Using interactive whiteboards in pre-service teacher education: Examples from two Australian universities

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Research indicates that when interactive whiteboards are used well they can increase student engagement and learning (Glover, Miller, Averis & Door, 2007; Schuck & Kearney, 2007, 2008). This means it is important to educate future teachers in how to use interactive whiteboards and how to incorporate them successfully into their teaching. Current research indicates that a teacher's pedagogy or 'how they teach' has a major influence on the quality of student learning outcomes. Thus 'how teachers use ICT' has a great effect on student outcomes. A range of pedagogical models concerned with the concept of authentic pedagogies are commonly used within Australian classrooms. Training designed for pre-service teachers dealing with the pedagogical application of interactive whiteboards is designed to guide and assess the implementation according to these pre-existing and widespread pedagogical models. This paper examines examples of how IWBs can be used in teacher education as well as how to integrate their use across courses that pre-service teachers undertake.

Introduction

Many primary and secondary schools in Australia have at least one interactive whiteboard installed and most schools have implementation programs where IWBs are integrated in some way into everyday classroom teacher practice. IWBs have the ability to transform the way teachers use technology in their classrooms (BECTA, 2003; Glover & Miller, 2001; Glover, et al., 2007). They provide ways to incorporate eTeaching into lessons by allowing digital convergence in the classroom, whereby this technology is no longer an add-on feature but an integral part of classroom teaching (Kent, 2004a, 2004b). As teacher educators, it is perceived as important to introduce developing teachers to this still relatively new technology, to ensure they not only become more conversant with IWB technology but also are alert to how the IWB can influence their pedagogical practices.

In order for teachers to be competent and effective users of IWBs within their teaching and learning programs there are two basic skill sets that they require. They need to have a basic level of IWB technical skills and they need to know how to operate the technology as well as be confident in this operation. Teachers also need to have competent ICT pedagogical skills and pre-service teachers need to be taught how an IWB works, as well as understand how to pedagogically apply these technologies in such a way as to enhance student learning. It is important to avoid the situation where

pre-service teachers cannot articulate clearly the difference between good and poor teaching with an IWB, as the effect of poor quality teaching undermines student learning, and this effect is cumulative (Darling-Hammond, 2000). One of the difficulties of having such discussions amongst pre-service teachers is that there is no one 'perfect' way to teach. Often when sharing innovative lessons, pre-service teachers make no mention (or are not fully aware) of subtle changes in the way they interact with the class – changes that are crucial to the success of the lesson. This means that others may not be successful when teaching a similar lesson in the same way. This paper demonstrates how two universities are successfully teaching pre-service teachers IWB skills that will prove beneficial in their teaching practice.

This research reports on the implementation and use of interactive whiteboards with pre-service teacher education students at two Australian universities, one in the state of Victoria and the other in Canberra. The examples are quite distinct and allow the opportunity to see the various ways in which educational institutions implement a teaching tool such as the interactive whiteboard. In 2010, the Minister for Education, Julia Gillard, announced that the Federal Government had allocated forty million dollars for teachers' professional development in ICT, as part of the Australian Government's A\$2.2 billion *Digital Education Revolution* (Gillard, 2010). This will potentially have further impact on how IWBs are taught to pre-service teachers as part of this new funding. Thus, this research is timely as it may allow other universities to build on the types of IWB use already occurring.

Background

Many universities have often been slow on the uptake of technology and in some ways are grappling with the transformations required "to cope with the challenges and opportunities posed by information and communication technologies" (Breen, Lindsay, Jenkins & Smith, 2001, p. 95). This observation is also applicable to the use of IWBs (sometimes called digital whiteboards, electronic whiteboards or SMARTboards). IWBs are large, touch-sensitive boards connected to a digital projector and a computer. Software that is used in conjunction with the IWB provides a variety of functions that have been described by Kennewell (2006, p. 2) as including "drag and drop (objects on the board can be moved around); hide and reveal; highlighting; animation; indefinite storage and quick retrieval of material and immediate feedback (when a particular object is touched, a visual or aural response is generated)". IWBs "replicate the functions of older presentation technologies such as flipcharts, overhead and slide projectors and video players" (Schuck & Kearney, 2007, p. 8) and offer a more varied use of teaching materials as they allow creative and dynamic integration of web based materials, rich media, and manipulation of text and images. Information can be saved and printed directly from the board (Walker, 2002) and presenters have the opportunity to spontaneously and seamlessly access and annotate, if needed, a wide range of web based resources (Kennewell, 2001).

IWBs provide versatility of learning for all ages and across all areas of the curriculum by offering useful ways for a class as a whole to interact with new electronic content (Smith, 2000). According to research by Levy (2002), IWB use increases the enjoyment and motivation of all classroom participants. Kennewell (2001) also conducted research which showed that students enjoyed presenting and discussing their work via the IWB and that this sharing is a vital component in increasing motivation and learning gains. The British Educational Communications and Technology Agency (BECTA), found

heightened student motivation to be a key benefit of using IWBs (Schuck & Kearney, 2007). While the focus on motivational outcomes is well researched, it should be noted, however, that a recent study by Swan, Schenker and Kratcoski (2008) suggests only small achievement increases in classes where the teacher used an IWB. This is one of the few studies that clearly demonstrate improved student achievement from using IWBs in the classroom. Despite being relatively easy to use, it is also important to note that there are issues associated with teachers using IWBs, such as time to establish individual presentations and required training and support, as well as having adequate confidence in the technology.

Having an IWB in the classroom, however, does not necessarily open a lesson to higher levels of student interaction. IWBs require an investment of time, and some degree of training and independent exploration by teachers is generally necessary before IWBs are well utilised in the classroom. In addition to feeling confident in using IWBs, users need to understand the technical issues, they need to be sure there is appropriate technical support, and they need to have confidence in their network connections. As IWBs are a relatively new teaching resource, there is also a need for teachers to build up a range of multimedia teaching materials and for teachers to understand that initially this process can be quite time consuming. Teachers may also become alert to the new level of presentation expectations engendered in students and the associated outcome of having to find ways to maintain this dynamic interaction.

Methodology

This research is the result of discussions between researchers who are involved in implementing IWB programs at two universities in Australia. Data was collected concurrently from both implementation programs and was then evaluated. Within a qualitative methodology framework, a case study approach was used for this research. A case study is the detailed examination of a single individual or single discrete social unit (Ary, Jacobs & Razavieh, 1990). Yin defines a case study as an investigation of "a contemporary phenomenon within its real life context" (Yin, 2003, p. 13). Having two cases allowed for a depth of understanding, as the use of multiple cases may enable more compelling evidence to be gathered and more powerful conclusions to be generated (Yin, 2003), with single case designs possibly being vulnerable "because you will have put all your eggs in one basket" (Yin, 2003, p. 53). The data collected by way of the two cases at two different universities has the advantage of being strong in reality, which allows attention to be focused on the contextually unique features of this study (Cohen, Manion & Morrison, 2000).

Participants

Participants varied at each of the universities. At La Trobe University, Bendigo, Victoria, there were 212 first year education students who were introduced to IWBs in the first semester of a general ICT education course. The students were then asked to consolidate their skills in semester two in a mathematics education course.

In the Canberra case, there were 60 pre-service education students, participants in the final day of the Master Teacher training course. This was a voluntary day comprising a part of their pre-service teacher education training, organised through the University of Canberra's Library.

Data gathering techniques

The data collection period was in 2008 at both universities, although data was collected in different ways. In Semester One at La Trobe University data was collected through the use of a *WebCT* discussion space. This space was used for informal chats on various uses of the boards and was particularly important in assisting pre-service teachers to reflect on their teaching experiences, which in turn assisted pre-service teachers with a further assessment component that required reflective analysis on ICT in schools. They were expected to ground their reflection with reference to the text book for the unit 'Meaningful Learning with Technology' (Jonassen, Howland, Marra & Crismond, 2008) and to comment on each other's experiences. This reflection was worth six percent of the unit's total assessment.

From the 100 pre-service teachers who gave ethics approval for any first year project data to be reported, there were a total of 94 comments pertaining to IWBs with some pre-service teachers from this group making more than one comment. Using the *WebCT* discussion board, pre-service teachers added comments that described the number of boards in schools with these comments varying greatly. The discussion data was then coded and analysed for emerging themes.

Semester Two at La Trobe University provided the opportunity for very different data collection. The same first year students were studying a unit in mathematics education and they worked in groups of three to present a tutorial to their class based on a mathematical concept. Data collected during this phase of the research included student assignments and reflection on and grading of the student presentations. The lecturer from this unit then analysed this data.

The University of Canberra students were invited to participate in an evaluation of the one day course by completing a questionnaire. The questionnaire, which was administered to the students at the end of the day, asked them several types of questions. These included asking the students what they thought of the one day course with regards to learning how to use IWBs and if they would recommend the course to others. Other questions pertained to improving the one day course in the future as they revolved around any improvements the students thought could be made to it.

One of the limitations of this study was the various ways in which data were collected. This makes analysis in a consistent way across both examples limited. In the future a more systematic approach would be advisable. Another limitation is that the data were collected by different researchers, and once again this makes analysis limited due to the various data collection methods.

Data analysis techniques

The researchers recognised the importance of analysing the data in a systematic and continuous manner (Burns, 1994) across both of the university cases. The data was examined and the themes explored through the use of categories relating to the research questions. Once these categories were assigned, the analysis relied heavily on description rather than inference. Analysis of the student responses have been presented in the first case.

Case One: La Trobe University

With the increase in access to IWBs in schools comes the expectation that future teachers will be well versed in providing an efficient, seamless integration of IWB technology into lessons across the curriculum. Working with first year pre-service teachers to develop knowledge of and comfort with teaching using IWBs may be expected to assist them with this integration process, as IWBs are one important tool available for integrating ICTs in the classroom.

The Faculty of Education, La Trobe University Bendigo, purchased its first interactive whiteboard in June 2005. The staff were introduced to IWBs at this time with a seminar presented by Peter Kent. This seminar focused on the pedagogy of using an IWB in the classroom and provided practical instruction in its use. The Faculty of Education's initial IWB was placed in the Mac computer laboratory ('Maclab'). This location allowed access to the board by all first year pre-service teachers undertaking the subject 'ICT for Education' and fourth year pre-service teachers undertaking the elective subject 'Interactive Technologies'. The board was a Promethean *Activboard* with *ActivStudio* software (Promethean, n.d.), selected because the software was very similar on both the Mac and Windows platforms and because the library within the program was considered well-developed.

In 2008, the Faculty of Education introduced the "Connecting with Education: The First Year Experience" project. This project was conceptualised initially as an outcome from the Bachelor of Education review conducted during 2007. One aspect of the project was to 'Embrace online teaching and learning mechanisms as an integral part of the teaching and learning program' (Masters, 2007, p. 2). Grant funding enabled the purchase of two more IWBs. The Faculty funded another two boards, bringing the total number of boards in the Faculty to five. Three of the new boards were placed in regular teaching rooms, with the remaining board placed in the Windows lab. All boards were *Activboards*. The IWBs were strategically placed in rooms deemed to offer high usage. They were positioned at a height deemed adequate for all pre-service teachers in the room to see when it was in use yet still low enough to be useable by the presenter(s). The three IWBs placed in regular teaching classrooms had software that enabled use via either Window or Mac laptop computers and laptops were made available to pre-service teachers for class presentations.

In Semester One, all Bachelor of Education pre-service teachers complete a unit of study that focuses on ICT. This unit aims to provide pre-service teachers with up to date computing skills and teaches them how to integrate ICT in primary school classrooms. The subject ensures the pre-service teachers become familiar with various kinds of software, for example, *PowerPoint*, *Photostory* and *Inspiration*. In 2008, with the new boards placed in three classrooms and both computer labs (Mac and PC), pre-service teachers found they could use IWBs for presentations and class activities across a range of subjects. In the ICT unit the lecturer placed considerable emphasis on using and teaching with IWBs.

Within the ICT unit there were two core lectures on IWBs. The first lecture focused on the theory and pedagogy behind using IWBs in the classroom. It demonstrated using quality teaching with technology, how to enhance learning in the classroom as well as how to use the IWB when teaching with higher order thinking skills. Practical classroom examples were provided with *ActivStudio*. In lecture two, pre-service

teachers were informed of the location of the boards within the university and given instruction on how to access them, via the university owned laptops that had *ActivStudio* and *SMART Board Tools* (SMART Technologies, n.d.) software installed. Pre-service teachers were then introduced to the Promethean website and instructed in how to download existing flipcharts from the Promethean Community website. These flipcharts were further discussed by the class. In addition to the two lectures, the pre-service teachers had one practical workshop in the computer laboratory where they were introduced to *ActivStudio* and *SMART Board Tools*. During the class the pre-service teachers created two different flipcharts. One was an ordering activity and the other a sorting activity as described by Kent (2008). During this class pre-service teachers were also given the handout *Creating Simple and Effective IWB files* (Kent, 2005).

To further support the pre-service teachers, instructions on how to use the *Smart Board Tools* and *ActivStudio* were placed in both the Maclab and the Winlab. Information was placed within the University's learning management system (*WebCT 6*), and for those seeking more information, pre-service teachers were given web links to various websites. A *WebCT* discussion on interactive whiteboards was also created. In this space pre-service teachers were able to comment on how they foresaw IWBs being used in different settings. The pre-service teachers also had, as an assessment option, an opportunity to complete an assignment using the IWB software.

Outcomes and evaluation of Semester One

Although no pre-service teacher took up the IWB assignment assessment option, all pre-service teachers elected to create a *PowerPoint* for the assignment and were keen on using the *WebCT* discussion space. As described above there were 94 comments with some pre-service teachers making more than one comment.

There emerged a general picture of either a small number of IWBs being located within each school and/or indications that these boards were never or rarely used. Using the *WebCT* discussion board, pre-service teachers added comments that described the number of boards in schools with these comments varying widely, for example:

> Most classrooms had an IWB.
> There are only two IWBs in the whole school.
> To my knowledge there are no IWBs installed in classrooms.
> My school didn't have any IWBs at all.

Other comments discussed the amount of time they were used. These included:

> The students used the interactive whiteboard once while I was there.
> The teachers used them different[ly] according to different year levels.
> My teacher heavily used the Internet through her interactive whiteboard.

Discussion also centred on the placement of the boards

> The IWB that we used was in the next room so we moved into that room to complete a maths topic.
> The only IWB was … in the year 5 classroom and other classes borrow this room for specific lessons.
> There are IWBs installed in every classroom except for the grade 5/6 classrooms.

The students also discussed the curriculum areas in which IWB technology was used with one pre-service teacher stating "for Prep maths the teacher set up a 1 to 20

number line and then pulled some numbers out so the students could take in turn and go up and put the numbers back in order." Other comments included:

> They looked at fractions.
> I … saw rainforest maths used on the interactive whiteboard.
> The class I saw … did … literacy groups.
> During integrated studies the teacher used the IWB …
> The IWB was … used during a music lesson.

These comments by the pre-service teachers also show that students were observing how IWBs were used in schools:

> It amazed me to see that all students knew how to use the IWB and if the teacher was having trouble they all knew what to do most of the time.
> The teachers use the IWB to its full extent and put up all the content they want to teach to the students … The teachers would use the interactive whiteboard to take attendance. … Students … fill in the missing words and brainstorm.
> I have been rather disappointed to see … [that in] classrooms that do in fact have IWBs installed [they] … do not seem to make much use for them, except for actually writing on.

These comments display, to some degree, how strongly schools have supported the implementation of IWBs. Of course there are many factors that influence this implementation process such as funding, where the IWBs are physically located, and who in the school has access to them. Other issues relate to a consideration of pedagogical issues such as the underpinning of a teacher's beliefs, and how these beliefs impact on how a teacher values an IWB as a tool for providing enhanced learning opportunities.

Comments also included suggesting a lack of ICT being taught in some schools and either a small number of IWBs being located within each school and/or indications that these boards were never or rarely used. For example, one pre-service teacher described how:

> The students used the interactive whiteboard once while I was there. There are only 2 IWB in the whole school. The IWB that we used was in the next room so we moved into that room to complete a maths topic. They looked at fractions and each student got to go up to the IWB and choose which answer was the right one. The students really liked the IWB and when I asked them if they wanted one in their classroom they said yes.

There are many reasons for a lack of use and as this quote suggests one of these reasons was the practicalities associated with moving to the classroom next door – where the IWB was located. Pre-service teachers also made specific mention of the shortage of IWBs in the school they visited. For example:

> To my knowledge there are no interactive whiteboards installed in classrooms which is a real disappointment for a few reasons. I think the IWBs are a fantastic technology tool that all students, across Victoria especially, should have access to. I would have also liked to see the way in which teachers use IWBs. It would be great to see these boards installed in the school as soon as possible.

These discussions also displayed positive feedback between pre-service teachers through the learning management system discussions. Pre-service teachers commented on both the ways the boards were used and on associated learning activities. For example:

> It was surprising to see other comments and read how different schools are when it comes to integrating technology into lessons … most classrooms had an IWB and the teachers used them differently according to different year levels.

These comments were positive in terms of outcomes, such as "the interactive whiteboard proved to be of great success in students' learning" and also in terms of highlighting the benefits of being a reflective practitioner.

Semester Two

In order to embed IWBs into the production and presentation of the mathematics education unit 'Working Mathematically' and to promote the pre-service teachers' organisational skills, the lecturer set as part of the unit, a series of potential uses for the IWB for each of the pre-service teacher led presentations. Due to time constraints in the class there was no prior modelling of how to use the IWB in these tutorial presentations. There was, however, an account of what was expected from presenters with regard to their use of the IWBs. The students worked in groups of three to present a tutorial based on a mathematical concept area selected during week one of classes.

In holding learning to be a social activity, the lecturer subscribed to learning theories that promote the negotiated construction of knowledge where beliefs and understanding are reinforced as vital to learner engagement and knowledge construction. The lecturer often discussed with the pre-service teachers how easily class and small group discussions can be built around the activities on the IWB and directly worked to have them articulate what they considered to be the value of IWBs to their teaching style. They were asked, among other things, to use wherever possible the interactive whiteboard to display information to the class.

Pre-service teachers were asked to present information in an interesting and engaging format to the rest of the class and were alerted to the availability of IWBs and supporting software and hardware. The pre-service teachers were strongly encouraged to access these sites as needed, find relevant information and use the IWBs to display this information during their presentation. It must be noted here that the lecture theatre and one classroom out of the rooms used for tutorial presentations did not have an IWB installed but they did have rooms with computers linked to projectors. In lectures the many benefits of using IWBs were often referred to and demonstrated where possible. For example: in Lecture Three on 'Place Value' it was demonstrated how using the IWB could release a teacher from making resources such as a number expander. One 'master' copy could be created on the IWB and students could come to the front of the class and manipulate the 'master' when or as needed, noting that the master could easily be saved for future use. A key aim was to have pre-service teachers find ways to creatively capture attention and imagination by including direct links to teaching/learning opportunities via the IWB.

Outcomes of Semester Two

It was expected that by designing lessons around the IWBs the pre-service teachers would provide streamlined presentations using efficient integration of ICT. It was anticipated that presentations would begin addressing what Glover and Miller (2001) identify as the three levels of whiteboard use. These were that teachers draw upon a variety of ICT-based resources without disruption or loss of pace, the use of IWBs for extended learning, and using more engaging materials to explain concepts. The final

type of IWB use identified was the creation of new learning styles stimulated by interaction with the whiteboard.

Pedagogically speaking, the teacher believed that avenues for learning could be established that specifically addressed collaborative group work around the IWB. Pre-service teachers were alerted to the benefit of the IWB's visual presence and to the interactive opportunities it offered the class. Pre-service teachers were particularly involved in discussing how beneficial the IWBs were in constructing and deconstructing mathematical equations as well as negotiating understanding.

Throughout the second semester little to no transfer of the technological knowledge gained in the first semester's ICT course was used in the 'Working Mathematically' course. Pre-service teachers rarely used the IWBs in their presentations and when they were used the presentations were superficial and class engagement severely limited. Despite providing multiple use options and offering clear directions to use IWBs in presentations, the pre-service teachers shied away from embracing the technology.

Outcomes and evaluation from the La Trobe University example

In Semester One, students used *ActivStudio* (Promethean, n.d.), an IWB software program as part of class lessons. The students were also involved in a discussion pertaining to classroom activities that use IWBs. Students often also commented on the use of IWBs in primary classrooms as part of a discussion that revolved around their practice teaching. Although in Semester One pre-service teachers were given clear instruction in the technicalities of IWBs and an opportunity to investigate potential teacher/learner use, they were reluctant users of IWBs in the second semester. Pre-service teachers either used the IWB simply as a presentation tool, an outcome discussed in research by Armstrong, Barnes, Sutherland, Curran, Mills and Thompson (2005), as a clear hindrance to interactivity, or they neglected to use the IWB at all. Indeed, many pre-service teachers displayed that they had accessed sites, as directed for class presentations, by bringing printed copies of a flipchart or an annotated assessment map etc., to share with the class. In fact they presented these hard copies while standing in front of an IWB designed to accommodate this very type of presentation, yet made no attempt to use it. When on the odd occasion the pre-service teachers did access the sites referred to via the IWB, they rarely engaged peers in discussions about what was being displayed and did not attempt to manipulate the applications displayed.

The pre-service teacher-led class work did not demonstrate a clear engagement with IWB instruction in their pedagogy. Despite developing realisations that they needed to know more about IWBs, for example how a flip chart works once you have it located, they appeared reluctant to address this need once each class was complete. As the second semester developed, and it should be noted here that there was a strong cohesion and genuine mutual respect for each other in each class, there was rarely a time when pre-service teachers demonstrated a strong understanding of IWB use by assisting peers struggling with IWB activities. In the future more links will be made between units and through this it is hoped that students will increasingly use IWBs throughout their course and while practice teaching.

Perhaps the pre-service education students were not able to integrate IWBs into their university course because they have not seen IWBs used well in primary school

classrooms. Students often reported the boards were not being used in innovative ways, thus setting a pattern for these pre-service teachers to not use them well.

Case Two: University of Canberra and ACT Department of Education

This example of integrating IWB use was developed in the Australian Capital Territory (ACT) by the ACT Department of Education and the University of Canberra, in an attempt to improve the skills of teachers in using IWBs, as well as give pre-service teachers knowledge about when to use IWBs once they are practising teachers. Interactive whiteboards were first introduced into schools within the ACT during 2002. In 2005 an ACT Government initiative subsidising purchases of interactive whiteboards by schools significantly increased their numbers within schools. This created a need for extensive in-service teacher professional development. A peer coaching and mentoring model was adopted to deliver this professional development. IWB *Master Teachers* were trained and then led school-based projects to support the implementation of IWBs within their local area. The IWB Master Teacher training was a five-day course, spread over a ten-week period. Within each session, in-service teachers were exposed to a new IWB teaching technique which they could then integrate into their teaching practice over the course of a fortnight. Participants were then able to share and discuss their experiences, before being exposed to a new IWB teaching technique. The first three days of the program were devoted to exploring the potential of IWBs to improve pedagogy, consistent with the New South Wales (NSW) *Quality Teaching Framework*. The ACT Department of Education has formally adopted the *Quality Teaching* model as its defined pedagogical strategy to support the delivery of the curriculum to ACT schools. The section below first described the *Quality Teaching Framework* and then describes the five-day course.

Quality Teaching Framework

The IWB pedagogical skill set used within the pre-service course is based on the NSW *Quality Teaching Framework* (NSW Department of Education and Training, 2004). Quality Teaching has a strong foundation in research (Newmann, Marks & Gamoran, 1996; Newmann, Secada, & Wehlage, 1995). The framework consists of three dimensions (Intellectual quality, Quality learning environment, Significance), each comprising six elements of pedagogies.

IWB technical skills

The potential range of IWB technical skills that can be learnt is vast. The range of potential IWB software that pre-service teachers may encounter, and the fast pace at which IWB hardware and software is upgraded, means that the skill set required by teachers is constantly changing. Given this, the clear focus of the pre-service training course was on developing an understanding of teaching strategies that focus on the pedagogical skills that are associated with IWBs in education. This was carried out by conducting the workshops in a computer laboratory so that skills were taught in a way that was predominately hands on.

Delivery of ICT pedagogical skills

Teachers acquire pedagogy skills through an extended process of dialogue and reflection undertaken by a team of teachers (Gore, Griffiths & Ladwig, 2004; McRae, Ainsworth, Groves, Rowland & Zbar, 2000). The common call for pedagogical change

associated with the introduction of IWBs indicates that the bulk of exemplary pedagogical practice involving the use IWBs within the classroom is still being or is yet to be developed (Miller, Glover & Averis, 2005). In this context the delivery of professional learning needs to be shifted from teachers as receivers of knowledge developed by others. This pre-service training course is designed to support a cycle where pre-service teachers develop opportunities and trial applications of IWBs, reflect upon the outcomes, and develop further the opportunities for the effective enhancement of teaching and learning though the use of IWBs.

Day One: Enhancing the intellectual quality of lessons with an IWB

Day one focused on the teachers gaining an understanding of how an IWB has the ability to provide classes with content that can be easily manipulated. This ability provides teachers which a wide range of opportunities to lead rich class discussions, allowing students to move beyond memorising the content of the board to engage more deeply with the underlying concept being taught (Kent, 2008).

This day focused on the *Quality Teaching Framework's* dimension of intellectual quality with the importance of this dimension shown in the research data. Students within classrooms that have a high level of intellectual quality achieve improved student outcomes (Newmann, et al., 1996). Indeed, Amosa et al. (2007) indicates that high levels of intellectual quality can significantly close the gap between students of high and low socio-economic status. More fundamentally, the inherent importance of this dimension lies in the fact that it focuses teachers and students on the processes and outcomes of learning. 'Traditional pedagogies' that proceeded quality teaching and authentic pedagogies seemed generally didactic, treating knowledge as a body of facts to be learnt rather than discovered.

The dimension of intellectual quality encourages teachers to understand deeply their subject areas and to demand that students reflect this depth through analysis and interpretation of information presented. The dimension of intellectual quality insists that students weigh up conflicting points of view and wrestle with the ambiguous nature of knowledge. Students become acquainted with the meta-language specific to various disciplines of study as well as learning that understanding comes through sustained and elaborate 'conversations' with others and with oneself through a process of reflection. Without a high level of intellectual quality within lessons, students avoid having to understand the complexities and inferences of a subject area and instead focus on memorising the content presented so that it can be recalled on assessment tasks exactly the same way it was read or heard. Thus it is important that teachers understand this dimension.

Day Two: Increasing the significance of lessons with an IWB

The content of this day focused on the ability of an IWB and other associated technologies to capture digitally the students' 'world' and to use what is captured as the context of the lesson. In this way teachers can use the IWB to make clear connections to students' prior knowledge, experiences and interests to construct the 'context' for their lessons (Kent, 2008).

This day was also underpinned by the *Quality Teaching Framework* and the quality learning environment domain which involved pedagogies that facilitate relationships between and amongst the teacher and students. Within a quality learning environment

the focal point was one of learning and was evident through the engagement and focus of the students. This dimension dictates that the environment within the class must hold high expectations of students so that they are empowered to take risks with their learning, and feel safe and supported in doing so. The findings of the study by Amosa et al. (2007) indicate student achievement can improve significantly when the tasks include explicit quality criteria that contain within them high expectations for student performance.

The pedagogies that underpin the dimension of a quality learning environment insure the necessary social and attitudinal criteria for learning; the dimension of 'intellectual quality' contains pedagogies that relate to cognition and the cerebral construction of knowledge; however in order for learning to be meaningful and relevant it also needs a context. The pedagogies that underpin the dimension of 'significance' aim in a large part to provide this context. Beane (1995, p. 616) argues that "the source of curriculum ought to be problems, issues and concerns posed by life itself". The concerns being those that are both personal to students lives and problems put forward by the wider world. The dimension of significance encourages new learning to be based on previous learning from both previous school and non-school experiences. The knowledge of social and cultural group needs to be recognised and valued.

Day Three: Using an IWB to promote a supportive classroom environment

The content of this day focused on how an IWB can contribute to more effective communication within a classroom. The IWB can provide increased opportunities to present information including visual, auditory and textual information. This enhanced communication can be used to more clearly describe explicit quality performance criteria and set high expectations for students (Kent, 2008).

Day Four: Coaching and mentoring

The fourth day focused on coaching, mentoring and in-service presentation strategies. IWB Master Teachers were required to prepare three workshop presentations that corresponded to the *Quality Teaching Framework* concepts of the first three days. The general mode of delivery of ICT pedagogical skills during these workshops were guided by the principles outlined by the 'learning by design' model of teaching outlined by Cope and Kalantzis (2005). This model is characterised by four main phases:

- *Experience the new* – Immersion of participants in cutting edge examples of how IWBs are being used well.
- *Analyse critically and functionally* – Workshop participants will analyse and interpret the examples such that links are drawn between the examples and how they enhance particular elements of the quality teaching framework, and extrapolate how this principle can be transferred to their own teaching context.
- *Conceptualising* – Participants will identify and define features of the specific hardware or software that where key in enhancing the teaching and learning experience in the exemplars.
- *Transforming practice* - Participants will construct a plan to enhance a chosen element of the quality teaching framework through the use of relevant technology. This plan would also include a reflection and refinement tool.

Day Five: Workshops to pre-service teachers

The fifth day presented the IWB Master Teachers with the opportunity to conduct professional development workshops for pre-service education students from the University of Canberra. This was seen as a way of honing their professional development presentation strategies. This day began with the 60 pre-service teachers being divided into four groups. They then completed three practical sessions throughout the day with sessions relating to each of the dimensions of the *Quality Teaching Framework*. These sessions were called 'Enhancing intellectual quality within lessons with an IWB', 'Increasing the significance of lessons with an IWB' and 'Using an IWB to promote a supportive classroom environment'. The eight master teachers were split into pairs to present one of these topics with all pre-service teachers having access to a PC with IWB software on it during each of the sessions. The groups of pre-service teachers rotated around three of the four pairs of master teachers during the three sessions and at the end of the day each pre-service teacher had been through the three workshops including being supplied with support notes. This model of teaching proved particularly effective for both the pre-service teachers and the master teachers with positive feedback received from each group.

Outcomes and evaluation from the University of Canberra example

There were a variety of outcomes achieved from the day with the pre-service teachers. The goals of the day were for the IWB Master Teachers to gain confidence in presenting workshops relating to IWB teaching strategies as well as for the pre-service teachers to gain a greater understanding of IWB pedagogy – goals which the participants regarded as highly successful. As space was limited, a total of 60 pre-service teachers were able to participate in the final day of the workshops. Participation for the university pre-service teachers was voluntary and not linked to any course or assessment activity. Demand from pre-service teachers to participate in this day was strong with more students wanting to participate than there was capacity to cater for. Formal feedback gathered from the 60 students who participated within Day Five was very positive. This included 55 pre-service teachers who rated the day as being 'Very high' or of 'High quality'. While 57 pre-service teachers indicated that they would 'recommend' the workshops to fellow students. This day will continue to run in future years and perhaps more often throughout the year.

By conducting this day the pre-service students directly learnt skills as described by Kennewell (2006) and Schuck and Kearney (2007) relating to the IWB and effective use in the classroom. These skills, along with information learnt on how to apply the *Quality Teaching Framework*, will be very useful to the pre-service teachers in the future. It is hoped these future teachers will be able to apply the skills learnt in the day to their classrooms once they are teachers.

Recommendations

Australia is currently in the process of a *Digital Education Revolution* whereby the Australian Government has announced that $2.2 billion over six years will be put into various ICT projects and infrastructure, including "new and continuing teachers have access to training in the use of ICT that enables them to enrich student learning" (Department of Education, Employment and Workplace Relations, 2010a, p. 1). This paper thus has wider implications for this *Digital Education Revolution*, particularly as

at the beginning of 2010 the Australian Minister of Education announced A$40 million for pre-service and in-service teacher professional development in this area (Gillard, 2010), with the specific areas to be targeted including improving the capability of pre-service teachers and enhancing the capacity of in-service teachers (Department of Education Employment and Workplace Relations, 2010c).

Those in higher education are no different to educators across all other educational sectors in relation to professional development. They must have a positive attitude toward change, maximise ways to navigate and incorporate modern communication opportunities into lessons, establish a degree of technical expertise, continue to face changes in technology, and integrate these changes into their work patterns. IWBs provide flexible channels for information delivery, offer dynamic opportunities to disseminate evolving content, and provide an avenue to work with knowledge in contemporary situations. It is clear that there is a need for structured research studies to examine why first year pre-service teachers are reluctant users of IWBs, despite specific support being available. Such research studies should include: an investigation into how coursework can better address the needs of pre-service teachers; ways to create more structured links between technology and pedagogy; and strategies to engage pre-service teachers in a genuine exploration of what IWBs may offer teachers and their learners. The guidelines for the new funding by the Australian Government allow for future research in these areas (Department of Education Employment and Workplace Relations, 2010b).

Universities need to continue to provide unique and varied experiences to pre-service teachers in a variety of the units they undertake and while on practicum. This will allow the student teachers to develop skills needed to use technologies, including IWBs, as this is an important growth area in schools. Perhaps the next step in providing pre-service teachers skills to being able to use IWBs effectively in the classroom is to provide more opportunities for them to make use of the IWB as a central classroom hub.

Conclusion

Although these two examples cannot be compared with each other due to data collection differences they show two unique ways of up-skilling pre-service teachers in using IWBs, so that they have greater knowledge of pedagogy using IWBs when teaching in the future. Although these examples provide overviews of two distinct educational contexts they indicate how universities in Australia are addressing the needs of pre-service teacher's vis-à-vis IWBs as well as how to change pedagogy in order to effectively incorporate IWB lessons into teaching. This is due to IWBs having the potential to make a major impact on learning and teaching at all education levels. For educators in higher education, strategies for the use IWBs in pre-service teacher education level must be seriously considered. IWBs are currently used in many schools across the world, however, this use ranges across a continuum incorporating the use of boards for merely presentation purposes to being an integral part of the primary school classroom (BECTA, 2003; Schuck & Kearney, 2007).

It is important for academics to continue to offer classroom teachers more professional development in using IWBs as well as assisting school leaders with whole school implementation plans. It would be expected that this change and increased use will assist pre-service teachers in being able to integrate IWBs more comprehensively

within their pre-service teaching experiences and following that throughout their university studies in general. Pre-service teachers are the teachers of the future and they must have every opportunity to develop both their personal ICT skills as well as the ICT skills they will be required to teach. Thus, more research is needed on how universities are successfully implementing IWBs into pre-service education courses. With increased funding it may be possible to set up more programs where both pre-service education students and in-service teachers can assist each other with learning and using pedagogies that improve teaching outcomes, and enhance the effectiveness of IWB use in classrooms across the Australia.

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