens, 2000) and is successful in presenting learning information and resources in a variety of ways (Kennewell & Beauchamp, 2003).

Evidence-based research in the United Kingdom and Australia (Baker, 2009) indicates that, if taken advantage of, IWBs can be used to facilitate high quality learning and management of classroom learning. One study carried out in England, examined how 10-13 year olds thought the IWB impacted upon their learning (Schroeder, 2007). This study found that the IWB, when utilised by teacher and students simultaneously, was successful in gaining and maintaining student attention and participation which, in turn, proved to be an effective tool for the initiation and facilitation of the learning process (Schroeder, 2007). In addition to acknowledging the importance of student attention, attitudes to learning also play an important part in determining how engaged students are going to be and how students are going to retain information and knowledge (Beeland, 2002).

Additional research in Australia (Hedberg & Freebody 2007; Millea & Galatis 2009, as cited by Baker, 2009) suggests the use of interactive whiteboards in the school setting is advantageous as a delivery method but also acknowledges that effective teacher use of IWBs is reliant on effective teacher training. Therefore, teachers' skills play an important part in determining whether the use of IWBs is effective (Moss, Jewitt, Levaaic, Armstrong, Cardini & Castle, 2007). Baker (2009), along with Moss et al (2007), indicate that teachers need to be trained in interactive whiteboard usage if they are to use this technology for purposes other than for teacher-centred instructional purposes. It is important though, as Glover and Miller (2001) point out, that the IWB be used as an effective teaching tool in the capacity to facilitate student involvement and not just be used as a stand and deliver tool.

One of the reasons that IWBs have been shown to be useful is the way they can have a powerful impact on student engagement. Researchers believe that the IWB not only has the ability to hold students' attention, but that the IWB also has the power to convey information and material in a way that makes it more accessible to students (Jones, 2004; Thomas & Jones 2010). The IWB can facilitate the use of a wide range of teaching materials and resources to a greater extent than the conventional, whole-class approach (Jones & Vincent, 2006). The IWB has also been credited with facilitating pupil participation through the use of interesting media and interactive materials (Jones, 2004; Smith, Higgins, Wall & Miller, 2005).

Interactivity

The IWB's ability to facilitate visual and tactile aspects of learning ensures its interactivity. This interactivity, as described by Jones and Vincent (2006), is greater when it exists between teachers and students, and where an IWB is employed. One reason for high levels of engagement is the capacity of IWBs to provide interactive learning experiences. That is, where students are seen to present with on-task behaviour. This interactivity has now been credited with sustained interest and superior learning (Jones and Vincent, 2006). Interactivity, as defined by Higgins, Beauchamp and Miller (2007), has two elements; the first being the interaction between students and teachers, students and students, and teachers and teachers (Birmingham, Davies, & Greiffenhagen, 2002). The second dimension is the relationship between digital information and the learning process (Buckley, 2002). Furthermore, Smith, Higgins, Wall and Miller (2005) discuss the IWB in terms of "pedagogic interactivity" whereby students are more inclined to participate in whole-

class interactions during which their answers and ideas can be recorded. These dimensions, when constituting the interactivity concept, work together to give the student a more in-depth learning experience.

Impact of Student Attitudes on Learning

One's attitude towards a task greatly impacts their performance (Nasr, Booth & Gillett, 1996). Similarly, when a student's attitude towards the use of a learning tool, such as the IWB, is positive, improved achievement of numeracy and literacy outcomes seem to occur (Murcia & McKenzie, 2008; Li, 2007). Rumberger and Palardy (2008) support this notion stating that student and teacher attitudes play an important role in the achievement of students.

A study conducted by the School of Education at Newcastle University, England, considered the impact of interactive whiteboards on students' attainment and engagement as well as teachers' perceptions of the IWB. The study concluded that students valued the IWB for its adaptability, multimedia capacities and the entertainment value of programs used (Schroeder, 2007).

An additional study of six classrooms in the UK discovered that IWBs had a positive impact upon student motivation and engagement, and self-esteem, and some of these positive effects were linked to the fact that students were able to re-visit previous images linking to prior learning (Knight, Pennant, & Piggott, 2005). The study found that linkages formed prior to learning are of immense importance. These links create

opportunities for students to refer back to past information relating to their work (Knight, Pennant, & Piggott, 2005).

Further, Hall and Higgins (2005) conducted a study, which focused on the impact of IWBs on classroom interaction and on students' attainment. The study concluded that students' attitudes were positive regarding the use of the IWB in the classroom, especially in relation to its flexibility, multimedia capabilities and the "fun and games" aspect of learning with IWBs (Hall & Higgins, 2005, p. 107).

Today's students are surrounded by technology every day and have been since the time they were born. According to Prensky (2001, p.1), "computer games, email, the Internet, mobile phones and instant messaging are integral parts" of students' lives. Prensky (2001, p. 1) states that today's students are "Digital Natives" because they are "native speakers" of the language of computers, video games and the Internet. It is important, however, that the term "Digital Natives" (Pretsky, 2001, p. 1) not be generalised to all young people (Margaryan & Littlejohn, 2008). Educators need to know their students so they can accommodate all levels of technological skills. Those not born when computers were installed in every home have become accustomed to technology and have adopted computers into many aspects of their lives. They are described by Prensky (2001) as "Digital Immigrants".

The importance of this distinction is that students of today are Digital Natives, while most teachers of today are Digital Immigrants. This can cause some friction when

teachers, or Digital Immigrants, teach with the use of a computer or IWB, to Digital Natives. Further, Bennet, Maton and Kervin (2008) claim that the students of today are engaged and interested in technology. Educators, therefore, must find ways to link Digital Natives with technology in a positive way.

Does this mean that the IWB is just an interesting tool for learning in an interactive and technologically savvy environment? Glover, Miller and Averis (2004) suggest that, for the IWB to be an effective teaching tool, the quality of teaching supporting it must also be of a high quality. To back this up, other research suggests that the IWB should be used, not only as a means of presenting information, but also as an interactive tool by which students interact with each other. Further, Greiffenhagen (2000) suggests that the enhancement of communication skills must also be prevalent for the success of IWBs.

The influence of gender on students' attitudes is an important area to consider. Back in 2001, Clegg in addition to Volman and Eck (2001), stated that males tend to have more positive attitudes to technology when used in the classroom. Heemskerk, Brink, Volman and ten Dam (2005) suggest that a contributing factor to positive student attitudes may be industry inclinations to unintentionally tailor software to male interests. Further, Glover and Miller (2001) attribute positive male student attitudes to lessons taught with an IWB in terms of motivation and interest driven factors. Glover and Miller (2001) found that males reported feelings of focus and involvement as being strong positive attitudes. While there is a large amount of research that has investigated the relationship between gender and technology, a study which examines

gender differences exclusively in relation to IWBs is needed (Smith, Hardman & Higgins, 2007). Therefore, this study will aim to determine if there is a significant relationship between gender and students' attitudes towards IWB use in the classroom.

Teacher Attitudes to Interactive Whiteboards in Education

The attitudes of teachers to the use of interactive whiteboards are varied. While some believe that it greatly improves students' engagement and, thus, learning, others believe it is just a novelty that will wear off. The relationship between attitudes and learning is an important one as they influence each other. Within an effective learning environment, attitudes of both teachers and students play a crucial role as a determining factor of quality of learning (Murcia & McKenzie, 2008).

The incorporation of IWBs into the classroom can have a positive effect on the attitudes of teachers as well as students (Jones & Vincent, 2006). Cogill (2002), as cited by Jones and Vincent (2006), attribute teachers' attitudes to IWBs pedagogical uses. The attitudes presented in Cogill's (2002) study were positive and had an effect on the way teachers used the IWB (Jones & Vincent, 2006). Consequently, the ways in which teachers use IWBs in the classroom also have an effect on the ways students view the use of this technology.

Pedagogy

Pedagogy, as described by the NSW Department of Education and Training (2003, p. 4), is the process through which "knowledge is constructed, produced and critiqued". The pedagogy that surrounds IWB usage is widely debated. Smith et al (2005), as cited by Jones and Vincent (2006), suggest that while there is great enthusiasm surrounding the IWB, it may not be sufficient enough to support effective and purposeful practice. Hennessy, Deaney, Ruthven and Winterbottom (2007) argue that IWBs have the potential to promote interactive teaching where teachers use higher-order questioning and facilitate higher-order thinking. Despite the varied views about the use of IWBs, many researchers (Smith et al., 2005; Hennessy, Deaney, Ruthven & Winterbottom, 2007) suggest that teacher attitudes to learning and the IWB itself directly influence the way the IWB is used.

NSW Quality Teaching Model

The NSW Department of Education and Training (2003) outlines three domains in which quality teachers should be accomplished: intellectual quality, quality learning environment and significance.

If teachers are to provide a quality learning environment, which is engaging and meaningful, then they need to know not only how to use the IWB, but also how they can use are using it to achieve learning outcomes. An important factor here is the engagement of students in their learning. The NSW Department of Education and Training (2003) recognises the need for highly engaged students as it helps foster a more productive and effective learning environment. As such, it is important to study

how attitudes impact upon levels of engagement to ensure a quality-learning environment can be established.

Another dimension the NSW Department of Education and Training (2003) points out is that of intellectual quality. Intellectual quality maintains that work is challenging and requires substantial "cognitive and academic engagement with deep knowledge" as well as fostering higher order thinking and substantive conversations (NSW Department of Education and Training, 2003, p. 10). To promote this higher order thinking, as proposed by Kent and Holdway (2007), teachers should provide opportunities for students to manipulate information, explore various implications and construct their own knowledge. An effective way, to assist in this process, as suggested by Kent and Holdway (2007), is by facilitating dialogue within the classroom that enables students to grasp concepts and gain deeper understanding with the use of an IWB.

IWBs allow students to interact and engage in the learning process (Kent & Holdway, 2007). Further, IWBs have the capacity to promote higher order thinking that is advocated by the Quality Teaching Model (NSW Department of Education and Training, 2003). They can also facilitate substantive conversations that allow students to create or negotiate content.

Type I/Type II Uses of Technology in the Classroom

Two prominent models of technology use consider how computers are used by teachers in the classroom. They are the computer-as-tool model (Moursund, Bielefeldt, Ricketts & Underwood, 1995) and the Type I/Type II model (Maddux, LaMont Johnson & Willis, 1997). Although these models are several years old, they are still useful today because they enable the classification of computer use according to levels of student-centredness and ways in which teachers are implementing technology in the classroom.

There is a debate among educators as to the type of learning that IWBs facilitate. The constructivist and instructivist debate of teaching and learning is one that has sparked much interest over the past few years (Siemens, 2005). While student-centred learning has been associated with constructivist teaching models, instructivist models of teaching are typically associated with teacher-centredness. However, while educators argue that one is better than the other, perhaps a middle ground where both are used would be of greater influence (Siemens, 2005). That is, a place where both student-centredess and teacher-centredness strategies are implemented where appropriate.

There are many computer-as-tool categories that Moursund et al (1995, p. 59-60) apply to the use of computers in education. These can also be applied to the use of the IWB in learning. Table 2.1, shows how computer-as-tool categories can be applied to computer programs that may be used with the IWB to create learning experiences.

Table 2.1 Computer-as-tool Categories (Moursund, et al., 1995)

Category	Software	Application
1. Generic tools	Software programs such as word processors, database managers, and graphics packages	Students can learn to use these tools in almost every area of intellectual work
2. Subject-specific tools	Designed for a particular academic discipline. E.g., software used to compose music	Meets the needs of subject units.
3. Learner-centred tools	Tools requiring programming skills. E.g., The Logo programming language developed by Seymour Papert.	Programs designed to create a rich, interactive learning environment for students.

These categories range from lower order processes to higher order learning experiences for students. Learner-centred tools are more effective in impacting students' learning in a positive way (Moursund, et al, 1995, p. 59-60).

Similarly, the model described by Maddux, LaMont Johnson and Willis (1997, p. 17), the Type I/Type II model, uses a more application-based approach. Where Type I uses are essentially delivery methods making content easier, quicker or more efficient to teach using traditional pedagogies, Type II applications promote novel and improved ways of teaching (Maddux, et al., 1997, p. 18). As well as providing a model for categorising the uses of technology, Maddux et al (1997, p. 18) also state that, although Type I applications make teaching easier and can play an important role in education, Type II applications are more beneficial to the teaching of students.

These ideas can be linked with the use of IWBs.

According to Northcote, Mildenhall, Marshall and Swan (2010), the types of uses of IWBs in the classroom can range from teacher-centred approaches to student-centred approaches. However, as Kennewell and Higgins (2007) point out, past research has focused more on teacher-centred uses as opposed to student-centred uses.

Hattie (2009, p. 221) describes the use of computers as having the potential to increase the probability of learning and notes that especially when teachers use a diverse range of strategies. Teachers allow students to take control of learning, encourage peer learning and give helpful and timely feedback (Glover and Miller, 2001).

Conceptual Overview

A conceptual overview of this study is useful and will help explain the links which may occur between background factors and outcomes. This study focuses on attitudes towards IWB use in the classroom and student and teacher backgrounds are explored. Factors influencing IWB use may include teachers' attitudes, gender of students, computer experience of students and age of students. How IWBs are used in the classroom may have an effect on students' attitudes and on engagement.

The conceptual overview of this study (see Figure 2.1) does not intend to be presented as a causal model. It does however, attempt to represent links between variables that may occur.

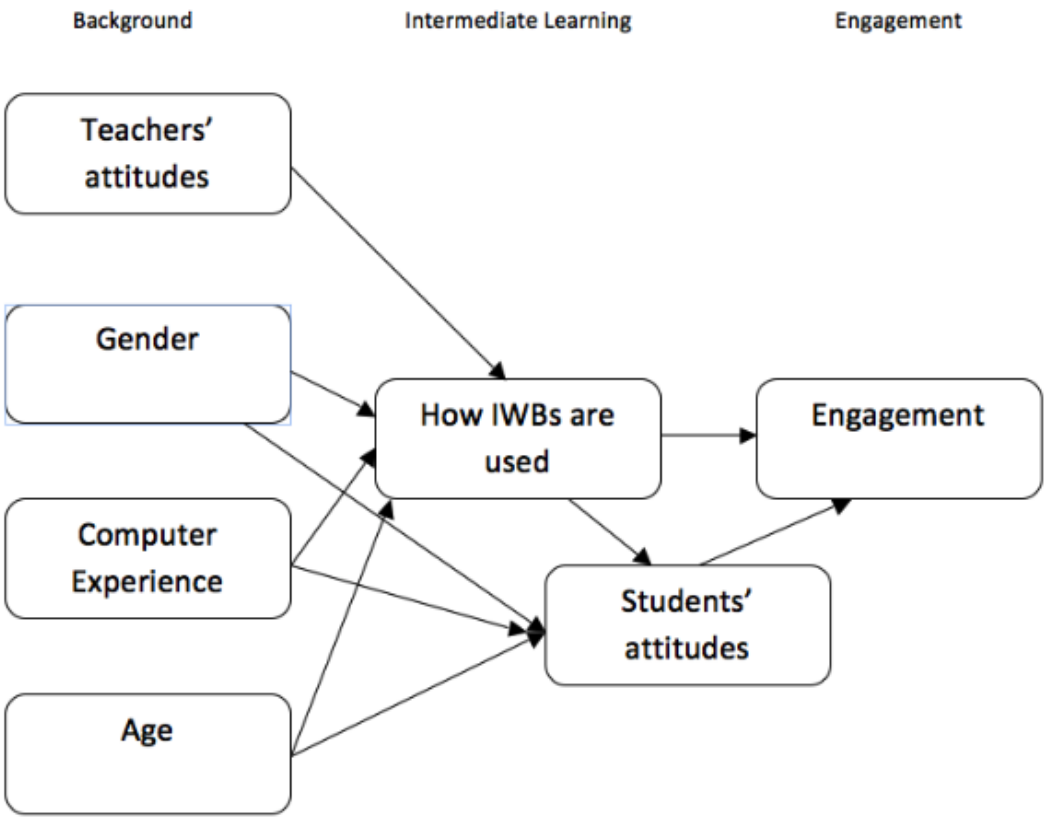

Figure 2.1. Conceptual overview

Conclusion

The IWB has been incorporated into learning environments for almost a decade in come countries and an increasing amount of research has been undertaken to determine its impact. From the available literature, several themes have emerged including the positive effect interactive whiteboards have on student engagement and

motivation as well as its capacity to facilitate the use of a wide range of learning styles. It is claimed that the IWB has the ability to enhance students' learning and retention. Observations also indicate that using the IWB in the classroom to develop lessons can help educators integrate ICT more effectively into the classroom.

While a great deal of research has been completed on the effect of IWBs on student learning, little has been done on the impact IWBs have on teacher strategies or workload (McKenzie, 2001). This literature review has provided evidence that IWBs do have an effect on student learning. Whether this effect is positive or negative may be a result of the ways in which they are used. This is an area that requires further investigation.

Studies that centre around the ways in which IWBs are used are important if we are to more fully understand the effects of IWBs on students' learning. This study aims to determine some of the pedagogical ways that teachers use IWBs and how these uses affect student attitudes and engagement in learning.

CHAPTER 3 ~

RESEARCH METHOD

Introduction

This chapter presents the research methodology used in this study including the research questions posed, the design of the study, the data collection and analysis methods adopted, the piloting process and the instruments employed. Ethical considerations and information on the participants involved in the study are also discussed.

Research Question

The research question emerged from and was informed by previous research conducted in this area. The question aims to guide the study in a way that provides more information about IWB use in the classroom and how this impacts on teachers' and students' attitudes. The question that the researcher investigated in this study is: What are student attitudes to the use of IWBs in the classroom and what factors impact on the effective use of IWBs?

The researcher also examined these subsidiary research questions:

- How are IWBs used in classrooms?
- What are the teacher attitudes towards IWBs?
- Does the degree of student-centredness impact on students' levels of engagement.

Research Design

Research designs are traditionally classified as qualitative or quantitative. Qualitative research is that "which relies on the views of participants; asks broad, general questions; collects data consisting largely of words (or texts) from participants; describes and analyses these words for themes; and conducts the inquiry in a subjective, biased manner" (Creswell, 2008, p. 46). On the other hand, quantitative research is a design, which requires the researcher to ask "specific, narrow questions" (Creswell, 2008, p. 46), collect quantifiable data, analyses this data in terms of statistics and is unbiased and objective in their approach to the study (Creswell, 2008, p. 46).

As mentioned by Drew, Hardman and Hosp (2008, p. 185), an exclusively quantitative or qualitative method does not always suffice. Sometimes studies must employ a mixed method approach so as to "capitalise on the strengths of each type of design" (Drew, Hardman and Hosp, 2008, p. 185). As outlined by Creswell (2005, p. 514), a mixed method approach can take on one of three main designs (See Figure 3.1 below).

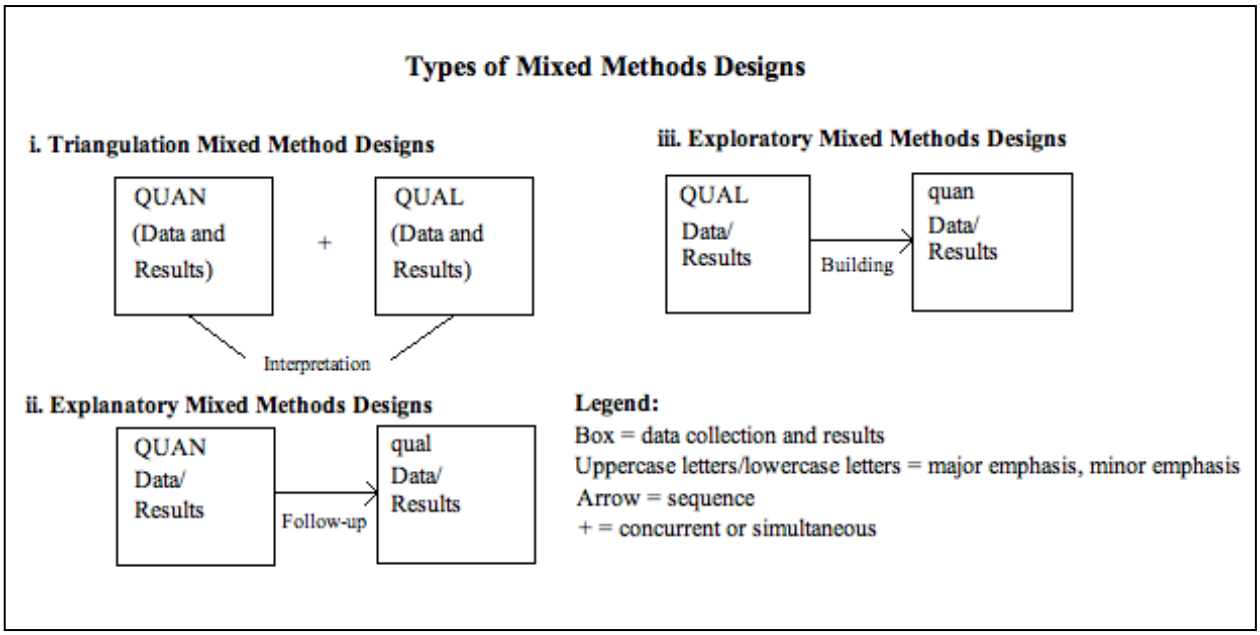

Figure 3.1. Types of Mixed Methods Designs (Creswell, 2005, p. 514)

The study reported in this thesis employed a triangulated mixed methods approach where the researcher implemented both qualitative and quantitative methods. Teachers from one selected Australian primary school (A), were asked to complete a questionnaire that investigated their attitudes towards and document their use of interactive whiteboards in the classroom as well as how they perceived the effectiveness of the IWB in teaching and learning (see Appendix H for the Teacher Questionnaire).

Students from two Australian primary schools (A & B) were asked to complete a questionnaire, looking at factors determining how the IWB may be used in the classroom (see Appendix G for the Student Questionnaire). The questionnaire included items which gathered information about age, gender, previous computer experience and attitudes, and students' perceptions of the effectiveness of IWBs in

teaching and learning. Teachers and students at School A were then investigated more intensely to determine their attitudes towards IWBs in more detail (see table 3.1).

Table 3.1 Participants in Data Collection

	School A	School B
Student Questionnaire	✓	✓
Teacher Questionnaire	✓	
Observations	✓	

During the course of this study, the researcher took observational field notes within the setting of School A. These observations took place in the classroom during a variety of lessons in which the IWB was being used, with the permission of the teacher, and were unobtrusive to the students (see Appendix I for Observation sheet).

Setting of the Study

All teachers participating in the research are currently teaching in New South Wales public schools in the Lake Macquarie area. Teachers from all four stages were represented in the research project: early stage 1 (Kindergarten), stage 1 (year 1 and 2), stage 2 (year 3 and 4) and stage 3 (year 5 and 6). The main primary school (A) consisted of approximately 270 students with approximately 11 teaching staff. School B, on the other hand, was a larger school consisting of approximately 500 students and approximately 25 teaching staff.

Recruitment of Participants

The sample for this study is made up of students within the ages of nine and twelve years old who currently attend one of two Australian primary schools. Once the study

was approved by the NSW Department of Education and Training (see Appendix A for the SERAP Approval Letter), the researcher held separate meetings with the two different school principals and asked permission to conduct this research study in their schools. School A allowed the researcher to approach teachers and distribute teacher questionnaires to cooperating teachers. The researcher was also permitted to approach the teachers of Stage 3 to obtain permission to send out a letter of explanation and consent form to students to be sent home to parents. Once signed consent forms were received from the students' parents, the researcher was able to administer student questionnaires and conduct classroom observations. School B allowed the researcher to distribute student questionnaires to students throughout stage 2 and stage 3.

Reflexivity

As this study implements the use of both quantitative and qualitative methods, it is important to note the researcher's reflexivity within the study (Lichtman, 2010, p. 122). The researcher is a pre-service teacher, studying at Avondale College and lives within the Lake Macquarie region. Both schools (A and B) are located relatively logistically close to the researcher. The researcher has completed a practicum within both schools and maintains a positive professional relationship with staff and principals in each school.

Ethical Clearance

To ensure that the study was conducted ethically, permission was obtained from the Avondale Human Research Ethics Committee (see Appendix B for Approval letter

from Avondale Research Committee). Issues such as participant consent, participant anonymity, the manner in which the participants would be supported, as well as issues associated with the access to, storage of and confidentiality of records, were addressed in this application. Ethics approval was then obtained from the NSW Department of Education and Training through the State Education Research Approval Process (SERAP) no 2010054 (see Appendix A for SERAP approval letter).

A declaration of consent form and an information letter was sent to parents and/or caregivers of the students in Schools A and B (see Appendix E for Parent/Guardian Consent Form, Appendix F for Student Consent Form, Appendix C for Invitation to Participate in Research letter and Appendix D for Information Statement to Parents). In consideration of how the study could be conducted ethically, the risks to participants and the benefits to participants and to humanity in general were noted. The only anticipated risk to participants was associated with the time taken to complete the questionnaires.

In order to preserve anonymity of the research participants, each student was allocated a number to use in place of his or her name. This enabled the researcher, whilst analysing data, to track trends and compare students' pre- and post-questionnaires if required.

Data Gathering Research Methods

Questionnaires and classroom observations were used to collect data which was qualitative and quantitative in nature. School A participated in student and teacher questionnaires as well as classroom observations and School B participated in student questionnaires. For an overview of data collection methods see Table 3.2.

Table 3.2 Data Collection Methods

Question	**Data Collection Method**
What are student attitudes to the use of IWBs in the classroom and what factors impact on the effective use of IWBs?	Student Questionnaire
How are IWBs used in the classroom?	Student Questionnaire Observations
What are the teacher attitudes towards IWBs?	Teacher Questionnaire
Does the degree of student-centredness in classroom lessons impact on students' level of engagement?	Student Questionnaire Observations

Questionnaire

Questionnaires were used to determine teacher attitudes towards using interactive whiteboards in the classroom. Questionnaires consisted of structured questions that focused on the uses of interactive whiteboards in the classroom. Both Likert-style rating scales and open questions were incorporated in the questionnaires. Students were also asked to complete a questionnaire, with items that looked at factors determining how the whiteboard may be used in the classroom including: age, gender, previous computer experience and attitudes. Student questionnaires were also used to information about the students attitudes towards the use of interactive IWBs in the classroom (See Appendix F for Student Questionnaire).

When student questionnaires were completed from School A and School B, Teacher questionnaires were conducted at School A. These questionnaires were used to determine teacher attitudes towards using interactive whiteboards in the classroom. Questionnaires also included of structured questions that dealt with the uses of interactive whiteboards in the classroom (See Appendix H for Teacher Questionnaire).

Pilot Questionnaires

A pilot study was conducted to trial questionnaires used in the main study. Before pilot questionnaires were administered, principals from both School A and School B were given the questionnaires and gave recommendations as to changes that could be made. These suggestions included taking out time-consuming open-ended questions that they felt teachers would dislike completing as well as ensuring student questionnaires were 'kid friendly'. Thus, strategies which ensured the face validity of the questionnaires (McMillan and Schumacher, 2010, p. 175) were employed to determine whether the items from both questionnaires were relevant and valid.

Construction of the Pilot Questionnaires

The pilot version of the student questionnaire consisted of 27 items including 16 Likert-style items (Burns, 2000, p. 559), three open-ended items and five defined items. The Likert-style items were presented as statements and participants were asked to record their level of agreement or disagreement with each item using a 4-point scale, ranging from strongly agree to strongly disagree. The open-ended items

were placed throughout the questionnaire and requested participants to answer three questions related to how IWBs are used in the classroom and why they liked or disliked using computers. The pilot version of the teacher questionnaire consisted of 10 items including nine defined questions, with three having the choice to expand on, and one open-ended question.

Administration of the Pilot Questionnaires

A total of 10 trial participants volunteered to complete the pilot questionnaires, including five pre-service teachers and five primary school students. Trial participants commented on a few wording choices for questionnaires which were adjusted to improve the clarity of the items. There were a few minor changes made to the teacher questionnaire regarding the format of questions. For example, trial participants noted that teachers may be reluctant to answer too many qualitative questions, so some were excluded from the final questionnaire.

Construction and Implementation of Final Questionnaires

The final version of the student questionnaire consisted of 27 items including 16 Likert-style items, three open-ended questions and five defined items. Participants were then requested to select a level of agreement or disagreement on a 4-point Likert scale to represent their response to the 16 items in the inventory ranging across the following categories: “strongly disagree, disagree, agree and strongly agree”. A copy of the final questionnaires that were administered in the study are located in Appendix G and Appendix H.

Observations

Observations were used to ascertain how teachers use interactive whiteboards and to what extent they may have been perceived as effective teaching tools. These observations took place during the main study in the classroom and were unobtrusive to the students. An observation schedule was constructed which guided data collection during this process (see Appendix I for Observation Sheet and Appendix J for Observation Schedule).

Analysis of Data

As this study employed both quantitative and qualitative components, the researcher employed a variety of analytical techniques to analyse data. The quantitative data in this study were analysed using the SPSS statistical analysis program, making use of the factor analysis, analysis of variance, reliability and correlation functions of this program. Descriptive statistical analyses were used to analyse data gathered from the questionnaires and observation field notes.

Coding of themes was used to analyse the data gathered from qualitative questions from both student and teacher questionnaires as well as from observational notes. To maintain reliability of this coding, the researcher as well as the researcher's supervisor coded themes separately and then the coded themes were collated.

CHAPTER 4 ~

RESULTS

This chapter provides information on the results of the data collected from student questionnaires, teacher questionnaires and classroom observations. The results are structured in line with the conceptual overview and are compared and contrasted in order to understand the relationships between attitudes towards IWBs and how they are used in the classroom.

Background Factors for Students

The results for the student background variables follow (including gender, age, year in school, school and previous computer):

Gender

Of the 130 students who participated, approximately 54% were male and approximately 46% were female. 36 students (21 male, 15 female) were from School A and 94 (49 male, 45 female) were from School B. Analysis of variance indicated that there was no significant difference between attitudes in relation to student gender.

Age

Student age ranged between nine and 12 years with an average age of 10.7 years (see Table 4.1). Analysis of variance showed that there was no significant difference between attitudes in relation to student age.

Table 4.1 Student age distributions across both schools

Student Age Distribution					
School	**Nine**	**Ten**	**Eleven**	**Twelve**	**Total**
School A	0	15	16	5	**36**
School B	8	30	39	17	**94**
Total	**8**	**45**	**55**	**22**	**130**

Year in School

Students' year level ranged from year 4 through to year 6. The largest year group, with 23% (n=28), was found to be from classroom 7.

School

Table 4.2 illustrates the distribution of the sample amongst the two schools. Clearly, School B had the bulk of students participating in the sample (72% of the sample, n=94 of a possible 130). This was expected, as School B was the largest school out of the two that participated.

Table 4.2 Student distributions across two schools

Student Distribution			
School	**Male**	**Female**	**Total**
School A	21	15	**36**
School B	49	45	**94**
Total	**70**	**60**	**130**

Students' Attitudes to Computer and Previous Computer Experience

Students reported as to whether they liked using computers. 91% (n=116) of students stated that they like using computers with the remaining 9% (n=11) stating that they did not like using computers (See Figure 4.1). Using a Pearson Correlation test, it was found that there was no significant correlation between computer use and attitudes towards IWBs.

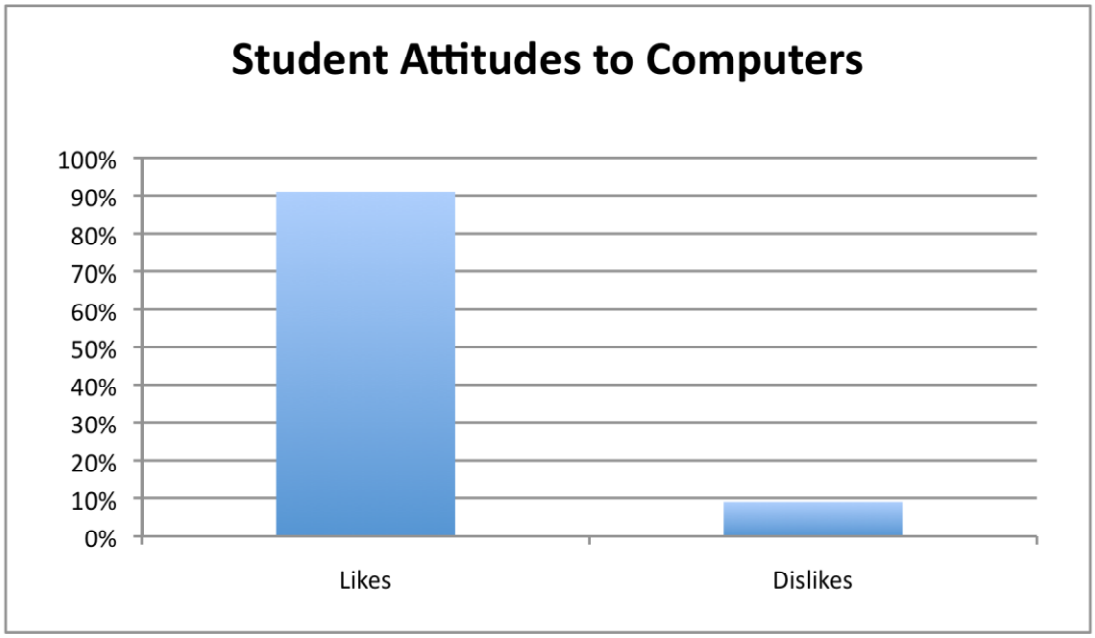

Figure 4.1. Responses to Question 4 of Student Questionnaire: Attitudes to Computers

Responses as to why students liked or disliked computers were coded and themes and categories emerged. Among the responses to why they liked or disliked computers, a high percentage of students listed fun, games, learning, information/research and communication as major computer based activities in which they were engaged that contributed to them liking computers. Common themes included computers' capacity for learning, gaming and accessing information. Most students listed that computers

are “fun”. One student in particular noted that computers are like “a big book about everything” while another student noted that computers are “like having an interactive Steven Hawkins”. Figure 4.2 demonstrates the themes that emerged from student questionnaires as a result of coding by the researcher.

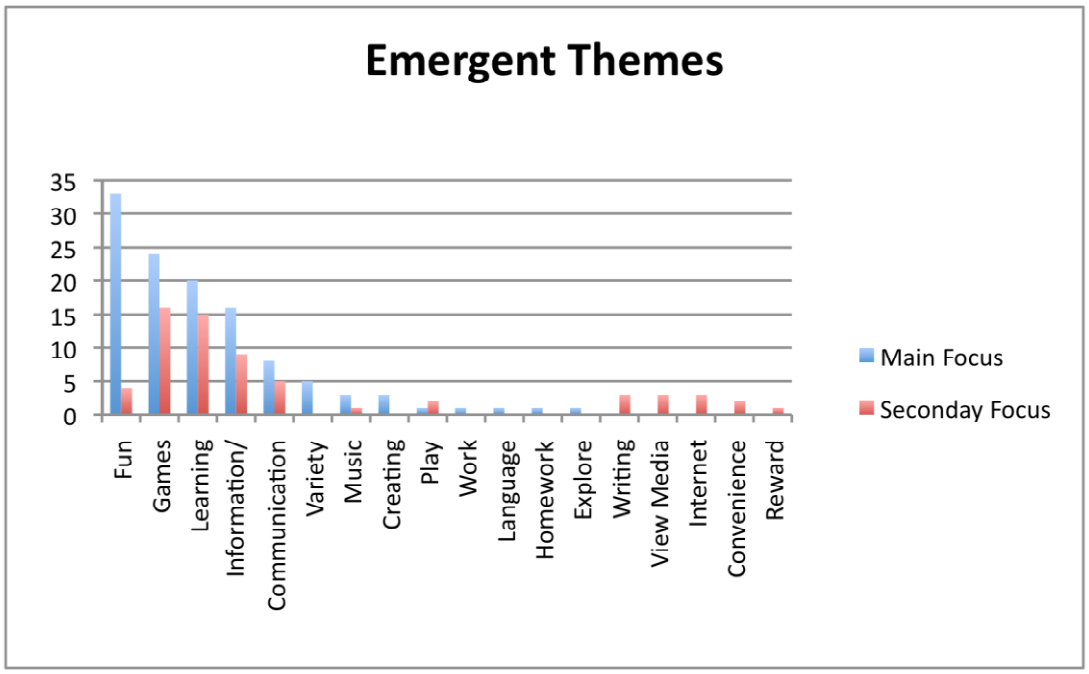

Figure 4.2. Emergent themes from coding

Student Attitudes Towards Interactive Whiteboards

The Likert-style items included in the student questionnaire were developed into a scale that measured student attitudes towards IWB use in the classroom (see Appendix A for Student Questionnaire). Principal component factor analysis was used to refine the questionnaire through the elimination of items loading below 0.3. The reliability was checked at each stage of the removal process. A construct variable called “Attitudes to IWBs” was constructed by averaging scores of items that were related to students’ attitudes to IWBs. The factor loadings of the final scale are shown in Table 4.3.

Table 4.3 Factors Loadings for Attitudes to IWBs

Attitudes to IWBs, Alpha = 0.87		
Q. No	**Item**	**Loading**
20	I prefer lessons which are taught with an IWB	.782
14	It is easier to understand the work when my teacher uses an IWB	.726
24	I think teachers' lessons are more prepared and organised when	.681
26	I concentrate better in class when the teacher is using the IWB	.663
15	When I use the IWB, it makes learning more interesting and	.643
22	I would work harder if my teacher used the IWB more often	.633
12	I learn more when my teacher uses an IWB.	.630
18	I am confident when using the IWB	.617
23	I would work harder if I used the IWB more often	.582
21	IWBs makes it easy for the teacher to repeat, re-explain, and summarise	.577
25	We get to join in on lessons more when my teacher uses an IWB	.561
17	I think students behave better in lessons with IWBs	.528
27	I concentrate better in class when other students are using the IWB	.500
19	Teachers teach just the same with or without an IWB	.436

As the items in the questionnaire were scored as continuous variables, the internal consistency method of checking reliability was employed by calculating Cronbach's alpha reliability coefficient (Creswell, 2005, p. 164). The reliability of the final scale was found to be 0.87 which is above the recommended coefficient level (Bryman & Cramer, 2001, p. 63).

On average, students' general attitudes towards the use of IWBs in the classroom were positive. The scale used in the study ranged from zero to three. The mid point was 1.5 meaning that scores above 1.5 represent positive attitudes towards IWBs. On average students reported a positive attitude to IWBs with a mean of 2.01 (SD = 0.51) (see Figure 4.3).

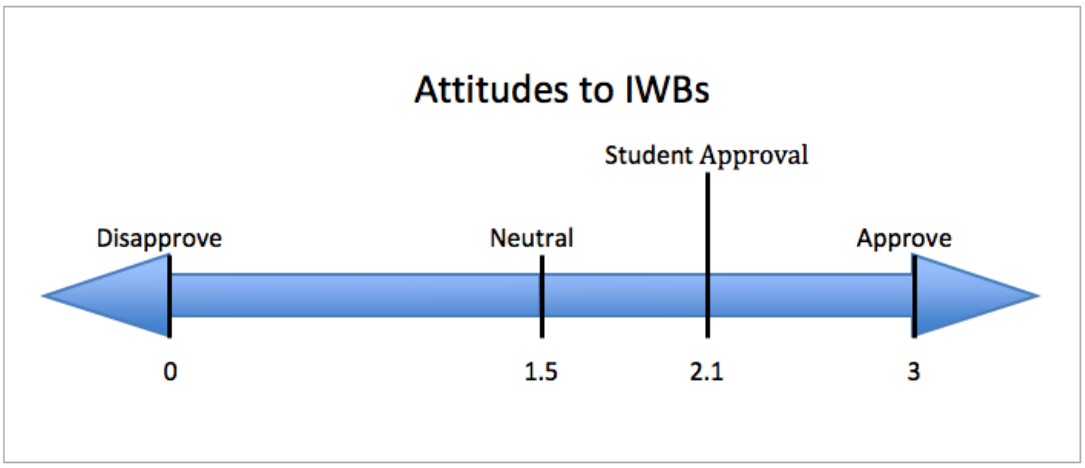

Figure 4.3. Student Attitudes towards IWBs

An analysis of variance (ANOVA) test was conducted of the questionnaire data which indicated that, from those classrooms observed, students in Classroom 3, were the most positive in terms of attitudes towards IWBs. There was a significant difference ($p<0.01$) between the attitudes of students from School A and School B. That is, the attitudes of students from School A were more positive than students from School B.

Table 4.4 provides more detail on the general positive student attitudes to IWBs Statements with the highest endorsement appear to relate to the teacher's use of IWBs and the way in which IWBs are used to teach. For example, question 15, which related to interest and excitement, had the largest endorsement (88.1%). The statements with lower endorsement levels suggest the use of IWBs has little effect on pupils' motivation. For example, question 22, which related to student effort in regards to work when the IWB was being used, had the lowest endorsement (46.1%). Of particular interest is question 19 where 50% of students agree or strongly agree

with the statement pertaining to teachers teaching similarly with or without the use of an IWB.

Table 4.4 Statements: Percent of Pupils who Agree or Strongly Agree

Statement	Agree/strongly agree
12. I learn more when my teacher uses an IWB.	81.6
14. It is easier to understand the work when my teacher uses an IWB	83.9
15. When I use the IWB, it makes learning more interesting and	88.1
17. I think students behave better in lessons with IWBs	64.3
18. I am confident when using the IWB	84.9
19. Teachers teach just the same with or without an IWB	49.6
1. I prefer lessons which are taught with an IWB	82.8
2. IWBs makes it easy for the teacher to repeat, re-explain, and	79.5
3. I would work harder if my teacher used the IWB more often	46.1
4. I would work harder if I used the IWB more often	50.4
5. I think teachers' lessons are more prepared and organised when	83.4
6. We get to join in on lessons more when my teacher uses an IWB	77.6
7. I concentrate better in class when the teacher is using the IWB	61.9
8. I concentrate better in class when other students are using the IWB	59.9

Background Factors for Teachers

All teachers who participated in the study are currently teaching in a New South Wales public school in the Lake Macquarie region. They were all from School A. Out of these teachers who participated in the questionnaire one was male (14%) and six were female (86%).

Teacher Attitudes

Overall, teachers were extremely positive regarding IWB use in the classroom. 86% of teachers (n=6) stated that they believed using the IWB affected the extent to which students are engaged in the learning progress. Further, 100% of teachers (n=7) stated that they believed the IWB contributed to student learning.

In regards to using the IWB in the classroom, teachers cited a number of elements they liked the most. All seven teachers stated that they liked the fact that IWBS enabled access to a wide variety of technological and Internet resources for whole class use. All of the teacher in the study (n=7) also believed that the IWB increased enjoyment and motivation, and that it facilitated student participation.

On the other hand, teachers reported that preparation time and connectivity issues provided the most angst when using IWBs in the classroom. Teachers noted that when connectivity issues were present, these issues interrupted lessons as they affected their teaching.

Use of IWBs

To further understand attitudes to IWBs it is important to know what they are being used for in the classroom. Teachers and students reported on the use of the IWB in three classrooms from School A. Students' reported that IWBs were being used during most lessons (See Figure 4.4).

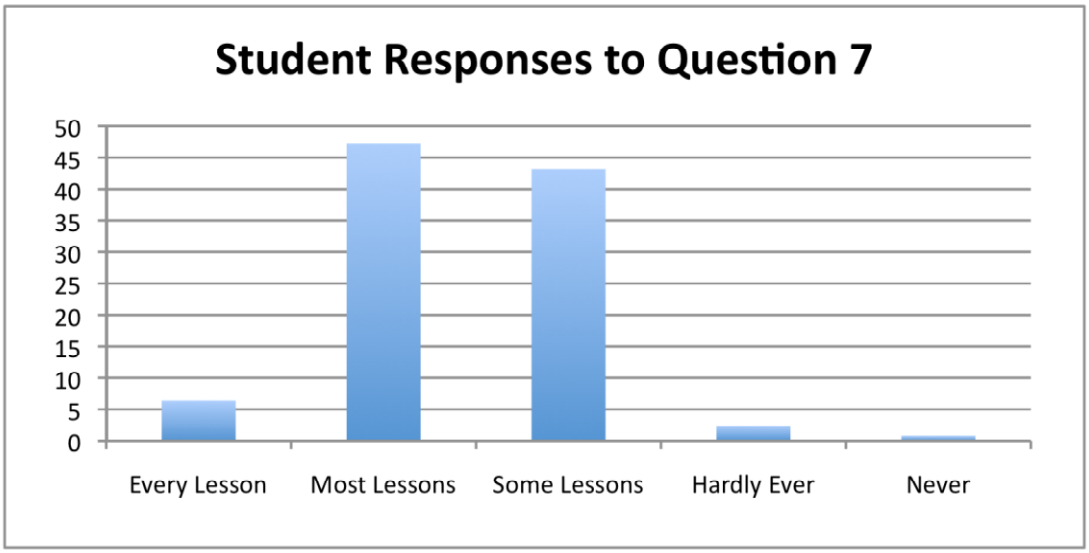

Figure 4.4. Student responses to question 7: Frequency of use of IWBs

Just over 21% of students (n=27 out of a possible 130) reported that students were permitted to use the IWB in every lesson or in most lessons. Just over 35% of students (n=45 out of a possible 130) reported that students were allowed to use the IWB during some lessons. The remaining 43.4% of students (n=55 out of a possible 130) stated that they rarely (hardly ever or never) got to use the IWB (see Figure 4.5).

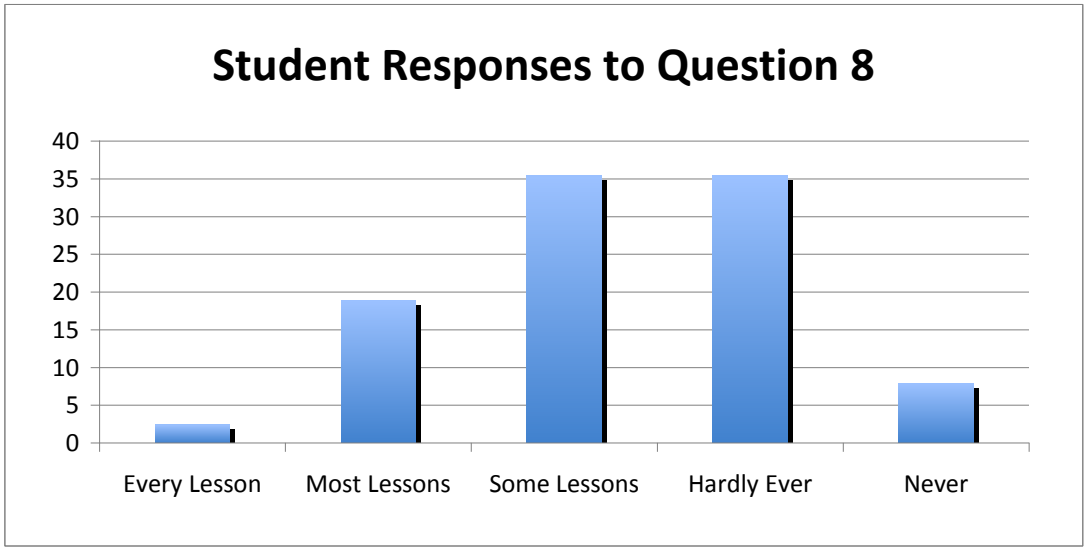

Figure 4.5. Student responses to question 8: Frequency of student use of IWBs

Type of IWB Use in the Classroom

Pedagogical observations were made to determine how IWBs were used in the classroom. Each of the following tables (Tables 4.5-4.10) presents observational data from one of three classrooms. Examination of the data reveals that in most instances, when the type of IWB use switched from one use to another (for example, teacher-centred to student-centred), engagement levels spiked to a rating of four (out of a possible rating of four).

This is an interesting result when contrasted against lessons when IWB use maintained a student-centred approach for an extended period of time (as seen in Table 4.5), and student engagement levels decreased. To better explain what was happening, a Scale of Centredness was used to describe student engagement when the teacher employed different pedagogical approaches in regards to IWBs. It was noted

that clumping occurred when teachers used a particular approach over a period of time. The term clumping refers to a period of time in which the teacher used only one approach.

The Scale of Centredness was constructed to analyse the data gathered during lessons observed in School A. The scale made it possible to report on the results of the timed data in a meaningful way. Since the element of time length was an important factor in classroom observations, this scale enabled the researcher to report on this element of the study.

Table 4.5 shows the level of centredness for the first lesson observed in Classroom 1. IWB use in the classroom was recorded in two-minute time intervals (t) and levels of engagement were given a possible mark of four (one indicating that students were not engaged at all, two indicating that students were mostly not engaged, three indicating that students were mostly engaged and four indicating that students were very engaged). It can be seen that the lesson moved quite clearly from a teacher-centred approach, to a student-centred with a transition period of a teacher/student-centred approach at the beginning of the lesson (t=5-6 mins). At the beginning of the lesson, the engagement levels (e) were quite high (average e=3). Throughout the transition period to the student-centred period, engagement levels spiked (e=4). While time progressed and IWB use maintained a student-centred approach, engagement levels went down (from e=4 to e=2).

Table 4.5 Classroom 1 Lesson 1 Scale of Centredness

Time (mins)	0-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Teacher- centred	●	●							●	●
Teacher/student-centred			●							
Student- centred				●	●	●	●	●		
Level of Engagement	3	3	3	4	4	3	3	2	3	3

During the second lesson observed in Classroom 1 (see Table 4.6), IWB use did not span the whole lesson exclusively. The teacher moved from IWB use (employing a range of teacher- and student-centred approaches) to other pedagogical tools such as the use of a workbook. Whilst the IWB was being used, engagement levels were quite high (average e=3.5) and when IWBs were not being used engagement levels were lower (average e=2.5). When the teacher adopted a student-centred or teacher/student-centred approach, engagement levels were high (average e=4). However, when the teacher employed a teacher-centred approach, engagement levels were lower (average e=3.25). It must be noted that where no dots appear on the scale, this indicated that the IWB was not being used at that time in the classroom.

Table 4.6 Classroom 1 Lesson 2 Scale of Centredness

Time (mins)	0-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Teacher- centred		●	●			●			●	
Teacher/student-centred							●			
Student- centred										●
Level of Engagement	3	3	3	3	2	3	4	2	4	4

Whilst observing lesson 1 in Classroom 2 (see Table 4.7), the teacher moved smoothly and concisely from teacher-centred to teacher/student-centred IWB use. When a teacher-centred approach was utilised, engagement levels were lower (average e=3.1) than when the teacher used a teacher/student-centred approach (average e=4).

Table 4.7 Classroom 2 Lesson 1 Scale of Centredness

Time (mins)	0-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Teacher- centred	●	●	●	●				●	●	●
Teacher/student-centred					●	●	●			
Student- centred										
Level of Engagement	3	3	3	3	4	4	4	4	3	3

Table 4.8 shows the second lesson observed in Classroom 2. The teacher began the lesson with a teacher-centred approach (average e=3.5) and then transitioned into a student-centred activity where engagement levels went up (average e=4 for t=5-10). Again, the teacher did not use the IWB for the whole lesson. When the IWB was utilised engagement levels were higher (average e=3.75) than when the IWB was not being used (average e=3).

Table 4.8 Classroom 2 Lesson 2 Scale of Centredness

Time (mins)	0-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Teacher- centred	●	●						●		
Teacher/student-centred						●	●			
Student- centred			●	●	●					
Level of Engagement	4	3	4	4	4	4	4	3	3	3

During the first lesson observed in Classroom 3 (see Table 4.9), the teacher used the IWB in a solely teacher-centred manner. When the IWB was not being used, engagement levels were lower (average e=3) than when the IWB was being used (average e=3.5).

Table 4.9 Classroom 3 Lesson 1 Scale of Centredness

Time (mins)	0-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Teacher- centred			●	●	●	●	●	●	●	●
Teacher/student-centred										
Student- centred										
Level of Engagement	3	3	4	3	3	4	4	3	4	3

The second lesson observed in Classroom 3 (see Table 4.10) was quite different from that of lesson 1 observed in Classroom 3. The lesson implemented the use of all three approaches, including teacher-centred, student-centred and teacher/student-centred. When the teacher employed a teacher-centred approach, engagement levels were the same as when they used a teacher/student-centred approach (average e=3.5). However, when the teacher used a more student-centred approach, engagement levels were higher (average e=4).

Table 4.10 Classroom 3 Lesson 2 Scale of Centredness

Time (mins)	0-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20
Teacher- centred		●		●	●					●
Teacher/student-centred			●						●	
Student- centred						●	●	●		
Level of Engagement	3	4	4	4	3	4	4	4	3	3

Factors that Influence Students' Attitudes to IWBs

During observed lessons taught with the use of the IWB, teachers employed a range of methods including teacher-centred, teacher/student-centred and student-centred approaches. Whilst it was evident that average engagement levels were higher when the IWB was used (average e=3.6) than when the IWB was not used (average e=2.7), the type of use was also found to influence engagement.

On average, teachers used a teacher-centred approach when using the IWB, 50% (n=30 time intervals) of the time. Teachers employed a teacher/student-centred approach 15% (n=9 time intervals) of the time and a student-centred approach 20% (n=12 time intervals) of the time with the IWB not being utilised during the remaining 15% (n=9 time intervals) of time.

When teachers used a teacher-centred approach, student levels of engagement were, on average, lower (average e=3.3) than when teachers adopted a teacher/student-centred (average e=3.8) or a student-centred approach (average e=3.6).

CHAPTER 5 ~

DISCUSSION

This research seeks to clarify the pedagogical uses of IWBs in the classroom by teachers and how they impact upon student learning. It also examines the role that teacher and student attitudes have in association with the use of IWBs. For deeper understanding of the complexities that surround IWB use and factors influencing attitudes, four research questions were proposed in Chapter 3. Each of these research questions will now be considered. Due to the scope and time limitations of the study, some questionnaire data was not analysed but was taken into consideration throughout the discussion.

What are Student Attitudes to IWBs?

Students' attitudes towards the use of IWBs in the classroom were positive. This is similar to the findings of Hall and Higgins (2005). Students liked using the IWB and perceived that its use positively impacted upon their learning. Many students felt that they learnt more when their teacher used the IWB, and it was easier to understand work when the IWB was used. Students also reported that their classroom participation was more frequent and that they were more engaged when the teacher employed the IWB.

This result is not surprising. Students are consistently exposed to new forms of technology and it is being used more and more in everyday life. Today's, students

have been identified as “Digital Natives” (Prensky, 2001). They can easily pick up new technologies and learn how to use them. Students expect that they are always connected (to the internet) and can access information easily. The IWB is not an exception to this. It is not unexpected that students feel that the IWB helps them learn, because they have grown up with technology and consider that technology in general assists their learning.

When attitudes towards a particular teaching tool, such as the IWB are positive, then engagement levels are higher (Murcia & McKenzie, 2008; Li, 2007). If students like IWBs, then they are more likely to be engaged in their learning as a result.

Gender as a Factor on Student Attitudes to IWBs

According to Glover and Miller (2001) males tend to like working with technology more than females. However, this study found no significant direct relationship between gender and the students’ attitudes to computers in general. Additionally, no significant direct relationship was found between the students’ gender and their attitudes towards IWBs. It could be that the graphical nature of the IWB appeals to girls. More research is needed to clarify this issue.

Age as a Factor on Student Attitudes to IWBs

The study found that there was no correlation between age and students’ attitudes towards IWBs. As students’ ages were relatively close (between nine and 12 years), this was to be expected. If the study included a larger range of students, perhaps over

the primary and secondary schooling system, the results may have been different.

Computer Experience as a Factor on Student Attitudes to IWBs

On average, students were positive towards the use of computers. Students reported that they liked the "fun" and "games" elements of computers as well as computers' capacity to hold information from which they can learn.

Particularly in this technologic age, students are being exposed to many new types of technologies. Students as Digital Natives (Prensky, 2001) can think and process in a way that centres around technology. The IWB is very closely linked to computer use, as a computer is required for the operation of an IWB.

Students' previous computer experience was found to have little impact on students' attitudes towards IWBs. Most students liked using computers in general and responded positively towards the use of IWBs: by themselves, by their teacher and by their peers.

What are Teacher Attitudes to IWBs?

Teachers reported that they liked using the IWB in their classroom and that they felt it enhanced students' learning in a positive way. One teacher in particular was very positive and reported that students can "see the content/process and manipulate (or modify) to needs" on the IWB better than they can with a conventional blackboard or whiteboard. Another teacher noted that the IWB addresses the tactile modality of

learning. Teachers reported that being able to touch the IWB and move objects on screen made students "feel special". The majority of teachers believed that students were more engaged in the learning process when the IWB was being used and that the three modalities of learning (visual, auditory and kinaesthetic) were heightened with the use of the IWB.

Again, this is not a surprising result. Computers have the capacity to make work easier (most of the time). With the development of the Internet, the IWB is another teaching tool that has the capacity to make internet access possible on a large classroom-wide scale. Teachers can now produce worksheets, save their work and access the internet while in the classroom as well as use the IWB as an interactive tool for teaching.

How are IWBs Used in the Classroom?

Important relationships were found between IWB use and the impact on student engagement and attitudes. During the study IWBs were used in most lessons. Teachers were observed using the IWB with confidence and with skill. Students were engaged in these lessons and participated in dialogue surrounding information, resources and activities presented on the IWB.

This is an interesting result. Teachers were able to employ the use of the IWB to engage students in their learning and, as such, provide a quality-learning environment. One would expect rich learning to be the result as the use of the IWB in

this way embodies the requirements of the NSW Quality Teaching Model (NSW Department of Education and Training, 2003).

Does The Degree of Student-Centredenss in Classroom Lessons Impact on Student's Levels of Engagement?

During this study teachers were observed using a teacher-centred approach more often than they used a student-centred approach. It was surprising that engagement levels were not significantly affected by the type of use (teacher-centred, teacher/student-centred or student-centred). It was expected that engagement levels would be higher when teachers employed a more student-centred approach. However, this was not the case.

It is interesting, however, that on one occasion in particular, engagement levels dropped significantly when the teacher adopted a more student-centred approach for an extended amount of time. From the observational data, it seems that engagement levels remain higher when teachers oscillate between teacher-centred and student-centred uses. It must be noted, however, that on another occasion, the teacher employed a very teacher-centred approach when using the IWB, and engagement levels remained high. The conclusion to this may be that the type of use is not so important as the quality of the pedagogy used. Teachers who use a range of approaches seem to be more successful in gaining and maintaining student engagement levels.

Conclusion

Currently, IWBs are being used in classrooms as effective teaching tools. This study has concluded that students' attitudes towards IWBs are positive and can be positively linked to student engagement. This study has also concluded that teachers' attitudes towards IWBs are also positive and can be linked to how IWBs are used in the classroom. This study, found that teachers are using IWBs in a mainly teacher-centred way. On average, students have the opportunity to use the IWB in class time and they enjoy using the IWB. From observation data, it was found that the IWB is used more effectively in terms of student engagement, when teachers alternate between teacher-centred approaches and student-centred approaches. Additionally, this study found that whatever the approach, IWB use was more effective in terms of student engagement when teachers used either a student-centred or a teacher-centred approach in small clumps of time.

CHAPTER 6 ~

CONCLUSION AND RECOMMENDATIONS

Although this study does not aim to generalise the findings across all school populations, the findings can be applied to the schools involved in the study and may be of interest to educators in similar schools. The aim of the study was to identify the pedagogical uses of interactive whiteboards (IWBs) and their impact on the attitudes of students and teachers. Through identifying initial student and teacher attitudes, the study provides a better understanding of pedagogical uses and their impact on student engagement levels.

This study has identified that the pedagogical uses of IWBs do impact on student attitudes towards them. The way in which teachers use and implement IWBs in the classroom affects the extent to which students are engaged in the lesson. The study also concluded that students' previous computer experience, age and gender did not have a significant impact on attitudes towards IWBs.

Recommendations

From this study, recommendations can be made in order to help assist the effective implementation of IWBs into the classroom.

The major recommendation from this study is to use IWBs in the classroom. Student attitudes towards IWB use are positive. When IWBs were used in the classroom, students felt they were more involved in their learning and that they were given opportunities to engage in interactive activities. The use of IWBs in the classroom is a major contributor to students liking IWBs and technology in general. However, teachers need to be aware of the ways in which IWBs should be used. The most effective approach in terms of engagement levels is one which alternates between teacher-centred and student-centred. The use of small clumps of time that alternate between teacher-, teacher/student- and student-centred approaches appear to engage students in their learning more effectively than longer amounts of time devoted to one approach.

IWB software that is currently available in schools is quite substantial. From spending time within the observed school, it was noticed that teachers preferred to use familiar computer-based software such as Microsoft PowerPoint, rather than specific IWB software such as Notebook. The software available for use should be made accessible so that teachers can feel more competent using and implementing this software specifically designed for use with IWBs. This instruction on the use of IWBs could be employed through professional development activities for practising and pre-service teachers.

In addition to the specific recommendations noted above, general recommendations can also be made in regards to pedagogical uses of IWBs. The first point is that overuse of IWBs, or use for the sake of using, could be detrimental. If IWBs are used

with clear pedagogical purposes in mind, then IWBs can be used to positively impact on student engagement levels.

Reflections

The researcher, while observing school A, noted that IWBs could be used more effectively if schools worked together to affect pedagogical uses. A notable program that is currently being implemented into the Lake Macquarie region is one where schools collaborate on a professional level and where pedagogical issues are dealt with through collaborative practice. Through this program, administrative staff can be involved in teacher development as well as teacher support. If IWBs are to be implemented on a larger scale, the standardisation of teachers' skills should be linked with the Framework of Professional Teaching Standards (NSW Institute of Teachers, 2005).

Limitations of the study

This study focused on IWB use and teacher and student attitudes to IWB use in two schools. While findings from the study may raise issues that are relevant to the two schools involved, conclusions made in relation to two schools cannot be generalised to all other schools. However, conclusions and recommendations from this study may be applied to other similar schools. Also, this study may provide pointers for the shaping of later research projects.

Due to the nature of the study, the population sample was kept small. Students who completed the questionnaire were from only two New South Wales public schools. If research was to be conducted on a larger scale, findings from this study could be further backed up or different conclusions may be drawn.

Time was also a limitation to the study. The research project was conducted during the researcher's completion of a Bachelor of Education degree. Time was therefore a constraint. The approval to conduct this research in the NSW public school system was given near the scheduled holiday period for NSW schools and this delayed decision impacted on the timeframe for the collection of data. Although data was collected about teachers' perceived IWB usage as well as students' locations of computer use and types of computer use, this data was not analysed due to the scope and time limitations of the study.

Implications for Further Research

This research can be continued and investigated further. The research study could be enlarged and an invitation extended to a wider range of schools to participate in the research. This would give a broader perspective on teachers' and students' attitudes towards the use of IWBs as well as the opportunity to observe the pedagogical uses in more individual classrooms. Recommendations for future research can contribute to the body of knowledge about IWB research.

Student attitudes towards computers seemed to be emotionally linked. Students liked that IWBs were used for motivational purposes and that they felt competent using the IWBs. A small number of students who did not like using computers noted that the reason for this was because they felt incompetent using them. There was no significant impact of previous computer experience on IWB use in the classroom but further research could be conducted to investigate the reasons behind students' feelings of competency regarding computers in general.

This study used a teacher-centred, teacher/student-centred, student-centred model for measuring the types of uses of IWBs. This model needs further investigating and validating if we are to more fully understand how IWB use impacts upon the education of students. Using this model, researchers could look into the effect of pedagogy on a number of elements including impact on learning, on outcomes, on reporting and on evaluating.

Teachers need to also be conscious of different variables that can affect student attitudes and engagement towards IWBs - particularly in terms of gender and previous computer experience. Although this study concluded that gender and previous computer experience were not significant factors in students' attitudes towards IWBs, a study conducted on a larger scale may conclude differently.

In summary, this study shows that IWBs can be used as effective tools to engage and involve students in learning. The use of the IWB in the classroom can have an impact

on the learning of students. The IWB, when used effectively, has the potential to contribute to the creation of effective learning environments and greatly assist educators in their efforts to obtain and maintain students' attention and improve student achievement. This is best achieved by teachers alternating between teacher-centred and student-centred approaches to using the IWB.

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APPENDIX A – SERAP APPROVAL LETTER

NSW GOVERNMENT | Education & Training

Miss Kimberley Sharman
PO Box 57
WARNERS BAY NSW 2282

DOC 10/94666

Dear Miss Sharman

SERAP NUMBER 2010054

I refer to your application to conduct a research project in NSW government schools entitled *"Pedagocial uses of interactive whiteboads in two Australian Primary schools: Their impact on teacher and student attitudes".* I am pleased to advise that it has been approved and that the approval remains valid until 31 October 2010.

The following researchers or research assistants have fulfilled the Working with Children screening requirements to interact with or observe children for the purposes of this research for the period indicated:

Name	**Approval expires**
Miss Kimberley Sharman	31-10-2010

The following requirements also apply:

- principals have the right to withdraw the school from the study at any time. The approval of the principal for the specific method of gathering information for the school must also be sought
- the privacy of the school and the students is to be protected
- the participation of teachers and students must be voluntary and at the school's convenience; and
- any proposal to publish the outcomes of the study should be discussed with the Research Approvals Officer before publication proceeds.

You may now contact the principals of the nominated NSW government schools to seek their participation. It is recommended that you include a copy of this letter with the documents you send. When your study is completed, please forward your report to the Manager, Schooling Research, Department of Education and Training, Student Engagement and Program Evaluation Bureau, Locked Bag 53, Darlinghurst NSW 2010.

Yours sincerely

Dr Max Smith
Senior Manager,
Student Engagement and Program Evaluation
29 June 2010

NSW Department of Education & Training – Student Engagement and Program Evaluation Bureau
Level 1, 1 Oxford St. Darlinghurst NSW 2010 T 9244 5619 F 9266 8233 E serap@det.nsw.edu.au

APPENDIX B – AVONDALE ETHICS COMMITTEE APPROVAL LETTER

Avondale COLLEGE

From the Office of the Vice President
(Administration and Research)
Email: vivienne.watts@avondale.edu.au
Tel: 02 4980 2120
Fax: 02 4980 2117

30 April 2010

Ms Kimberley Sharman
c/- Dr Peter Beamish
Faculty of Education
Avondale College
COORANBONG NSW 2265

Dear Kimberley

Further to the letter dated 2 December 2009 regarding ethics approval from the Avondale Human Research Ethics Committee for your Honours research project *Different used of interactive whiteboards in an Australian school: Their impact on student learning.* The approval was subject to minor changes made to your application and supporting documents to the satisfaction of Dr Cedric Greive.

Dr Greive has reviewed all the changes made to your documentation and is satisfied with its content, therefore final approval has been granted for your project. This approval will cover the duration of your project till 31 October 2010. The following additional standard conditions apply:

1. That you notify the committee of any changes to circumstances or research design, which might require a review of the ethics approval.
2. That you provide an annual interim report of your progress to the committee, and a final report once this project is completed. The first report will be due twelve months from the date you commence the research.

We wish you well in your research endeavour.

Sincerely,

V. Watts

Dr Vivienne Watts
Human Research Ethics Committee Chair and
Vice-President (Administration & Research)

APPENDIX C – INVITATION TO PARTICIPATE IN RESEARCH

INVITATION TO PARTICIPATE IN RESEARCH

Date: _____

Dear Parents,

A research study is under way in which we are looking at the uses of interactive whiteboards in the classroom and their affect on student learning. In order to learn more about this area we are asking students and staff to participate in the completion of a questionnaire about their perceptions of the use of the interactive whiteboard in their classroom and how they feel it impacts upon their learning.

Enclosed you will find a letter explaining the research to be conducted and two consent forms for you and your child to sign.

If you agree to your child participating in this project and have spoken to your child and they agree, please sign both copies of the consent form and have your child sign the bottom portion. Please retain one copy for your records and have your child return the other Consent Form to _____ (classroom teacher) by _____ (date). Students with consent will be given a questionnaire to complete in school time within the next month.

Please note that you can withdraw at any time and any information will be held in strict confidence and will only be accessed by the researcher.

Thank you,

Kimberley Sharman

APPENDIX D – INFORMATION STATEMENT TO PARENTS

INFORMATION STATEMENT TO PARENTS

RESEARCH TITLE:
Pedagogical uses of interactive whiteboards in two Australian Primary schools: Their impact on teacher and student attitudes.

RESEARCHERS' NAMES:
Chief Investigator: Kimberley Sharman
Supervisors: Dr Peter Beamish
Dr Maria Northcote

Your child is invited to participate in a research project that examines the use of interactive whiteboards in the classroom and their effects on student learning. To help us improve our understanding of the uses of interactive whiteboards and their effects on learning, a sample of students and staff from years five and six from Valentine Public School will be asked to answer a simple questionnaire. This project is being conducted by researchers from Avondale College.

PURPOSE OF THE PROJECT
The purpose of this study is to research the ways in which interactive whiteboards are used in the classroom and to gauge how they impact student learning over a variety of subjects.

PARTICIPATION CRITERIA
Participants for this study will be as follows:

- Approximately 50 students from years four, five and six who are in a classroom whose teacher has regular and primary access to an interactive whiteboard (Smartboard).
- Approximately 10 staff who regularly use an interactive whiteboard in their regular classroom teaching.

WHAT PARTICIPATION INVOLVES
Students will be asked to participate in the completion of a questionnaire. At this time, students will be asked to answer questions relating to their experiences with the interactive whiteboard. Questions regarding how their learning has been effected by the interactive whiteboard and the ways in which it has been used will be explored. In order to gather the information, questionnaires will be collected and stored in a secure cupboard in the Faculty of Education, Avondale College.

POSSIBLE RISKS OR INCONVENIENCES
We are required to notify you of possible risks and inconveniences should you agree for your child to take part in the research. We perceive the only inconvenience will be the student having to complete the questionnaire during class time. Students will be advised of their right to not answer questions, or attempt the questionnaire. Students are free to leave at any time if they feel uncomfortable.

BENEFITS

Although there are only minor direct benefits to your child participating in the research, the main benefit of the research will be to improve teacher use of the interactive whiteboard to better engage and teach students. Administrators and teachers can use the information gathered to improve the use of the interactive whiteboard when teaching.

CONFIDENTIALITY AND DISCLOSURE INFORMATION

All of the data obtained from this study will be kept strictly confidential. Numerical coding of participants will ensure students cannot be identified. Only the consent form will contain your name and your child's and this will be stored separately to the data sheet. Data will be kept secure within the office of the Chief Investigator and stored for five years after completion of the study.

The data collected will be presented in a mini-thesis for the researcher's Honours program. In addition it may be used for scholarly journals and professional conferences. Confidentiality of individual participants and organisations will be assured. In any publication, information will be provided in such a way that your child cannot be identified. The school will be sent a summary of the final results.

FREEDOM OF CONSENT

Your child's participation in this study is voluntary and there is no payment to subjects for their participation. Please note that the students are free to choose not to take part in this research and you may withdraw your child at any time without providing a reason. Withdrawing will not disadvantage your child.

This research project has been approved by the Avondale College Human Research Ethics Committee (HREC). Avondale College requires that all participants are informed that if they have any complaint concerning the manner in which a research project is conducted it may be given to the researcher or if any independent person is preferred, to the College's HREC Secretary, Avondale college P.P. Box 19, Cooranbong NSW 2265 or phone (02) 49 80221 or fax (02) 49 802117.

APPENDIX E – PARENT/GUARDIAN CONSENT FORM

Parent/Guardian Consent Form

RESEARCH TITLE: Pedagogical uses of interactive whiteboards in two Australian Primary schools: Their impact on teacher and student attitudes.

RESEARCHER'S NAME: Kimberley Sharman

SUPERVISORS' NAMES: Dr Maria Northcote and Dr Peter Beamish

I agree for my child _____to participate in the above research project and give my consent freely.

I have read and understood the information provided in the Information Statement.

I understand that the project will be conducted as described in the Information Statement, a copy of which I have been given to keep.

I understand I can withdraw my child from the project at any time and do not have to give any reason for withdrawing.

The procedures required for the project and the time involved have been explained to me. I have had the opportunity to ask questions and have had them answered to my satisfaction.

I consent for my child to participate in the completion of a questionnaire.

I understand that my child's personal information will remain confidential to the researcher/s.

Print Name: _____

Signature: _____ Date: _____

APPENDIX F – STUDENT CONSENT FORM

Student Consent Form

RESEARCH TITLE: Different uses of interactive whiteboards in an Australian school: Potential impacts upon student learning.

RESEARCHER'S NAME: Kimberley Sharman

SUPERVISORS' NAMES: Dr Maria Northcote and Dr Peter Beamish

I, _____ agree to participate in the above research project and give my consent freely.

I have read and understood the information provided in the Information Statement.

I understand that the project will be conducted as described in the Information Statement, a copy of which I have been given to keep.

I understand I can withdraw from the project at any time and do not have to give any reason for withdrawing.

The procedures required for the project and the time involved have been explained to me. I have had the opportunity to ask questions and have had them answered to my satisfaction.

I consent to participate in the completion of a questionnaire.

I understand that my personal information will remain confidential to the researcher/s.

Print Name: _____

Signature: _____ Date: _____

APPENDIX G – STUDENT QUESTIONNAIRE

INTERACTIVE WHITEBOARD STUDENT QUESTIONNAIRE

This questionnaire is part of a study of interactive whiteboards. Your answers will help us decide how they can best be used for teaching and learning. The questionnaire will only take about 20 minutes to complete. Your answers will be kept completely confidential.

You do not need to write your name on this questionnaire as it is anonymous.

1. Gender. *Please tick appropriate box*

Male **[ ]** Female **[ ]**

2. Age: _____

3. Class: _____

4. Do you like using computers? Yes **[ ]** No **[ ]**

Why? _____

_____

5. Where do you use computers and for how long? (tick more than one if needed)

	0 Hours per day	0 – 2 Hours per day	2 – 3 Hours per day	3 + Hours per day
Home	**[ ]**	**[ ]**	**[ ]**	**[ ]**
School	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Friends House	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Public Library	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Other (please list)	**[ ]**	**[ ]**	**[ ]**	**[ ]**

_____

6. What do you use computers for and for how long? (tick more than one if needed)

	0 Hours per day	0 – 2 Hours per day	2 – 3 Hours per day	3 + Hours per day
Email	**[ ]**	**[ ]**	**[ ]**	**[ ]**
School work (research)	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Social Networking (e.g.: Facebook or MySpace)	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Downloading songs	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Other (please list)	**[ ]**	**[ ]**	**[ ]**	**[ ]**

_____

7. During an average week in your classroom, how often are interactive whiteboards (IWBs) used by the teacher? Please tick appropriate box.

Every lesson	Most lessons	Some lessons	Hardly ever	Never
[ ]	**[ ]**	**[ ]**	**[ ]**	**[ ]**

8. How often does the teacher let **you** or **any other student** use the interactive whiteboard (IWB) during a lesson? Please tick appropriate box.

Every lesson	Most lessons	Some lessons	Hardly ever	Never
[ ]	**[ ]**	**[ ]**	**[ ]**	**[ ]**

9. When you use the interactive whiteboard (IWB), what did you use it for? What kinds of activities do you get to do? (writing; drag and drop; etc)

_____

_____

10. What does the teacher do while you are using the IWB? (E.g. Discuss what you are doing, Tell you specifically what to do, etc)

_____

_____

11. Has your class ever been specifically taught how to use the interactive whiteboard (IWB)? Please tick appropriate box.

Yes **[ ]** No **[ ]**

If so, then by who? _____

Please tick the box ✓ that you think applies to the statement about interactive whiteboards (IWB).

	Strongly Agree	*Agree*	*Disagree*	*Strongly Disagree*
12. I learn more when my teacher uses an IWB.				
13. I dislike going out to the front to use the whiteboard				
14. It is easier to understand the work when my teacher uses an IWB				
15. When I use the IWB, it makes learning more interesting and exciting				
16. I think teachers go too fast when they use the IWB				
17. I think students behave better in lessons with IWBs				
18. I am confident when using the IWB				
19. Teachers teach just the same with or without an IWB				
20. I prefer lessons which are taught with an IWB				
21. IWBs makes it easy for the teacher to repeat, re-explain, and summarise				
22. I would work harder if my teacher used the IWB more often				
23. I would work harder if I used the IWB more often				
24. I think teachers' lessons are more prepared and organised when they use an IWB				
25. We get to join in on lessons more when my teacher uses an IWB				
26. I concentrate better in class when the teacher is using the IWB				
27. I concentrate better in class when other students are using the IWB				

APPENDIX H – TEACHER QUESTIONNAIRE

INTERACTIVE WHITEBOARD TEACHER QUESTIONNAIRE

This questionnaire has been developed to identify the different uses of interactive whiteboards. Your answers will help us determine how they can be used best for teaching and learning. The questionnaire will only take approximately 15 minutes to complete. All answers will be kept confidential and will be read only be the researcher and their supervisor.

You do not need to write your name on this questionnaire as it is anonymous.

1. Gender. *Please tick appropriate box*

Male **[ ]** Female **[ ]**

2. Generation:
Baby Boomer (1946 – 1964) **[ ]**
Generation X (1965 – 1975) **[ ]**
Generation Y (1981 – 1995) **[ ]**

3. Class: _____

4. What do you like most about teaching with an interactive whiteboard?

- ☐ Access to a wide variety of ICT and internet resources for whole class use
- ☐ Being able to save lessons/resources and use again
- ☐ Drag and drop, writing, text conversion
- ☐ Provides greater interactivity in whole-class teaching
- ☐ Enables the integration of ICT into classroom practice
- ☐ Increases enjoyment and motivation
- ☐ Facilitates student participation

Other (please specify):_____

5. What do you like least about teaching with an interactive whiteboard? What issues, if any, do you feel need to be resolved for the interactive whiteboard to be a more effective tool in the classroom?

- ☐ More preparation time
- ☐ Connectivity
- ☐ IWB is fixed too high not allowing students to use
- ☐ IWB is fixed too low making it difficult for the teacher to use

Other (please specify):_____

6. During an average week in your classroom, how often are interactive whiteboards (IWBs) used in these subjects. Please tick one box in each row.

	Every lesson	Most lessons	Some lessons	Hardly ever	Never
Maths	**[ ]**	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Science	**[ ]**	**[ ]**	**[ ]**	**[ ]**	**[ ]**
English	**[ ]**	**[ ]**	**[ ]**	**[ ]**	**[ ]**

7. When you use the interactive whiteboard (IWB) during lessons, do you allow students to use it?

	Every lesson	Most lessons	Some lessons	Hardly ever	Never
Maths	**[ ]**	**[ ]**	**[ ]**	**[ ]**	**[ ]**
Science	**[ ]**	**[ ]**	**[ ]**	**[ ]**	**[ ]**
English	**[ ]**	**[ ]**	**[ ]**	**[ ]**	**[ ]**

If yes, how do you let them us it? What kinds of activities can they do?

[ ] Writing

[ ] Picture manipulation (sizing, colour etc)

[ ] Drag and drop

Other (please specify):_____

_____

8. Do you believe using the interactive whiteboard affects the extent to which students are engaged in the learning process in your classroom?

Yes	No
[ ]	**[ ]**

Comments: _____

9. Do you believe the use of an interactive whiteboard in the classroom contributes to learning?

Yes	No
[ ]	**[ ]**

Comments: _____

10. In what ways, if any, does an interactive whiteboard address the three modalities of learning: visual, auditory, and tactile?

Visual: _____

_____

Auditory: _____

_____

Tactile: _____

_____

APPENDIX I – OBSERVATION SHEET

Observation Sheet

Date: _____ *KLA*: _____ *Class*: _____

Topic: _____ *Observation type:* Scheduled / Semi-Scheduled

Effectiveness

Minutes	0	2	4	6	8	10	12	14	16	18	20					
Teacher- centred												1	2	3	4	5
Teacher/student-centred												1	2	3	4	5
Student- centred												1	2	3	4	5
Level of Engagement																

Level of Engagement
- 1/4 = Not =engaged at all
- 2/4 = Most not engaged
- 3/4 = Most engaged
- 4/4 = Very engaged

Comments:

_____

_____

_____

_____

_____

_____

_____

_____