Exploring pedagogy with interactive whiteboards in Australian schools

ABSTRACT

This research project investigated the use of interactive whiteboards (IWBs) in K-12 education. Exploration of the use of IWBs in six different school settings provided insights into the activities, approaches, roles and beliefs of students and teachers in a range of primary and secondary class contexts and discipline areas. The study was informed by socio-cultural theory and a major focus was on the interactions between the new technology, pedagogy and the social conditions of the classroom. The findings presented in this paper focus on the pedagogical aspects of using IWBs that emerged from the study.

Matthew Kearney

Sandy Schuck

Centre for Research in
Learning and Change
University of Technology
Sydney

Matthew.Kearney@uts.edu.au

INTRODUCTION

Interactive whiteboards (IWBs) are a relatively new phenomenon in Australian schools. For example, in their recent 2007/8 state budget, the NSW Government announced as part of their *Connecting our Classrooms* technology initiative (NSW Government, 2007), that every NSW public school will have an IWB and videoconferencing facilities, amongst other new technologies. Australian school sectors follow British systems in this regard—the UK government has already invested heavily (approximately 50 million pounds) in the installation of IWBs in schools with a view to impacting on teaching and learning (Clarke 2004). Consequently, the literature on IWBs comes predominantly from research in the UK. This paper reports on selected findings from a recent Australian study investigating the use of Interactive Whiteboards in K-12 Education. Participating teachers saw the major use of IWBs as a presentation technology that improved whole-class teaching procedures, especially whole class discussions, exercises and explicit instructions. The authentic nature of students' learning tasks was mostly realised through links to current, 'real-world' websites and resources.

Background literature

In a meta-analysis of research on IWBs, Kennewell (2006) notes that unlike adoption of other educational technologies, IWBs have met with widespread interest and high rates of adoption in UK schools. A number of studies report significant teacher satisfaction with this technology, many suggesting that this is because the IWBs are well-suited to supporting whole class teaching. Other benefits of IWB usage have been reported, including flexibility, efficiency, motivation, support of preparation and ease of use (Miller, Averis, Door & Glover, 2005; Smith et al., 2005). Teachers and students both suggest that there is an improvement in lessons in which IWBs are used (Higgins et al., 2005) and a large UK study suggests that IWBs can have positive effects on teaching and learning (BECTA, 2003). However, Hall and Higgins (2005) suggest that IWBs are mainly being used to reinforce traditional teaching approaches. Indeed, Kennewell (2006) notes that the use of the IWB does not require any great changes from the mainstream teacher-directed approaches endorsed by the Department for Education and Skills (DfES, formerly the DfEE) in the UK, which encouraged teachers to use "direct teaching and questioning" of the whole class (DfEE, 1999). This finding is supported in another Australian case study, which suggests that the overall nature of classroom organisation is unchanged (Lee & Boyle, 2003). A recent case study in a Kindergarten classroom, by Vincent (2007), reported the positive impact of IWBs on classroom pedagogy, especially when teaching styles match the technology's affordances.

The study – methodology and methods

A qualitative research paradigm was used in this interpretive study (Erickson, 1986; Lincoln & Guba, 1985) to investigate practices in six case schools. An important feature of the study's methodology is its underpinning by socio-cultural theory, which emphasizes the importance of the context, the nature of human interactions and the reciprocal relationships formed between tools and their users (Salomon & Perkins, 1998). Data on teachers' and students' practices were collected and analysed from this socio-cultural perspective. Our methodology is supported by Ayersman (1996), who noted in a review of research on teaching with multimedia that research that is "authentic classroom-based research" is of most value to practitioners.

This study investigated pedagogy, attitudes, and school contexts in six NSW schools in which IWBs were being used: four primary schools and two high schools. Three schools were in the metropolitan Sydney region, one was in an urban area out of Sydney and two were in a rural area. The six schools were chosen as they were considered to be institutions where there was extensive interest in the use of IWBs as well as a number of teachers actively using them in their classes. Across these schools, a range of classes were investigated, in a variety of discipline areas (see Table 1). All school and teacher names in this paper are pseudonyms to ensure confidentiality of participants.

School	Classes (and their teachers if mentioned in this paper)
1. Ridges Primary School	Yr K, Yr 4 (Evie) and Yr 5.
2. Darcy Primary School	Yr 2 (Quentin), Yr 4 & two Yr 5 classes (Pam & Rosemary)
3. Sheridan Primary School	Yr 6 (Natalie) and IO (moderate intellectual classification) class
4. Kirkland Primary School	One multistage primary class (Leah)
5. Hidcote Girls High School	Yr 7 Personal Development, Health and Physical Education (PDHPE), Yr 9 Health, Yr 10 Business, Yr 11 Geography
6. Bayview Senior Secondary College	Yr 11 Business Studies (Will), Yr 12 Information Processes and Technology (IPT) (Val)

Table 1: Participating schools and classes observed

The researchers visited each site for a period of time ranging from one day to four days. A range of data were collected by means of classroom observations, school policy documents, interviews with executive staff, teachers who were using IWBs in their classrooms and other key staff including librarians, ICT and Learning and Teaching co-ordinators. Focus groups also were conducted with students. The researchers analysed the data and developed themes from this analysis. Three major categories of findings emerged through independent researcher analysis and subsequent intra-researcher checking of categories. These themes considered the role of the school in promoting use of this technology; teacher and student beliefs about the value of IWBs and their relationship to learning and teaching; and pedagogical approaches used with this technology in classrooms. The last theme is discussed in this paper, addressing the following research question: *What pedagogical approaches can be observed in classrooms using Interactive Whiteboards?* Details on other themes are discussed in Schuck and Kearney (2007a).

The study contributes to the literature in a number of ways. Firstly, although contemporary research contains many claims about the value of educational technology, little of this research critically analyses the ways in which such technologies interact with the complex social environment of the classroom as done in this study. Secondly, although studies have been conducted on the use of IWBs in the UK, the use of this technology is just beginning in Australia and this is one of the first studies in NSW that goes beyond practice in just one school. Finally, this study considers the use of IWBs from a variety of perspectives. It focuses on the value of using IWBs as seen by different stakeholders, the pedagogical approaches used (the focus of this paper) and the learning outcomes and school contexts for the use. Most other studies have concerned only one aspect of usage rather than looking at K-12 classrooms in all their complexity.

FINDINGS

Introduction

The study identified over 40 different uses of IWBs in lessons (see Schuck & Kearney, 2007a). Observed pedagogy focused on the teacher's ability to present relevant and current issues to students through carefully prepared lessons which took advantage of the IWBs, typically in whole class settings, to offer a large variety of resources, attractively presented and dynamically arranged. Teachers tended to use the IWB predominantly for explicit instruction and presentation, although they did give students the opportunity to participate in whole-class activities by interacting with the board, writing on it, or responding to discussions. The majority of the observed interactions were dominated by the teacher but other instances approached 'dialogic' exchanges, taking into account students' understanding, exploring their ideas and generating new meanings (Mortimer & Scott, 2003). Teachers viewed the IWB as a portal to bring in rich 'out-of-classroom' contexts into their lessons and noted its significance as an organisational tool. The major sources of data informing findings presented below were lesson observations, interviews with teachers and students' views as ascertained from focus group interviews.

Explicit Instruction

Teachers often used the IWB for explicit instruction and this was in keeping with the whole class nature of the pedagogy associated with this technology. The size and visual capacity of the boards encouraged clear teacher explications of subject matter and the ability to link to material supported this. Teachers mentioned their use of IWBs as being an improved version of pedagogy compared to the way they used a chalkboard or overhead projector. For example, IWBs had become an integral part of Pam's lessons: "What we would do on a chalkboard, we are now able to do a thousand times better!" (Pam, Darcy). However, as noted in the next section, they also gave students the opportunity to interact with the board, by writing on it, or responding to discussion centred on the material shown on the board.

In most of our observations, the teacher directed the IWB-mediated sessions. For example, Quentin (Darcy) mainly used the IWB as a demonstration tool. He would scan pages out of textbooks to use in class discussions and exposition work. He said his Year 2 students liked this modelling on the IWB as they could work together on textbook questions displayed on the IWB while he worked through solutions with them on the non-interactive board. Similarly, Natalie at Sheridan noted the value of modelling learning for her Year 6 students using the IWB.

I model learning I want them to understand. For example, note-taking exercises have been very successful – the students then come up to the board and write. They know it's okay to make mistakes and I have seen previously reluctant students take more risks with their learning, especially in social studies subjects.

Lessons would typically follow a schedule of explicit instruction, followed by teacher questioning and then sometimes go into group work to consolidate concepts being taught. An example was Rosemary's Year 5 English lesson at Darcy, focusing on comprehension. She firstly mind-mapped on the traditional whiteboard with each skill being explained and examples found from the narrative being used (titled the Potato Famine). After students silently read the text from the IWB for a few minutes, the teacher led a whole class discussion, focusing on the main ideas of the passage. During this discussion, Rosemary frequently asked focus questions to stimulate ideas. Students came out and highlighted aspects of the text (relevant to their answers) using the IWB functions. Rosemary then used the Internet to find additional information on aspects of Ireland's potato famine, comparing information found in the passage and the Internet site. The teacher toggled between the text and Internet sites she had previously bookmarked. Students were then given the option of working independently on separate tasks. The teacher used the IWB to model comprehension skills, in preparation for the students' own work.

Whole class interactions

The main way that lessons using the IWB were conducted in the cases was through whole-class interactions. This mode of teaching is unsurprising given the nature of this 'whole-class' technology: one board in the front of the classroom and an accompanying stylus was considered by the teachers as best used as a resource for whole class teaching. Teachers in this study saw the major use of IWBs as providing a form of interaction for whole class discussions, exercises and exposition work.

We saw very little didactic lecturing as teachers attempted to use the IWB to establish purposeful discourse between themselves and their students (Alexander, 2006). However, these whole class interactions were very much controlled by the teacher, often in a traditional authoritative interaction (Kershner & Warwick, 2006). The teacher would lead students through a series of questions and answers with a particular outcome in mind. A traditional Initiate – Respond – Evaluate (IRE) interaction (Mehan, 1979) was often evident. Teachers would initiate a query or activity, the students would respond and the teacher would then evaluate the response.

We saw some examples approaching a 'dialogic' process where teachers took more account of learners' understanding, focusing on probing students' views, inviting feedback and elaborations, and providing support for learners' 'meaning making' processes

(Mortimer & Scott, 2003). One example of such responsive teaching was observed in a Year 11 Geography lesson on ecosystems and environmental management. Outcomes were to develop a deep understanding of ecosystem management and look at how such management is applied. The lesson started with students seated in a 'U' shape with the teacher (Geraldine) at the front near the IWB. She discussed the philosophies of ecosystem management and revealed text descriptions of the different management philosophies on the IWB before students had to match the particular philosophy description with the definition. Students came up to the IWB to link (by moving the text around) the description and the definition and to discuss the answers. There were 15 students in the class, so they worked as one group. Geraldine then printed off the descriptions and definitions from the IWB and handed them to all students so that they each had a copy. Four PowerPoint slides were then shown, each with a photographic image of a particular ecosystem. Students had to decide which management philosophy was likely to have underpinned each image. They had to discuss the characteristics of each philosophy to decide which image they best fitted. Students were able to write on the IWB during this process. Geraldine then revealed the correct answers (already on the board) and a deeper conceptual level of discussion took place, both between teacher and students and also amongst students themselves. She used further questioning to elicit higher-order thinking and made suggestions to assist with these discussions. She gave more status to students' views, focusing on feedback, elaboration and support.

Promoting authenticity and connectedness

As noted in a previous paper by the authors (Kearney & Schuck, 2006) the term authentic learning has a variety of meanings. There is general agreement that authentic tasks provide real world relevance and personal meaning to learners, although issues of what constitutes authenticity and how to design authentic learning tasks are still emerging (Radinsky, Bouillion, Lento & Gomez, 2001). The authentic nature of many tasks in the study was mostly realised through links to current, 'worldly' websites and illustrations of topics, as shown in the examples that follow. However, communicative, connected and multimodal features of the IWB were not fully exploited to enhance authentic learning.

Task authenticity was enhanced through teachers' links to 'real-life' illustrative online contexts and media. A teacher at Darcy mentioned how she can easily bring rich contexts into her lesson using the IWB: "They allow you to do things that you've never been able to do before." For example, she did a lesson on negative numbers and the students asked her, "How is this relevant?" She responded, "I was able to pull up a weather program … the whole class could see it. It was large, it was interactive, they were able to see the negative numbers …" (Pam, Darcy).

Two other teachers chose to comment on rich contexts in their survey responses. One teacher commented on how easy it was to bring current topics into the classroom: "I can easily bring in up to date information into the classroom especially via the Internet. The recent earthquake near

Katoomba was an example in Year 9 Science". Another teacher wrote: "Hyperlinking to web sites really helps students connect with the concepts I teach. Google Earth on the board is brilliant and students are interested in geography again." Teachers were also conscious of the opportunity to use diverse media (video clips, photos, sounds etc.) to bring real, rich contexts into their classroom-based tasks. However, the visual and especially the auditory affordances of the IWB were generally not fully exploited for this purpose, perhaps due to the time-consuming nature of finding and sourcing such media or due to the relative recency of the technology in Australian schools and teachers' lack of familiarity with the potential of the technology.

> *"Hyperlinking to web sites really helps students connect with the concepts I teach. Google Earth on the board is brilliant and students are interested in geography again."*

Despite teachers suggesting that they used the IWB to enhance communication with people 'outside' the classroom, we only came across a few examples of classrooms taking full advantage of the 'connectedness' of the IWB to embed 'real-world' processes into their tasks. Evie (Ridges) described a Social Studies /Maths lesson she had conducted as part of a unit on shopping with her Year 4 class. The specific topic was *Who will buy?* She set the context of buying flowers for a wedding and used the Internet to go to the Sydney flower market web site and to online shopping sites. She also purchased an item on eBay and commented that this was a highlight for the students and following this, students suggested designing their own online shopping centre and this idea formed the basis of a future IWB-mediated activity. Similarly, Pam (Darcy) described a Social Studies lesson with her Year 5 students. They organised a 'virtual holiday' overseas, choosing specific stopovers on the way to their destination. They accessed the Qantas website for information on destinations, time taken, and other websites for currency conversion. Her students later recalled this activity with fondness during their focus group interviews. At Bayview, Val noted how she liked the way the IWB "allows you to connect to the world and be creative: You can actually take whole countries and move them! … The limits are your imagination". She reported on a video-conference using the IWB, using the IWB to communicate with another class in Canada using Skype and Google Chat. She claimed the IWB provided a unique opportunity for her classes or small groups to communicate in this way (e.g. via chat, video-conference) with outside experts, relatives, peers and others from around the world. However, the researchers noted that use of communication facilities to connect to people outside the classroom was rare.

Organisational tool

Another observed benefit of the IWBs was the ability to prepare, organise and store lessons, which led to highly structured, well sequenced lessons with access to useful resources. Teachers commented on how easy it was to collect a variety of resources, plan a whole lesson and cater for unexpected questions by having additional resources stored but hidden from view until required. Teachers noted the IWB's strength in this regard and said they consequently did more careful lesson preparation and also became more aware of relevant websites and resources that could be used in their lessons.

Evie, a teacher from Ridges PS, said she could bring things into the classroom easily: "…before, you'd be chasing large colour pictures from libraries, download at home and print out—cumbersome! Now it's there easily on the big screen." The Assistant Principal at Ridges also noted this feature of organisational ease: "I can keep everything there as a record of the day's work. … In preparing lessons I can email files from home to work, no board work. Hence, there is less interruption in transition from lesson to lesson. It's a really good organisational tool (AP, Ridges)

Indeed, the value of being able to keep a record of lessons was noted by many teachers. Leah (Kirkland) said she "like[d] being able to print and store what I have done with the children. I can store their work too, the visual memory that this tool enables is impressive – I can back it up and burn to a disc." Will (Bayview) mentioned that although it was time consuming to prepare the lesson, the fact that they could be saved was important. He could "pass on the memory stick to others. They can take what they want, modify it or not. You can't do that with a chalkboard". Will had a number of lessons and images and was building a library of material that could be used with the IWB and be accessible to other colleagues on the school hard drive. Indeed, at schools where the IWB had been established for some time, we noted a culture of sharing of IWB resources, lesson plans and general teaching ideas amongst staff, usually via the school network.

Discussion and Conclusion

Observed lessons tended to be in a whole class format and teachers saw the major use of IWBs as providing an environment for whole class discussions, exercises and explicit instructions. Many teachers also gave students the opportunity to participate in presentations and interact with the IWB, by writing on it, or responding to discussions. The project confirmed the findings of other projects on IWBs (BECTA, 2003; Smith, et al. 2005) that indicate its major strength as an organisational tool.

The authentic nature of students' learning tasks was mostly realised through links to current, 'real-world' websites and illustrations of topics. Process levels of authenticity (ways in which learner practices are similar to those practices implemented outside of school,

Exploring pedagogy with interactive whiteboards

Exploring pedagogy with interactive whiteboards

as discussed in CTGV, 1990), were not apparent in tasks we observed. In general, open-ended, complex tasks requiring problem-solving and the construction of valuable products using real-world skills (Reeves, Herrington & Oliver, 2002) were not common in case classrooms. Many tasks were highly structured, involved explicit instruction from the teacher and eventually led to fairly inert individual tasks spanning a relatively short time frame. Perhaps this was one reason contributing to the relatively few instances of small-group use of the IWB. Also, although we did report on increased levels of student ownership (of lesson procedures), we saw little evidence of students 'owning' content on the IWB, for example, students presenting 'self-made' products to their peers. We believe that as teachers become more accustomed to IWB use, such uses will become more common. The IWB has obvious potential for the promotion of authentic learning in classrooms, although ultimately authenticity "lies in the learner-perceived relations between the practices they are carrying out and the use value of these practices" (Barab, Squire & Dueber, 2000, p. 38).

Staff and student attitudes towards use of IWBs were very positive and despite the greater expense of the IWB technology compared to many other educational technologies, it was apparent that usage would be widespread. We speculate on whether this enthusiasm is because initial use of IWBs can replicate traditional teaching methods, enabling traditional teacher-centric pedagogies. Indeed, Kennewell, (2006) makes the point that despite the huge uptake of IWBs, "To date, the top-down policy driven approach to pedagogical change, represented by the National Strategies in England, seems to have stalled at the stage of surface interactivity which is reflected in replicatory use of IWBs" (p. 7). He concludes by suggesting that there is a potential for IWBs to be more than a tool to support outmoded pedagogies. We further explore these issues in Schuck and Kearney (2007b) where we consider the potential for IWBs to disrupt traditional pedagogies.

Findings from this study suggest other aspects of research on IWB use would be worthwhile. These include the following areas.

a) How can changes in pedagogies using the IWB be supported so that pedagogies interweave traditional didactic ones with disruptive, emancipative approaches? Pedagogies surrounding students' use of IWBs seem to reflect traditional didactic pedagogies at present. Investigation of how use of IWBs can contribute to the formation of new pedagogies is vital if we are to use them to their fullest potential.

b) How can the IWB be used to create a more 'dialogic classroom' (Kershner & Warwick, 2006)? There is potential for student-directed discussions and interactions using the IWB as a tool to present, exchange and develop ideas with peers, teachers and other 'experts' both within and outside the class and school community. What types of software, what specific tasks and what teaching roles facilitate this potential to give learners more status in class discussions and make students' ideas and artefacts a central focus of class discussions?

c) What is the role of the IWB in computer-supported collaborative learning? Most research has focused on whole class settings for IWB use. It is important to investigate how this technology can be used to encourage different types of peer learning within and outside of the classroom.

In summary, this paper provides indications of the dominant pedagogies used with IWBs. The technology was highly valued by case teachers as a presentation technology that improved whole-class teaching procedures and in this sense, the IWB was seen as an improved 'teaching technology', albeit underpinned by traditional pedagogies. Depending on how it is used and the nature of the learning task, IWBs can become a gateway for learners to 're-claim the classroom'; a 'window to the world' (Val, Bayview) that learners can control through the inviting interface of a tactile, visually appealing surface or the mobile, accessible stylus. They have the potential to enhance authentic learning in K-12 classrooms, and encourage a 'disruptive pedagogy' (Hedberg, 2006), giving students autonomy over the direction of lessons and giving them a voice in whole-class interactions.

BIOGRAPHY

MATTHEW KEARNEY *is a senior lecturer in the Faculty of Education at UTS. He coordinates the e-learning related subjects in the BEd (Prim) and BTeach (Sec) programs and is interested in innovative technology-based learning in K-12 and teacher education contexts.*

SANDY SCHUCK *is an associate professor in the Faculty of Education, UTS. Her research interests include teacher and student learning with the use of ICT, as well as mentoring and teacher induction and teacher professional learning. She teaches in the primary education course and is the faculty director of higher degrees.*

REFERENCES

Alexander, R. (2006). *Towards dialogic teaching: Rethinking classroom talk*. Thirsk: Dialogos.

Ayersman, D. (1996). Reviewing the research on hypermedia-based learning. *Journal of Research on Computing in Education,* 28(4), 500-525.

Barab, S.A., Squire, K.D. & Dueber, W. (2000). A co-evolutionary model for supporting the emergence of authenticity. *Educational Technology Research and Development, 48*(2), 37-62.

BECTA (2003). *What the research says about interactive whiteboards.* British Educational Communications and Technology Agency.

Clarke, C. (2004) *Secretary of State for Education and Skills Opening Address, BETT Conference,* Olympia, 7 January 2004. Accessed 11 December 2006 from http://www.teachernet.gov.uk/community/webcasts/bett2004/transcripts/clarke7jan04/.

CTGV (Cognition and Technology Group at Vanderbilt). (1990). Technology and the design of generative learning environments. *Educational Technology,* 31(5), 34-40.

DfEE (1999). The national numeracy strategy: Framework for teaching mathematics. Cambridge: CUP.

Erickson, F. (1986). Qualitative methods in research on teaching. In M. Wittrock (Ed.), *Handbook of research on teaching,* (3rd ed. pp. 119-161). New York: Macmillan.

Glover, D., Miller, D., Averis, D. & Door, V. (2005). The interactive whiteboard: A literature survey. *Technology, Pedagogy and Education,* 14(2)

Hall, I. & Higgins, S. (2005). Primary school students' perceptions of interactive whiteboards. *Journal of Computer Assisted learning, 21,* 102-117.

Hedberg, J. (2006). E-learning futures? Speculations for a time yet to come. *Studies in Continuing Education, 28*(2), 171-183.

Higgins, S., Clark, J., Falzon, C., Hall, I., Moseley, D., Smith, F., Smith, H. & Wall, K. (2005). *Embedding ICT in the national literacy and numeracy strategies.* Newcastle: University of Newcastle.

Kearney, M. & Schuck, S. (2006). Spotlight on authentic learning: Student developed digital video projects. *Australasian Journal of Educational Technology, 22*(2), 189-208.

Kennewell, S. (2006). *Reflections on the interactive whiteboard phenomenon: a synthesis of research from the UK.* Paper presented at the AARE conference, Adelaide, Australia, 26-30, November 2006.

Kershner, R. & Warwick, P. (2006). *Replacement or transformation? Teacher research into learning processes associated with interactive whiteboard use in primary classrooms.* Paper presented at BERA 2006 Annual Conference, Warwick University, September 2006.

Lee, M. & Boyle , M. (2003). *The educational effects and implications of the interactive whiteboard strategy of Richardson primary school.* Richardson Primary School: ACT Australia.

Lincoln, Y. & Guba, E. (1985). *Naturalistic inquiry.* Newbury Park: Sage Publications.

Mehan, H. (1979). *Learning lessons: Social organization for the classroom.* Cambridge, MA: Harvard University Press.

Miller, D.J., Averis, D., Door, V. & Glover, D. (2005). *How can the use of an interactive whiteboard enhance the nature of teaching and learning in secondary mathematics and modern foreign languages?* Report made to BECTA. Accessed 19 January 2007 from http://www.becta.org.uk/page_documents/research/bursaries05/interactive_whiteboard.pdf

Mortimer, E.F. & Scott, P.H. (2003). *Meaning making in secondary science classrooms.* Buckingham, UK: Open University Press.

NSW Government, (19 June 2007). Budget 2007-8 Meeting our commitments. Dept. of Education and Training.

Radinsky, J., Bouillion, L., Lento, E. & Gomez, L. (2001). Mutual benefit partnership: A curricular design for authenticity. *Journal of Curriculum Studies, 33*(4), 405-430.

Reeves, T., Herrington, J. & Oliver, R. (2002). Authentic activities and online learning. In A. Goody, J. Herrington & M. Northcote (Eds.), *Quality Conversations: Research and Development in Higher Education,* 25, 562-567. Jamison, ACT: HERDSA.

Salomon, G. & Perkins, D. (1998). Individual and social aspects of learning. Review of Research in Education, 23, 1-24.

Schuck, S. & Kearney, M. (2007a). *Exploring pedagogy with interactive whiteboards: A research report.* Sydney: UTS. Accessed 10 October 2007 from http://www.ed-dev.uts.edu.au/teachered/research/iwbproject/home.html

Schuck, S. & Kearney, M. (2007b, June). Disruptive or compliant? The impact of two educational technologies on pedagogy. In C. Montgomerie & J. Seale (Eds.) Proceedings of Ed-Media 2007 World Conference on Educational Multimedia, Hypermedia and Telecommunications pp.2619-2626. Chesapeake, VA, USA: Association for the Advancement of Computing in Education.

Smith, H.J., Higgins, S., Wall, K. & Miller, J. (2005). Interactive whiteboards: boon or bandwagon? A critical review of the literature. *Journal of Computer Assisted Learning, 21*, 91-101.

Vincent, J. (2007). The interactive whiteboard in an early years classroom: A case study in the impact of a new technology on pedagogy. *Australian Educational Computing,* 22(1), 20-25.

Exploring pedagogy with interactive whiteboards