Whiteboard Technology: engaging children with literacy and numeracy rich contexts

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Executive summary
This innovative research project was a collaborative enterprise between Coolbellup Community School in Perth, Western Australia and researchers from Murdoch University. It was funded by Department of Education, Employment and Workplace Relations (DEEWR) under the Round Three Literacy and Numeracy Innovative Projects Initiative. The Murdoch Researchers used principles of action learning to work with the Primary School teachers in identifying and developing strategies that utilise Interactive Whiteboard (IWB) technology for improving children’s literacy and numeracy.

The findings of this project reveal that using the IWB to improve literacy outcomes is inextricably linked to effective use of ICT and pedagogical change. The usefulness of the IWB in promoting children’s literacy and numeracy depends on the reliability of the ICT equipment and support for its use, the skills of the teacher and the teacher’s response to the learning needs of individual class groups. The case studies reflect both the differing ICT skill levels of the teachers and the individual literacy and/or numeracy learning needs of their classes and hence the teaching and learning foci and use of strategies. In trailing and implementing teaching and learning strategies that utilise IWB technology for improving children's literacy and numeracy development, the teachers revealed that the IWB is a tool that relies on sound pedagogy and response to the unique learning context. When used most effectively, the children and their unique needs are at the centre of teaching and learning, and the IWB is a versatile technical tool available to the skilled teaching professional. The following quote from one of the project teachers illustrates this point:

*The board allows me easy access to the internet which is ‘real life’, I find it so much easier to explicitly teach how to be numerate and use my knowledge of maths to do so. Children can see how the big picture fits together and begin to ask mathematical questions thus having a reason to learn mathematical concepts.*
Project objectives

The aims of the project were as follows:

1. To investigate the use of Interactive Whiteboard technology as a tool for facilitating children’s development of literacy and numeracy skills.

2. To support the classroom teachers in trialling and implementing teaching and learning strategies that utilise Interactive Whiteboard technology for improving children’s literacy and numeracy development.

3. To document and disseminate effective strategies and programs that could support national K-7 initiatives for integrating technology with literacy and numeracy.

The key project outcomes include:

1. Guidelines for successful teaching pedagogies and practices regarding the use of interactive whiteboards that promote literacy and numeracy

2. Four case studies including specific practice examples that will support teachers in using interactive whiteboard technology

3. The potential for the development of a professional learning package for teachers implementing Interactive Whiteboard technology.

Background to the project

The project’s rationale is based on the assumption that being numerate, at the very least, is about having the competence and disposition to use mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life (Willis, 1992). Numeracy is a blend of mathematical, contextual and strategic knowledge viewed as important for people to participate in their every day life, in social and work settings and for critical citizenship.

In common with numeracy, literacy is a blend of knowledge that individuals need to be able to choose and use strategically in a wide range of situations. Being “literate” refers to the ability to understand and interpret written and
spoken language and symbols and to be able to communicate in writing for a range of purposes across a range of contexts; Effective literacy is intrinsically purposeful, flexible and dynamic and involves the integration of speaking, listening and critical thinking with reading and writing (DEET, 1991).

The disparity in access to technology across socio-economic and cultural lines is of global concern and success in both literacy and numeracy is influenced by access to technology. The capacity of IWB technology to offer students and teachers a range of options in the classroom makes it a potentially powerful learning tool which could assist in bridging the digital divide. The significance of Interactive Whiteboard technology lies in its ability to be interactive and fluid and the ability to integrate with other technologies.

As IWB technology is relatively new to the education context, research on the use of IWBs in classrooms and their contribution to student outcomes in key learning areas is limited. This project contributes to limited research in this area.

Project Location and Team

Apart from the Murdoch Researchers, the project team included teachers and students from Coolbellup Community School. Four teachers demonstrated particular interest and engagement with issues and opportunities for integrating interactive whiteboard technology into their classroom practice. This School’s population was comprised of students who were considered educationally disadvantaged and at risk of not achieving literacy and numeracy benchmarks. Data gathered through Western Australia’s Literacy and Numeracy Assessment indicated many students in the school were performing well below state averages and significant numbers of students were failing to reach state benchmarks in most areas and year levels of literacy and numeracy.

The research team drew on the expertise of Critical Friends for the project: Beth Powell- Senior Lecturer in the School of Education at Murdoch University, Doug Averis and Dave Miller- Researchers in the Education Department of Keele University, Keele, Staffordshire, UK, and internationally published experts in interactive whiteboard pedagogy.
Methodology/project design

Both quantitative and qualitative methods were used in this project. Part A involved the development, administering and analysis of a Likert style questionnaire measuring children’s attitudes to IWB technology in their classroom. In Part B, action research methods were used for structuring and supporting teachers use of creative IWB strategies for developing children’s literacy and numeracy.

Part A: IWB questionnaire

A student questionnaire was developed for monitoring children’s attitude towards the IWB technology experienced in their classrooms. This was a self-evaluation tool for the students which contained 16 Likert style items. An initial set of 40 questions was developed based on the project children’s comments during the semi-structured interviews and a review of attitudinal scales and related literature.

The project teachers administered the questionnaire in their classrooms early in the action research process. The questionnaire was re-administered post-project and the resulting data was entered into excel with the pre-project data.

Part B: Teachers’ Action Research

Action research principles were utilised in this project as they supported a constructivist approach to professional learning and facilitate real, practical action based on the learning needs of the students and teachers in the school. The teachers undertook action learning and research as a part of, rather than separate from, their classroom practice. Collaboration between the researchers and teachers was established and project actions cycled between planning, acting, describing and critically reflecting (Murcia 2005).

The teachers selected a literacy or numeracy focus for their classroom project. Each teacher’s project was then based on an aspect of classroom practice that had as a foundation the utilisation of IWB technology for improving students’ literacy and numeracy outcomes. Teachers were encouraged to keep a learning journal and share their experience through interim presentations to the group. Structured exercises were also used at facilitated action team meetings to increase the depth and critical nature of the teachers’ professional reflection.
Teachers’ interim project presentations and final case studies provided rich data for analysis. A mapping exercise was conducted independently by two researchers across the qualitative data.

**Major findings/implications of the findings**

Analysis of the complete qualitative data set resulted in the identification of a continuum of teachers’ IWB development as they trialed strategies for using the technology to promote children’s literacy and numeracy development. Themes and issues surrounding the teachers’ development also emerged as significant findings in this project.

At the outset of the project each of the four teachers had different levels of skill in ICT use and experience with the IWB. The case studies reflect their differing ICT skill levels and the individual literacy and/or numeracy learning needs of their students and hence, their teaching and learning foci and approaches. Each teacher chose either a literacy or a numeracy focus for the action learning project which is evident in each of the individual project aims and the strategies adopted in using the IWB. For example, one teacher identified a numeracy focus for her project with the main aim being to increase her students’ repertoire and use of mental strategies to solve mathematical problems. One of her strategies was to create a sorting box using a layering technique developed over the course of the project. The sorting box enabled students to place multiples of two into the box whereas other numbers would not go in, meaning the activity was self-correcting. This teacher progressed from using on line ready-made resources to developing her own resources to meet the individual needs of her students. She explained:

> I made more sorting boxes for multiples of 3, 4 & 5. Discussions during these activities were exciting as some students were interacting trying to find patterns in the numbers without being prompted. This was a big leap forward in terms of the students directing their own learning.

Another teacher who described herself as an ICT novice used the IWB to complement the hands-on and pen and paper aspects of learning tasks:

> I have used a few online sites, with relevant clock and time activities, to reinforce the telling of time using analogue and digital clocks, comparing the time readings between the two. The children who were having difficulty with time, showed greater confidence when it was
presented in a bright ‘game’ like way, with the ‘Try again’ prompt giving them multiple attempts to practice and learn the telling of the time.

Questionnaire Results
The sample (73) of Western Australian primary school children from Coolbellup Community School completed pre- and post-project IWB questionnaires measuring their attitudes toward use of the Interactive Whiteboard technology in their classrooms in 2007. The responses suggested that children’s motivation and engagement with learning increased when their Teacher effectively use IWB technology in the classroom. A majority of children believed their school should have more IWB technology and wanted their teacher to use the IWB more often in their classroom. The majority of children said using the IWB made them happy and it was exciting. A summary of Questionnaire responses appears below:

Children’s attitudes to IWB

- Very positive response to all items on the questionnaire.
- The data showed children’s motivation and engagement with learning increased when their Teacher effectively use IWB technology in the classroom.
- 86% of children said using the IWB made them happy and it was exciting.
- A majority of children believed their school should have more IWB and they wanted their teacher to use the IWB more often in their classroom.
- 79% of children believed learning maths was easier for them when using the IWB.
- 56% thought reading and writing was easier on the IWB.

How the IWB helps children’s learning

- Children’s responses to the questionnaire items suggest they found a learning benefit in the large and flexible learning space created by the IWB.
- 74% of children liked working on the IWB because they could rub out easily. This encouraged a degree of risk taking in their learning with reduced anxiety about getting the wrong answer.
- 82% stated being happy to have a go and try out ideas when working on the IWB.
- 86% agreed they listened to the teacher when they used the IWB to explain new ideas.
Signposts in Teachers’ IWB development

A seven-stage continuum of teachers’ IWB development emerged out of the data. This continuum began at the novice level and progressed through to critical use of IWB for facilitating students’ achievement of learning outcomes. Each stage was signposted by a significant question that drove the teachers’ professional learning. Further more, critical incident stories were found within the teachers’ case studies and used to capture and communicate the experience of the teachers at each stage. The seven signposts are as follows:

1. Raising awareness: How can I get an IWB in my classroom?

Initial product demonstrations by the suppliers of the IWB were fast paced and visually stimulating. The teachers were engaged and considering the potential of the technology for supporting their classroom teaching and learning. They valued the interactivity in the board and its potential for supporting effective teaching and learning. They made a professional commitment to learning IWB skills.

2. Getting started: Where does this cord go?

There was some degree of anxiety amongst all teachers when first accessing an IWB. The novice teachers found setting up the board intimidating. Their confidence level did vary and it appeared to be correlated with their general ICT skills development.

3. Using the tools: What can I do with the IWB?

Teachers explored the IWB tools and experimented with their functions. They developed skills in writing on the board and basic actions such as drag and drop. They were observed importing tools and functions from other types of more familiar software. During this stage teachers gained greater confidence in setting up the IWB and using it in the classroom with children.
4. Sifting and using: What ready made on-line resources can I find and use?

Teachers used the IWB as a way to display their computer screen to the classroom. Interactivity was introduced through ready made on-line activities. Children were using the IWB under the Teacher’s direction while observed by the whole class or in small groups. Over time all teachers observed the variable quality of the on-line materials.

5. Making resources: How can I tailor make activities for the children’s learning needs?

Teachers found that time spent searching for just the right on-line activity could at times be better used for constructing their own interactive activities. The skills used by teachers varied and increased overtime. At this stage the teachers’ focus continued to be on their IWB skills development but targeted to the specific learning needs of the children in their classroom.

6. Integrating activities: How can I integrate the IWB into a meaningful learning sequence?

The teachers’ thinking about teaching and learning with the IWB shifted at this stage of their development. The IWB was no longer the centre of the learning experience but an integral component, fluently integrated with a range of learning activities and styles. There was increased awareness of the connections needed between what happens on the IWB with children’s talking, thinking and at desk tasks. Each component of the learning became related and consistent. At this stage there was a fundamental shift in the manner in which IWB was integrated into classroom learning experiences.

7. Embedding in practice: Would I want to teach without an IWB?

Teachers had become critical users of the IWB technology and using the IWB as a strategy for responding to children’s learning needs in the moment. They were
purposeful in its use and reflective about its impact on children’s learning. The IWB had become embedded into their daily practice and there was fluency with its use.

Emerging Issues and themes

The reliability of the different technologies, the availability of effective ICT support and access to the IWB technology (for both children and teachers), emerged as significant. The emerging issues and themes can be summarised as follows:

*Permanently fixed boards vs mobile IWBs*

Once the boards were fixed (rather than mobile) in their classrooms, the teachers used the boards across the curriculum and engaged the children in their use on a daily basis.

*ICT support in the moment*

The project teachers experienced technological difficulties throughout the project that clearly detracted from the effective use of the IWBs. The availability of effective ICT support emerged as a significant issue in the project.

*Techno-resilience*

The teachers attribute a great deal of success in using the IWB technology to their techno-resilience. Although the project teachers experienced technological difficulties that hindered some of their efforts, their determination to make the IWB technology work ensured they developed their skills in the long term.

*Children as part of the learning community surrounding the IWB*

Each teacher maintained a focus on children’s development in the use of the technology and ensured children remained at the centre of the learning. The project revealed that the children needed access to the board and the time and opportunity to explore along with the teachers. Children were clearly part of the learning community surrounding the teachers’ IWB development.

*Teachers’ evidence of improved literacy and numeracy outcomes*

The project teachers’ Case Studies provided further evidence of children’s improved literacy and numeracy learning when the IWB is used effectively.
This evidence also supported the findings of the IWB Questionnaire and illustrated children’s positive attitudes to learning with the IWB. Positive attitudes to the use of IWB technology appeared to translate to improved achievement of numeracy and literacy outcomes.

Implications/ Suggestions for further research

The findings of this project demonstrate that while initial product demonstrations often raise awareness of the potential of the IWB, professional learning must go much further than this in order for IWBs to be used effectively in classrooms. Through this project, the teachers had become critical users of the IWB technology. They were purposeful in its use and reflective about its impact on children’s learning. The IWB had become embedded into their daily practice and there was fluency with its use. Teachers were preplanning interactive activities but now also using the IWB as a strategy for responding to children’s learning needs in the moment.

Overall the findings showed that children in the project had a positive attitude to the use of IWB technology in their classrooms. This is evident both anecdotally throughout the teachers’ case studies and from the student IWB Questionnaire responses. Questionnaire responses suggested that children’s motivation and engagement with learning increased when their Teacher effectively used IWB technology in the classroom. The IWB Questionnaire used in the present study has provided a quantifiable measure of the IWBs impact on primary school children’s motivation and engagement with learning. This Questionnaire represents a new foray into the evaluation of IWB technology in classrooms and may contribute to future research.

The findings of this project suggest that in order to ensure sustainable and embedded use of IWBs in classroom practice, teacher development in the use of IWBs needs to be viewed as an evolution rather than a revolution. The Signposts in Teachers’ IWB Development identified in this project illustrate that teachers cannot move straight from learning how to set up the board to effectively embedding the IWB in their practice.

This research highlighted four conditions or characteristics as crucial to Teacher IWB professional learning:
- An effective learning support framework
- A context for constructive collaboration
- Expert input at point of need
- A focus on manageable change and development

Teachers involved in this project found that over the course of the year more and more teaching colleagues were taking an interest in what was happening with the IWB project group. Clearly there was a ripple effect which emanated from the project teachers’ commitment to IWB learning. The project teachers have become school based leaders and mentors developing IWB pedagogies. Miller and Glover (2007) suggest that this role is vitally important in assisting whole school IWB development.

These teaching professionals understood the importance of innovation and creativity for evolving their practice. Although the project focussed on the IWB it was evident that the board was only a tool, which had the capacity to support effective teaching and learning. The Project Team’s thinking about ways to move forward with IWB research and practice featured the notion of children as the creators of IWB activity. This was a shift from teachers’ creativity to the children as creative users of the IWB technology.

In conclusion, the teachers in this project moved from being IWB novices to critical practitioners. This required time, planning and collegial collaboration which was also evident throughout the IWB literature. The IWB was a medium for exploring their teaching and allowed them to expand their effective practice. When used effectively, the IWB contributed to enhanced literary and numeracy learning outcomes for children involved in the project.
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Background

This innovative research project was a collaborative enterprise between Coolbellup Community School in Perth, Western Australia and researchers from Murdoch University. It was funded by Department of Education, Employment and Workplace Relations (DEEWR) under the Round Three Literacy and Numeracy Innovative Projects Initiative. The Murdoch Researchers used principles of action learning to work with the Primary School teachers in identifying and developing strategies that utilise Interactive Whiteboard (IWB) technology for improving children’s literacy and numeracy. The research built directly on elements of each team member’s research interests and experience. The members of the Research Team were:

Dr Karen Murcia- expertise in numeracy research and action learning.

Dr Susan McKenzie - expertise in literacy development and support initiatives.

The project team also included teachers and students from Coolbellup Community School. This School’s population was comprised of students who were considered educationally disadvantaged and at risk of not achieving literacy and numeracy benchmarks. Many students required significant teaching and learning adjustments and the School has an Education Support Centre with 25 students in Years 1- 7. Aboriginal students form about 25% of the student population. Data gathered through Western Australia’s Literacy and Numeracy Assessment indicated that many students in the school were performing well below state averages and significant numbers of students were failing to reach state benchmarks in most areas and year levels of literacy and numeracy. The school was operating on a newly built site where access to high quality technology for supporting learning for all students had been included in the design brief. Furthermore, the School had invested in four mobile Interactive Whiteboards, which were available for use by all teaching staff. All teachers had participated in initial professional development sessions and four teachers demonstrated particular interest and engagement with
issues and opportunities for integrating interactive whiteboard technology into their classroom practice.

In addition, the research team drew on the expertise of Critical Friends for the project. The project’s Critical Friends were:

- Beth Powell- Senior Lecturer in the School of Education at Murdoch University.
- Doug Averis and Dave Miller- Researchers in the Education Department of Keele University, Keele, Staffordshire, UK, and internationally published experts in interactive whiteboard pedagogy.

The targeting and location of the project were congruent with Australia’s national Literacy and Numeracy Plan for Schools and the Innovative Projects Initiative. The key focus of the project was an investigation of schooling options alternative to the mainstream, specifically the use of technology, to support improved literacy and numeracy outcomes for students K-7. The project was consistent with the following objectives outlined in the Round Three Literacy and Numeracy Innovative Projects Initiative (1.21) including:

- Generated at local level;
- Supported improved literacy and numeracy outcomes of educationally disadvantaged students and;
- Small in scale but with the potential for national application.
Project Aims and Outcomes

The aims of the project were as follows:

- To investigate the use of Interactive Whiteboard technology as a tool for facilitating children’s development of literacy and numeracy skills.
- To support the classroom teachers in trialling and implementing teaching and learning strategies that utilise Interactive Whiteboard technology for improving children’s literacy and numeracy development.
- To document and disseminate effective strategies and programs that could support national K-7 initiatives for integrating technology with literacy and numeracy.

The project outcomes include:

1. Guidelines for successful teaching pedagogies and practices regarding the use of interactive whiteboards that promote literacy and numeracy
2. Four case studies including specific practice examples that will support teachers in using interactive whiteboard technology
3. The potential for the development of a professional learning package for teachers implementing Interactive Whiteboard technology.

Literature Review

The literature review outlines the understanding of literacy and numeracy within the context of the project. It also addresses the use of ICTs in schools and the significance of IWB technology. As IWB technology is relatively new to the education context, research on the use of IWBs in classrooms and their contribution to student outcomes in key learning areas is limited. This project contributes to limited research in this area.
Literacy and Numeracy

The project’s rationale is based on the assumption that being numerate, at the very least, is about having the competence and disposition to use mathematics to meet the general demands of life at home, in paid work, and for participation in community and civic life (Willis, 1992). This is a broad and inclusive perspective of numeracy that recognises that children need to be able to choose and use their mathematical knowledge strategically in a wide range of contexts. Numeracy is a blend of mathematical, contextual and strategic knowledge. This blend of knowledge is viewed as important for people to participate in their every day life, in social and work settings and for critical citizenship.

The blended nature of mathematical, contextual and strategic knowledge is reflected in the W.A. Curriculum Framework. In this document being numerate is described as …having the disposition and the competence to use mathematics to solve practical problems outside mathematics and a tool for learning beyond the mathematics classroom. Informed numeracy involves what mathematics is and isn’t and what it can and cannot do, in order to judge and question the assumptions underpinning particular uses of mathematics. Embedded in this description is the requirement for numerate individuals to have the ability to use mathematics as a tool for learning and to critically engage with the use of mathematics in a given situation.

The very nature of numeracy suggests that it cannot be developed solely within the mathematics lesson. Neither can it be assumed that learning mathematics will automatically produce numeracy. It is then essential that students have opportunities to learn to be numerate both across the curriculum and beyond the classroom, by experiencing practical uses of mathematics in a variety of contexts (Hogan et al, 2004). As such, numeracy can be described as a cross-curricular concept (Murcia & Powell, 2004).

When teachers engage students with numeracy demands from across the curriculum, opportunities are created for identifying student numeracy issues and problems. Deficits in students’ mathematical knowledge can then be dealt with specifically in the mathematics lesson using the original context to give meaning and relevance to learning, The First Steps in Mathematics (DET,
2005) project and associated resource materials, identify key understandings required by students to achieve outcomes in all sub-strands of the mathematics learning area. These materials and associated teaching and learning tasks would be useful for supporting the development of the students’ mathematical knowledge. Ideally, to complete an action-learning loop, the developing skills and understandings should be taken back into a similar cross-curricular situation. This then allows students to use their numeracy skills as a tool for developing learning outcomes in the particular learning area. Linking classroom mathematics to numeracy across the curriculum can result in students engaging in meaningful ways with the mathematical skills and concepts they are learning and, as such, there is potential to improve the numeracy of all students and, in particular, those identified at risk.

In common with numeracy, literacy is a blend of knowledge that individuals need to be able to choose and use strategically in a wide range of situations. Being “literate” refers to the ability to understand and interpret written and spoken language and symbols and to be able to communicate in writing for a range of purposes across a range of contexts; Effective literacy is intrinsically purposeful, flexible and dynamic and involves the integration of speaking, listening and critical thinking with reading and writing (DEET, 1991).

Literacy involves much more than reading and writing as it includes a broad range of knowledge and skills beyond reading and writing that are embedded in a sociocultural context. Gee (1990) clearly defines literacy as social practice. He also claimed that institutional and social literacies are often separate and that some literacies are valued more highly than others, thereby disadvantaging some groups. Therefore educators need to value the literacies that students bring to the classroom but also ensure that the classroom literacies represent the literacies of the societies in which they operate.

...when we look at the practices of such [social] groups, it is next to impossible to separate anything that stands apart as a literacy practice from other practices. ... You can no more cut the literacy out of the overall social practice, or cut away the non-literacy parts from the literacy parts of the overall practice, than you can subtract the white squares from a chess board and still have a chess board. (Gee, 1990: 43).
Significance of Interactive Whiteboard technology

The disparity in access to technology across socio-economic and cultural lines is of global concern. Technology is an integral part of social practice and those who do not have meaningful access to technology are clearly disadvantaged. McCormack and Ward (2003: 81) report that the hands on interactive opportunities offered by the use of Interactive White boards enhance student learning as well as bridge the gap between school and home. A national survey of more than 3,000 low-income families affiliated with The Smith Family programs showed that less than 60 per cent of families had a computer at home illustrating that the “digital divide” could compound disadvantage (McLaren & Zappalà 2002). Success in both literacy and numeracy is influenced by access to technology. This is acknowledged in the National Plan for Literacy and Numeracy in Schools which involves commitment to professional development and research funding to generate insights into potential ways of using information technologies to enhance the literacy skills of all young Australians (DEETYA, 1999). Further, it is clear that students from disadvantaged families are at risk of being further disadvantaged if they do not have access to technology.

The capacity of IWB technology to offer students and teachers a range of options in the classroom makes it a potentially powerful learning tool which could assist in bridging the digital divide. Interactive whiteboards can be used in a number of ways. They can be used as a presentation device and it has been suggested that this in itself can be motivating for students (Glover & Miller, 2002); however the IWB is much more than simply as means of projection. Unlike other projection devices, the software has the capacity to drag and drop, hide and reveal, highlight, animate (rotate, move or enlarge) store and retrieve images and text and provide feedback (such as when an object is touched a visual or aural response in generated) (Kennewell & Higgins, 2007: 207). Such features provide for facilities that are not possible without IWBs. For example in the area of literacy, such facilities as split screen for comparing texts, tools for drawing attention to print and aspects of language, and modification and substitution of words and phrases support many teaching and learning activities (Kennewell & Morgan 2003: 1).
The significance of IWB technology lies in its ability to be interactive and fluid and the ability to integrate with other technologies. For example, the whiteboard can be used like a traditional whiteboard; yet can also operate as a computer screen with a fingertip mouse. It can incorporate word files or pictures, digital images, video clips, Internet material and PowerPoint presentations. Files can be saved and retrieved, revised by students and teachers and then printed.

New approaches to pedagogy

Research and experience with ICT teacher development suggests strongly that for ICT ultimately to impact significantly on student learning, it requires teachers to be competent and critical users of ICT. A critical user of ICT can be defined as one who not only exhibits an ability to use the technology in a way that will enhance the learning of the students, but who also initiates pedagogical change and challenges educational practices in order to integrate ICT into the curriculum (Durrant & Green, 2000). In light of this, teachers participating in the current research project reported here were encouraged to focus on developing both their IWB skills and also effective pedagogy for its integration into classroom teaching and learning.

Many researchers highlight the need for changed pedagogy for successful integration of technology into the curriculum (McCormick & Scrimshaw, 2001). Interactive whiteboard technology can be less than successful if used simply as another chalk and talk approach with little student interaction (Hall & Higgins, 2005). Moreover, an IWB is a tool rather than a teacher, and the use of ICT in the classroom is only successful when teachers make sound use of the principles of teaching and learning (Goodison, 2003; McCormack & Ward 2003). This was found to be the case in the UK Becta evaluation of their Primary Schools Whiteboard expansion project where it was reported that:

*Many teachers have made radical changes to their lesson planning, creating or accessing their own resources and storing them in either personal or shared areas on the school’s server* (Somekh et al, 2007: 8).

The IWB affords the opportunity for teachers and students to interact with it in that text and pictures can be moved and replaced, changed and minimised, but Shenton and Pagett (2007: 130) question whether this actually promotes a
interactive style of teaching and learning. They ask, Is it the board that is interactive and/or does the use of the board encourage and interactive style of teaching? In a similar vein, Kennewell and Higgins (2007: 209) suggest that although IWBs are used to encourage student participation, this can be very superficial; as asking students to take turns to manipulate items on the board does not necessarily represent opportunities for authentic student engagement or participation. Where teachers maintain prescriptive control of the IWB it is less likely to be used in a truly interactive manner for teaching and learning.

Teachers’ professional learning

Miller and Glover found that teachers needed uninterrupted access to Interactive Whiteboard Technology rather than sharing the technology or having to move it from room to room. It needs to become a part of the regular pattern of classroom life- the novelty value might provide a temporarily heightened interest but it was only when the full potential was realised that teaching could be enhanced (Miller & Glover, 2002: 8). Glover and Miller (2001) also investigated the introduction of interactive whiteboard technology in a secondary school and claimed that interactive nature of electronic whiteboard technology requires both new approaches to pedagogy and professional development for teachers. Successful integration of any technology into the classroom requires more than simply acquiring that technology. Closing the digital divide requires much more than buying equipment, it requires the knowledge and skills of teachers using the technology, and access to digital tools in the community (Riel, Schwarz & Hitt, 2002: 147).

Glover and Miller (2001) claim that professional development is most successful when it comprises coaching and mutually reflective activity and it needs to be long rather than short term and characterised by “hands on” rather than demonstration. In relation to the technology itself, it must consider the use of linked multi-media and the possibility that teachers are not familiar with new technologies.

Inadequate professional development and lack of time to develop skills and plan lessons have been identified as barriers to the successful integration of IWBs into the classroom. McCabe and Emery (2003) report that teachers
found it helpful to pool resources and information, resolve technical problems together and share anxieties. There are clearly benefits when new technologies are introduced throughout the school as teachers learn from each other. Teachers also commented that they benefited from seeing how the IWB technology was used by others and would also like to see models of best practice so they could see what was possible (Miller & Glover, 2002).

Communities of learners

Many researchers have reported that the use of IWBs tends to create communities where teachers and students learn together and from each other. Co-construction of knowledge is central to such a learning community and new technologies can only enhance learning when they are used in a manner that is flexible, generative and responsive to individual students and contexts (Miller and Glover, 2002: 6). For example, McCabe and Emery (2003) found that the use of Interactive Whiteboards in primary classes encouraged power sharing and problem solving in the classroom. However, they stress that it is the approach to teaching and learning which drives the democratic style of collaboration and joint problem solving, not the equipment (McCabe & Emery, 2003: 10). Children often become experts when new technologies are used; teachers commented that the technological challenge presented to the staff offered even the youngest children a chance to shine because of their home-learned skills with computers and video machines (Miller & Glover, 2002: 13).

Hodge and Anderson reported that the effect of all students in the class viewing the same images on the IWB and discussing what is happening at the same time, is to enhance the spirit of enquiry and strengthen the class learning community (2007: 280). The successful use of IWB technology and its impact is …mitigated by collaborative, democratic activity; and they occur in situ (McCabe & Emery, 2003: 9). Similarly, McCormack and Ward (2003: 82) claimed that technology tools have added a “new twist” providing varied opportunities to empower students and allow them to take new responsibility for their own learning and expand possibilities for collaboration and construction of knowledge.

A study of primary school students’ perceptions of interactive whiteboards revealed the importance of adequate teacher training in the use of the IWB
and the importance of a more flexible collaborative approach between students and teachers. Hall and Higgins (2005: 114) contend that:

While the technology is clearly engaging from the students’ perspective, there is a concern that any gains in this direction may be lost if the technology is not reliable, if teachers are not adequately trained to use it and perhaps more importantly, if the educational climate militates against increased pupil access to the technology.

Research Methods

Both quantitative and qualitative methods were used in this project. Part A involved the development, administering and analysis of a Likert style questionnaire measuring children’s attitudes to IWB technology in their classroom. In Part B, action research methods were used for structuring and supporting teachers’ use of creative IWB strategies for developing children’s literacy and numeracy.

Part A: IWB questionnaire

A student questionnaire was developed for monitoring children’s attitude towards the use of the IWB technology in their classrooms. This was a self-evaluation tool for the students which contained 16 Likert style items. Due to the young age of the project children the response choice was limited to smile, no smile and down turned mouth. The language of the questions was aimed at young children, however, it was necessary for teachers to read out the questions and explain the response choice when administering the questionnaire.

To begin the development of the questionnaire, two semi-structured interview sessions were conducted with small groups of children from two of the project teachers’ classrooms. Three year 3 children were interviewed followed by four children from the year 4 classroom. The following questions guided the discussion.

- Your teacher tells me you have an interactive whiteboard in your classroom. What do you do with the interactive whiteboard?
- Do you like it when you use the interactive whiteboard? Why or why not?
• How do you feel when the teacher is setting up the interactive whiteboard?
• What is different about working on the interactive whiteboard?

An initial set of 40 questions was developed based on the project children’s comments during the semi-structured interviews and a review of attitudinal scales and related literature (Dowson, M. GOALS-S; Martin, A. The motivation and engagement scale, MES). Feedback about these questions was sought from project teachers and colleagues specializing in measurement and motivation research. The feedback informed the selection and refinement of the final set of 16 questions (see Appendix One). The final set of questions contained behavioral and affective domain items.

The project teachers administered the questionnaire in their classrooms early in the action research process. The pre-project data was entered into excel and included the children’s year of birth and gender. The questionnaire was re-administered post-project and the resulting data was entered into Excel with the pre-project data. A pre- and post- project analysis of children’s attitude to the use of interactive whiteboard technology in their classroom was conducted by a measurement consultant at Murdoch University. Descriptive analysis and tests of significance for any pre- to post- project change in item response patterns was conducted using SPSS software. A factor analysis was also conducted to determine the working of the scale items. The IWB student Questionnaire findings are reported in the following findings section of this report.

Part B: Teachers’ Action Research
Action research principles were utilised in this project as they supported a constructivist approach to professional learning and facilitate real, practical action based on the learning needs of the students and teachers in the school. Beaty and McGill (1995) describe action learning has a continuous process of learning and reflection supported by colleagues, with an intention of getting things done. Through action learning individuals learn with and from each other by working on real problems and reflecting on their own experiences. The teachers undertook action learning and research as a part of, rather than
separate from, their classroom practice. Collaboration between the researchers and teachers was established and project actions cycled between planning, acting, describing and critically reflecting (Murcia 2005).

(i) Planning an action research project.
The teachers selected a literacy or numeracy focus for their classroom project. Each teacher’s project was then based on an aspect of classroom practice that had as a foundation the utilisation of Interactive Whiteboard technology for improving students’ literacy and numeracy outcomes. Teachers were supported in the planning process by professional learning meetings which provided an orientation to international initiatives and research into IWB pedagogy.

(ii) Reflecting on the action research process.
The project provided time for teachers to develop, trial and assess IWB teaching and learning strategies. The common focus provided the connectedness, which enriched the whole group’s reflective process. Teachers shared their ideas, strategies, reflections and impact assessment at regular facilitated project team meetings. Teachers were encouraged to keep a learning journal and share their experience through interim presentations to the group. Structured exercises were also used at facilitated action team meetings to increase the depth and critical nature of the teachers’ professional reflection. This collegial sharing of ideas supported and motivated members of the group. The time and support offered by the action team meetings contributed to maintaining the momentum of the project and assisted the project teachers in making a mid-project presentation to the project team and writing their final project case study. The case studies were a significant source of research data but importantly enabled teachers to share their project experiences and learning with the broader education community. Grundy (1995) suggested case studies bring enormous satisfaction to the group as they distil the experience of the project and provide assurance to participants that something worthwhile has been achieved. The case studies demonstrated the teachers’ professional activities and made their process and outcomes accessible to others.
(iii) Analysing the qualitative data

The facilitated team meetings were an opportunity to document the teachers’ comments and importantly probe their thinking on issues related to their professional learning journey with IWB technology. This documentation, in conjunction with the teachers’ interim project presentations and final case studies provided rich data for analysis. The two researchers independently conducted a mapping exercise across the qualitative data. The researchers examined the teachers’ case studies and the documents collected during facilitated team meetings to identify themes and issues surrounding teachers’ use of the IWB in their classrooms. There was a high level of correspondence between the two independent analyses of the data and they converged to produce the project findings.
Findings

The project findings indicate that children had positive responses to the use of the IWBs in their classrooms and teachers reported advances in children’s literacy and/or numeracy over the course of the project. The findings also revealed signposts of teachers’ IWB development as they trialed strategies for promoting children’s literacy and numeracy learning. In addition, the data analysis revealed significant issues that played out alongside teachers’ IWB development and were clearly crucial to its progress. These findings have implications for teacher professional development and highlight particular conditions or characteristics as critical to teachers’ IWB professional learning.

The findings also reveal that using the IWB to improve literacy and numeracy outcomes is inextricably linked to effective use of ICT and pedagogical change. The usefulness of the IWB in promoting children’s literacy and numeracy depends on the reliability of the ICT equipment and support for its use, the skills of the teacher and the teacher’s response to the learning needs of individual class groups. The case studies reflect both the differing ICT skill levels of the teachers and the individual literacy and/or numeracy learning needs of their classes and hence the teaching and learning foci and use of strategies. In trailing and implementing teaching and learning strategies that utilise IWB technology for improving children’s literacy and numeracy development, the teachers revealed that the IWB is a tool that relies on sound pedagogy and response to the unique learning context. When used most effectively, the children and their unique needs are at the centre of teaching and learning, and the IWB is a versatile technical tool available to the skilled teaching professional.

Part A: IWB Questionnaire

The children in the Teacher’s classrooms completed pre- and post-project IWB Questionnaires, which measured their attitudes towards the use of IWB technology in their learning. The total data was collected from 76 children consisting of 60.6% (43/71) boys and 39.4% (28/71) girls (5 children, data unknown). There was some change in the pre-post sample with some children completing the post-project questionnaire who were not a part of the pre-project data collection and others who only completed the pre-project
questionnaire. There were 74 students who completed the pre-questionnaire and 73 students who completed the post questionnaire (Figure A).

**Figure A** Year of birth of the primary school children in the sample (N = 76)
Figure B compares the average level of agreement shown by the boys and girls in the sample at pre-project. A high level of agreement was generally exhibited by both boys and girls. Independent samples t-tests revealed no significant gender differences in average level of agreement for any of the IWB Questionnaire items ($p > .05$), except questions 9 and 16 (i.e. ‘Q9 Maths is easier for me on the IWB’; ‘Q16 I listen to the teacher when they use the IWB to explain new ideas’). That is, boys perceived maths to be easier using the IWB than girls (mean: 2.7 vs 2.3, SD: 0.7 vs 0.9), $t(48.43) = 2.2, p = .033$.

Furthermore, girls felt that the IWB was more useful than boys when listening to the teacher explain new ideas (mean: 2.9 vs 2.6, SD: 0.3 vs 0.6), $t(64.35) = -2.22, p = .03$.

![Figure B](image)

**Figure B** Average ratings given to each IWB Questionnaire item at pre-project by primary school children, according to gender
Figure C, which follows compares the average level of agreement shown by the primary school boys and girls in the sample at post-project. Again, a high level of agreement was generally exhibited by both boys and girls.

Figure C  Average ratings given to each IWB Questionnaire item at post-project by primary school children, according to gender

T-tests revealed no significant gender differences in average level of agreement for any of the IWB Questionnaire items ($p > .05$) post-project, except question 1 (i.e. ‘Q1 Working on the IWB makes me happy’). Girls gleaned significantly greater satisfaction working with the IWB than boys (mean: 3.0 vs 2.8, SD: 0.4 vs 0.2), $t(61.96) = -2.22, p = .03$. 
Pre to Post-Project Changes in Children’s Attitudes to the Use of the IWB

Frequency histograms exhibiting both the children’s pre and post project level of agreement (disagree, neutral, agree) for each item in the IWB Questionnaire are contained in Appendix 2. The histograms illustrate that the children consistently endorsed a high level of agreement to all items on the Questionnaire both pre and post-project. In fact, children’s responses for more than half the questions were extremely skewed toward agreement (i.e. data is non-normally distributed). The histograms indicate, however, that there was greater diversity in children’s responses to the post-project questionnaire items compared to pre-project.

There were generally no significant shifts in children’s attitudes towards the IWB during the project (\(p > .05\)), but with two exceptions. T-tests revealed significant differences in the average level of agreement for two of the IWB Questionnaire items (\(p > .05\)). These were questions 9 (‘Q9 Maths is easier for me on the IWB’) and 14 (‘Q14 I can do my best work when I use the IWB’). At post-project, children had significantly greater belief in the IWB making maths easier (mean: 2.5 vs 2.8, SD: 0.83 vs 0.55) than at pre-project, \(t(70) = -2.24, p = .028\). Similarly, children also possessed significantly greater belief in their ability to produce their best work using the IWB (mean: 2.3 vs 2.6, SD: 0.83 vs 0.63) by the end of the project, \(t(70) = -2.01, p = .048\).

Factor Analysis

Factor analysis was conducted on the pre-project questionnaire data in order to determine the working of each item in relation to the scale construct. Initially, the suitability of the 16 IWB items was examined for interrelationships or intercorrelations between all the items. Twelve of the 16 items correlated with at least one other item, suggesting most items were reasonably suitable for factor analysis. The remaining four items, however, were excluded on the basis of some degree of unrelatedness (i.e. correlation with few or no other items), ‘Working on the IWB makes me happy’ (Q1) and ‘I get excited when I am asked by the Teacher to work on the IWB’ (Q6), ‘My teacher should use the IWB more often in class’ (Q3) and ‘I like using the IWB because I can rub out easily’ (Q12).
Analyses of the 12 retained items yielded a four factor solution. The contribution of each factor was relatively equitable.

- **IWB Facilitation of Learning** (Factor 1)
- **IWB Facilitation of Understanding** (Factor 2)
- **Experience of School Enhanced by Using IWBs** (Factor 3)
- **Schools Need IWBs** (Factor 4).

The identification of these factors within the scale contributed to analysis of the project teachers’ case studies. The factors assisted in drawing out qualitative evidence of the IWB’s impact on the project children’s literacy and numeracy development.

**Part B: Teachers’ action research**

At the outset of the project each of the four teachers had different levels of skill in ICT use and experience with the IWB. Each teacher also had a class with individual learning needs in the areas of literacy and numeracy. The case studies reflect both the differing ICT skill levels of the teachers and the individual literacy and/or numeracy learning needs of their classes and hence their teaching and learning focus and their use of strategies. Each teacher chose either a literacy or a numeracy focus for their action learning project which is evident in the project titles and the strategies they describe in using the IWB. For example, one teacher identified a numeracy focus for her project with the main aim being to increase her students’ repertoire and use of mental strategies to solve mathematical problems. One of her strategies was to create a sorting box using a layering technique developed over the course of the project. The sorting box enabled students to place multiples of two into the box whereas other numbers would not go in, meaning the activity was self correcting. The teacher had progressed from using on line ready-made resources to developing her own resources to meet the individual needs of her students. She explained:

*I made more sorting boxes for multiples of 3, 4 & 5. Discussions during these activities were exciting as some students were interacting trying to find patterns in the numbers without being
prompted. This was a big leap forward in terms of the students directing their own learning.

Another teacher who described herself as an ICT novice used the IWB to complement the hands-on and pen and paper aspects of learning tasks:

I have used a few online sites, with relevant clock and time activities, to reinforce the telling of time using analogue and digital clocks, comparing the time readings between the two. The children who were having difficulty with time, showed greater confidence when it was presented in a bright ‘game’ like way, with the ‘Try again’ prompt giving them multiple attempts to practice and learn the telling of the time.

The teachers’ complete case studies are included at Appendix 3. Analysis of the complete qualitative data set resulted in the identification of a continuum of teachers’ IWB development. Themes and issues surrounding the teachers’ development also emerged as significant findings in this project.

(i) Continuum of Teachers’ IWB development

A seven-stage continuum of Teachers’ IWB development emerged out of the data. This continuum began at the novice level and progressed through to critical use of IWB for facilitating students’ achievement of learning outcomes. Each stage was signposted by a significant question that drove the teachers’ professional learning. Further more, critical incident stories were found within the teachers’ case studies and used to capture and communicate the experience of the teachers at each stage. These stories add depth to the continuum and allow the voices of the teachers to be heard in the sharing of the research experience. Discussion of each stage of the continuum is signposted below and illustrated with a teachers’ critical incident story.

1. Raising awareness: How can I get an IWB in my classroom?

The first time I laid eyes on an IWB I immediately began to see potential uses for the classroom. It was exciting, bright colours, fast pace and with so many options. Being able to touch and move the words and images on the board was fascinating. There was even a touch of magic as words appeared with a
wipe of an eraser. I could see the children in the classroom being captured by this technology. However, I thought having one of these in my own classroom was just a dream. Little did I know that in time I would have a wall mounted IWB in my own classroom.

Initial product demonstrations by the suppliers of the IWB were fast paced and visually stimulating. The project teachers were engaged and considering the potential of the technology for supporting their classroom teaching and learning. They valued the interactivity in the board and its potential for supporting effective teaching and learning. Importantly, these teachers made a professional commitment to learning IWB skills.

2. Getting started: Where does this cord go?

I had a vague idea of the IWB’s capabilities but I felt I was in the shallow end of the sand pit, without even a bucket and spade. I didn’t even know how to turn it on, or even which components I needed in order to make one work. I was a novice and I needed help. I approached a colleague who was happy to help me get started with setting up the board. She even photographed which cord went where, mounted it onto card, labelled the parts, listed instructions and laminated.

There was some degree of anxiety amongst all teachers when first accessing an IWB. The novice teachers found setting up the board intimidating. Their confidence level did vary and it appeared to be correlated with their general ICT skills development.

3. Using the tools: What can I do with the IWB?

Most teachers took the time to experiment with the IWB. All of us experienced similar types of problems – learning how to switch the laptop screen display, accessing the wireless network, positioning the projector for maximum space and how to realign the IWB. Over time some of us tried out the IWB software tools like pen types, colours, shapes, shading and screening. I remember writing clearly on the board even took a little practice.
Teachers explored the IWB tools and experimented with their functions. They developed skills in writing on the board and basic actions such as drag and drop. They were observed importing tools and functions from other types of more familiar software, for example Microsoft power point and publisher. During this stage teachers gained greater confidence in setting up the IWB and using it in the classroom with children.

### 4. Sifting and using: What ready made on-line resources can I find and use?

I knew how I would normally teach ‘understand number’ but was unsure how the whiteboard was going to help me. I heard there were lots of interactive activities and games on the internet so I went searching. I found hundreds of sites that proclaimed to teach and re-enforce the concepts I was aiming for. I spent night after night sifting through on-line interactive activities. I was playing games, shooting aliens, duelling pirates and rolling virtual dice. Every time I found a site that looked stimulating I would bring it into the classroom and spend the proceeding half hour teaching the concepts behind the game. We would then play the game as a group.

Teachers used the IWB as a way to display their computer screen to the classroom. For example, Google searches were conducted and displayed on the IWB so students could observe and learn ICT literacy skills. Interactivity was introduced through ready made on-line activities. Children were using the IWB under the Teacher’s direction while observed by the whole class or in small groups. One teacher described these as ‘Friday afternoon’ activities. Others used the on-line activities to reinforce learning and reward positive behaviour. All teachers observed overtime the variable quality of the on-line interactive materials.
5. Making resources: How can I tailor make activities for the children's learning needs?

I had a go at developing my own resources targeted to the children’s specific needs and interests. In the beginning, I learned how to use ordering and layering of objects to allow or not allow them into a sorting box using the IWB software. I used pictures form the interactive software gallery and collected others from the internet. I cloned images and later as I gained more confidence and skills linked in sounds and video clips. I scanned books and recorded myself and later the children reading. There were so many options and I only felt limited by my imagination.

Teachers found that time spent searching for just the right on-line activity could at times be better used for constructing their own interactive activities. The skills used by teachers varied and increased overtime. Activities ranged in their complexity from layering images to linking in sound and video. At this stage the teachers focus continued to be on their IWB skills development but targeted to the specific learning needs of the children in their classroom.
6. Integrating activities: How can I integrate the IWB into a meaningful learning sequence?

I experienced a ‘Damascus Road’ in the form of Book Week. It seemed a fantastic week where learning tasks, IWB and the class all seemed to merge together. I remember thinking ‘If this is what it is going to be like – WOW!!!’

There was one particular day where everything just seemed to flow. Learning happened at the board, children were thinking and talking; then consolidating their learning at their desk. Experiencing this at the Board, in the Head and on the Desk approach dramatically altered how I viewed the IWB and its place in learning tasks. I was now using the whiteboard as a tool to support what I wanted to teach instead of the board driving what I did.

The teachers’ thinking about teaching and learning with the IWB shifted at this stage of their development. The IWB was no longer the centre of the learning experience but an integral component, fluently integrated with a range of learning activities and styles. There was increased awareness of the connections needed between what happens on the IWB with children’s talking, thinking and at desk tasks. Each component of the learning became related and consistent. The biblical Damascus Road reference made by one Teacher reflects the significant realisation and fundamental shift in the manner in which IWB was integrated into their classroom learning experiences.
7. Embedding in practice: Would I want to teach without an IWB?

I think I have completely changed the way I teach. I use the board every day, in almost every lesson and for integrating the curriculum. For example, using the interactive notepad supported smooth transitions between learning about large numbers in resources I had created and the linked internet sites which used large numbers in context. The children had an opportunity to be numerate; that is not just able to understand what large numbers were but actually using them in real life situations. My whole practice of teaching had shifted focus. I now had all of the resources of the ‘real world’ right at my fingertips. I have come to depend on the IWB in my teaching. I find that the first thing I am doing every morning is connecting my board and checking the alignment. The board is always on stand by for use in every learning area.

Teachers had become critical users of the IWB technology. They were purposeful in its use and reflective about its impact on children’s learning. The IWB had become embedded into their daily practice and there was fluency with its use. Teachers were preplanning interactive activities but now also using the IWB as a strategy for responding to children’s learning needs in the moment.

(ii) Emerging Issues and themes

In the identification of signposts in teachers’ development of effective IWB use, other issues emerged that played out alongside their development and were crucial to its progress. In particular, the reliability of the different technologies, the availability of effective ICT support and access to the IWB technology (for both children and teachers) emerged as significant.

Permanent fixed boards vs mobile

In the early stages of school’s use of IWB technology, the teachers had access to mobile IWBs in a common foyer. The rationale was that, the IWBs would be mobile in order to increase accessibility to what was a very expensive resource. This meant that access to the boards had to be negotiated between teachers and the laptop, data projector and board had to be set up each time the boards were used. In addition, there were the challenges associated with
learning how to connect and set up the equipment, positioning the projector and cords to accommodate children and constant realignment of the board if the projector or board were moved. The mobility of the boards clearly led to problems in making the technology user-friendly or effective as a teaching tool which has also been reported in the literature (Higgins, Beauchamp & Miller, 2007). One of the teachers described the difficulties associated with the mobile boards:

In the classrooms with no IWB attached, where one would have to find time to move the mobile board from the upstairs storeroom, locate missing cords, connect it up and the projector, align the screen, train the children in the safe movement around the mobile board with all the cords crossing over the floor? I knew why they were not using the mobile board.

At the commencement of the project the teachers claimed the mobile IWBs for themselves, as they were not being used elsewhere in the school. Once the boards were fixed in their classrooms, the teachers used the boards across the curriculum and engaged the children in their use on a daily basis. These teachers were willing to experiment and incorporate this medium as a part of the learning experiences and this was clearly supported by the boards being fixed rather than mobile. One of the teachers commented, “Having the IWB mounted I believe was a pivotal moment in our IWB development. It is then that the IWB really launched itself and activities clearly made the transition to learning tasks”.

ICT support in the moment

The project teachers experienced technological difficulties throughout the project that clearly detracted from the effective use of the IWBs. In some instances, the teachers felt lack of ICT support and reliability of technology sabotaged their efforts. As the effective use of the IWB depends on the connection between a range of component technologies, any problem with one component can mean the IWB will not function. Problems with technology are frustrating at any time but even more so when the class lesson is abruptly interrupted by failure of the technology to fulfil its function and ICT support is not at hand. For example, there were numerous instances where the school wireless network would drop out, the laptop would not function or the IWB would not connect to other technologies. There were also compatibility issues
between technologies. This was exacerbated by lack of collaboration between sources of support and willingness for those from different organisations to work together. For example, it was sometimes the case that the school ICT support based off campus would not address a particular issue because “our school system does not support that particular technology”. The availability of effective ICT support emerged as a significant issue in the project.

Techno-resilience

The teachers attribute a great deal of success in using the IWB technology to their techno-resilience. Although the project teachers experienced technological difficulties that hindered some of their efforts, their determination to make the IWB technology work ensured they developed their skills in the long term. One of the project teachers describes his determination amid technological difficulties:

There are many times even today when the computer crashes, the scanner doesn’t seem to want to connect or the server is down and the Internet unavailable – but it doesn’t mean we pack everything up every time this occurs (mind you there have been many a time where I have felt the urge to hurl my laptop out the closed window). We persist and try again. The same applies to the IWB. I am really pleased I persisted with my efforts in using the IWB. I know with certainty that I wouldn’t be where I am today in terms my own skill development or have watched the development of my student’s confidence if I had given up.

As problems in the use of technology were overcome, setbacks were transformed into steps forward. These steps forward were documented as part of the action research process and then shared and celebrated with project team members. Despite each of the teachers having different levels of ICT skills and experience at the outset of the project, each of the teachers moved steadily forward in their development as the project progressed. Throughout the project it became clear that techno-resilience was bolstered by the support and community created by the action research context.

Children as part of the learning community surrounding the IWB

It was evident throughout the project that the teachers did not use the IWB as another means of chalk and talk but were aware of the importance of bringing
children into the IWB interaction. Each teacher maintained a focus on children's development in the use of the technology and ensured children remained at the centre of the learning.

Alongside the teachers’ development in the use of IWB technology, children were also developing their skills in its use. The project revealed that the children needed access to the board and the time and opportunity to explore along with the teachers. Teachers reported that it took time for some children to “drive” the IWB yet they were keen to “have a go and take risks”. The children often became expert at setting up the board or solving problems. One teacher reported that if her students had problems clicking and dragging objects on the board, they would ask her, “Are you sure you lined up the board this morning?” Children were clearly part of the learning community surrounding the teachers’ IWB development.

**Teachers’ evidence of improved literacy and numeracy outcomes**

The project teachers' Case Studies provided further evidence of children’s improved literacy and numeracy learning when the IWB was used effectively. This evidence also supported the findings of the IWB Questionnaire and illustrated children’s positive attitudes to learning with the technology. For example, two of the project teachers described children’s responses to their use of the IWB as follows:

> Their body language often changes, from slouched or ‘away with the fairies’ to more upright, leaning forward and eyes focussed on the teacher, the board and the activity. They all volunteer to be an active participant in manipulation on the board.

> All of a sudden these normally quiet students were showing confidence and calling out answers and things for others to try.

Positive attitudes to the use of IWB technology appeared to translate to improved achievement of numeracy and literacy outcomes. One of the project teachers reported a huge step forward for a child with learning difficulties in the area of literacy. The significance of this child’s progress was further recognised and supported by the other project teachers who had taught the child in the past. The child’s development is illustrated in the following quote:
At one point I was explaining the meaning behind the word liberia (Italian) in an IWB LOTE lesson – it is very much like library but actually means bookshop. As I wrote down bookshop, Ross declared out loud that he didn’t have to look at the word “book” because he remembered it from when I wrote it down earlier in the week. … So what makes this comment so remarkable? First, he spoke out in front of the class, out of turn in order to engage me. Secondly, he linked the present word to a word he’d seen in the past. Thirdly, he linked the word to the IWB. Fourthly, yes he had remembered the word and had correctly written it down without assistance. Surely one giant step!

Along with anecdotal reports of improved achievement, two project teachers used Student Outcome Mathematics tests produced and distributed in WA by a private company called Easy-Mark, to measure their students’ numeracy growth. These outcomes based standardised tests were administered before and after the project. Both teachers reported movement or increases in student achievement beyond what is expected as natural growth. In this context, improvement is measured by a unit referred to as a stanine and any improvement above one stanine is considered having added value. The following quote is a Teacher’s example of this growth in the children’s numeracy achievement.

> It is expected that the growth of a student over the year will be approximately 1 stanine. I have generally found this to be the case, however this year the focus group has made improvements of 1.2 stanines on average above the expected growth. The only difference in my teaching this year has been the IWB. From this I could assume that the IWB has been the significant factor in the perceived improvements.

**Discussion**

The findings of this project reveal that using the IWB to improve literacy outcomes is inextricably linked to effective use of ICT and pedagogical change. The usefulness of the IWB in promoting children’s literacy and numeracy depends on the reliability of the ICT equipment and support for its use, the skills of the teacher and the teacher’s response to the learning needs of individual class groups. The case studies reflect both the differing ICT skill levels of the teachers and the individual literacy and/or numeracy learning needs of their classes and hence the teaching and learning focus and use of strategies. In trailing and implementing teaching and learning strategies that
utilise IWB technology for improving children’s literacy and numeracy development, the teachers revealed that the IWB is a tool that relies on sound pedagogy and response to the unique learning context. When used most effectively, the children and their unique needs are at the centre of teaching and learning, and the IWB is a versatile technical tool available to the skilled teaching professional.

The findings also indicate that initial product demonstrations often raise awareness of the potential of the IWB but professional learning must go much further than this in order for IWBs to be used effectively in classrooms. Although teachers need information that answers the “Where does this cord go?” type of questions early on in their IWB development, they also require expert input at stages of their development and benefit from collegial collaboration with their teaching peers. Congruent with the findings of the present study, Miller and Glover (2007) found that teachers within secondary schools supported each other’s IWB development. They also suggested that large scale introduction of new IWB technology may lend itself to large group lectures and demonstrations by IWB suppliers but there is also need for deeper subject-specific pedagogic training for maximize the learning potential of the equipment (2007:320). Further, and in common with the present study, Miller and Glover (2007) proposed three developmental phases or levels of teacher development in the use of the IWB which share common features with the developmental continuum arising from the present study. Miller and Glovers three phases of IWB use are as follows:

1. Supported didactic - the teacher is using the IWB as visual support to lessons;
2. Interactive – the IWB is integrated into lessons to present verbal, visual and kinesthetic stimuli; and
3. Enhanced interactive - the IWB is integral to lessons, integrating concept and cognitive development in a way that exploits its interactive capacity.

Although these three phrases are evident in the continuum of teacher development proposed here, this 7-stage continuum provides fine-grained detail illustrated by teacher’s driving questions and classroom stories. The
teachers in the present study moved towards a more advanced level of IWB use and asked *How can I integrate the IWB into a meaningful learning sequence?*, where the IWB was no longer the centre of the learning experience but an integral component, fluently integrated with a range of learning activities and styles. The teachers then moved to a stage where the IWB was embedded in their practice and they asked, *Would I want to teach without an IWB?* and reported they had changed their practice. In common with Miller and Glover’s *enhanced interactive* phase the teachers had become critical users of the IWB technology. When working at stage 7 of the developmental continuum, they were purposeful in its use and reflective about its impact on children’s literacy and numeracy learning as illustrated by the following quote:

*By having the ability to more readily teach and evaluate true numeracy in children via real life use of maths I have discovered that many of the children I would have assumed were numerate were not necessarily so. I think over the years I slowly began to teach maths rather than numeracy and by having the IWB I found that I have now started teaching numeracy again. The board allows me easy access to the internet which is real life, I find it so much easier to explicitly teach how to be numerate and use my knowledge of maths to do so.*

The IWB had become embedded into their daily practice and there was fluency with its use. Teachers were preplanning interactive activities but now also using the IWB as a strategy for responding to children’s learning needs in the moment. These aspects of the IWB transforming teaching practice and enabling teachers to respond to the “teachable moment” in the present study are also reported both by Haldane (2007) and Hodge and Anderson (2007).

Overall the findings showed children in the project had a positive attitude to the use of IWB technology in their classrooms. This is evident both anecdotally throughout the teachers case studies and from the student questionnaire responses. This finding is consistent with much of the literature concerning the use of IWBs in the classroom. For example, Levy (2002, cited by Hodge & Anderson, 2007: 273) conducted a study in the secondary school context and reported that both *learners and teachers perceive a significant role for the IWB in helping to motivate students, focus their attention, and stimulate involvement in whole class learning.* Questionnaire responses suggested that children’s
motivation and engagement with learning increased when their teachers effectively use IWB technology in the classroom. A majority of children believed their school should have more IWB technology and they wanted their teacher to use the IWB more often in their classroom. The majority of children said using the IWB made them happy and it was exciting. Although the evidence regarding children’s motivation and engagement in this project has been gleaned from a relatively small sample, it is consistent with others in that the use of ICTs in the classroom tends to have positive impacts on student motivation and attainment (Hall & Higgins, 2005) and the IWB is reported in the literature as a positive influence on learner motivation and engagement and on learning processes such as thinking skills and encoding and retention of information (Hodge & Anderson, 2007: 272). The IWB Questionnaire used in the present study has provided a quantifiable measure of the IWBs impact on primary school children’s motivation and engagement with learning. This Questionnaire represents a new foray into the evaluation of IWB technology in classrooms and may contribute to further research.

Children’s responses to the questionnaire items suggest they found a learning benefit in the large and flexible learning space created by the IWB. In particular, 79% of children believed learning math was easier for them when using the IWB and 56% thought reading and writing was easier on the IWB. The children’s responses to the questionnaire items indicate that particular features of the IWB supported their learning. For example by the end of the project, 74% of children liked working on the IWB because they could rub out easily. This encouraged a degree of risk taking in their learning with reduced anxiety about getting the wrong answer. In addition, 82% of children post project stated being happy to have a go and try out ideas when working on the IWB and 86% agreed they listened to the teacher when they used the IWB to explain new ideas.

The project revealed that the children needed access to the board and the time and opportunity to explore along with the teachers which is also reported by Hall and Higgins (2003). It also demonstrated that children were clearly part of the learning community surrounding the teachers’ IWB development and the IWB also contributed to the classroom being a learning community. Hodge and
Anderson (2007: 280) reported this effect and suggested that because the IWB allows students to work together in groups and discuss and question what is happening, it enhances the spirit of inquiry and strengthens the class learning community.

**Conclusion**

The findings of this project suggest that in order to ensure sustainable and embedded use of IWBs in classroom practice, teacher development in the use of IWBs needs to be viewed as an evolution rather than a revolution. The Signposts in Teachers’ IWB Development identified in this project illustrate that teachers cannot move straight from learning how to set up the board to effectively embedding the IWB in their practice. The implications of these findings for teachers’ IWB professional learning follow.

Recommendations for teachers’ learning in the use of IWB technology emerged from the identification of developmental signposts in using IWB technology. This research highlighted four conditions or characteristics as crucial to Teacher IWB professional learning:

1. **An effective learning support framework**
2. **A context for constructive collaboration**
3. **Expert input at point of need**
4. **A focus on manageable change and development**

(i) **An effective learning support framework**

Much of the teachers’ success in this project can be attributed to their commitment to making the IWB work for them in order to facilitate children’s learning. The framework provided by the action research model gave teachers a way to learn from their action. Time was provided for planning, implementing ideas, observing, questioning and critically reflecting. The action research framework required teachers to question their perspectives of teaching and learning and the needs of the children in their classrooms. This questioning provided the focus necessary for a successful professional learning journey. In this project the teachers chose either a literacy of numeracy focus and this became the driver of changes to practice. The collegial nature of the action
research approach enabled individuals to receive support from their colleagues in directing their own professional IWB learning.

(ii) Constructive collaboration

In order for the IWB to be used effectively, a collaborative approach has to be developed and supported throughout the learning process. Time must be set aside for collegial collaboration, brainstorming and developing skills with the technology. Colleagues or others who act as critical friends also provide a context for sharing dilemmas, valuing learning and celebrating progress. In the case of this project, the action research framework provided a sound structure for meetings, time to explore the IWB and most importantly time for critical professional reflection on the learning journey. One of the project teachers described this constructive collaboration:

The team I worked with in the project on campus were supportive and happy to share with each other. Many discussions were held around the school, over staff room tables, climbing staircases together or during other incidental meetings. Our project days on the Murdoch campus were invaluable as far as reflecting on our journeys and defining our next steps. Constructive collaborative time and support is imperative for the successful implementation of IWB into classrooms.

(iii) ‘Expert’ input at point of need

The project demonstrates that professional development needs to be tailored to the needs of teachers at different stages of their development in the use of IWB technology. As teachers develop, their professional learning must have the capacity to work with their existing knowledge and established skills and extend those further. In the early stages of the project, the teachers attended a 2-hour session on site with a UK, internationally recognised expert in the area of IWB technology. He demonstrated some of the capabilities of the board and in particular introduced them to some simple techniques that were eagerly practised and then modified by the teachers. This session was pitched to the teachers at their level of IWB development and individualised in that they could determine to some extent what was covered. One of the teachers describes this learning:
I was pretty familiar with what he was doing until he showed us the sorting box created by a layering technique with the IWB software. He showed us how to use ordering and layering of objects to allow them or not allow them into the auto shape box. It was a simple idea and I was hooked.

Midway through the project, the Murdoch researchers arranged for a consultant to provide IWB skills development that specifically addressed teachers’ individual learning needs. Later in the project, one of the teachers attended a school-based conference, which then motivated him to access on-line learning and attend network meetings with other active classroom based IWB users. The importance of professional learning at point of need cannot be overstated. The learning must be tailored to individual or group learning needs and provided at different stages of Teacher development.

(iv) A focus on manageable change and development

Teacher development in use of IWBs should be understood as an evolution rather than a revolution. The developmental signposts identified in this paper reflect the notion that teachers cannot move straight from learning how to set up the board to embedding the IWB in their practice. The teachers in this project were prepared to keep moving forward by breaking with familiar practices and moving out of their comfort zones. They focussed on manageable change and the expectations of their own development were realistic. This gradual development is key in the process of teacher professional learning in the use of IWBs.

Future directions for IWB research

Teachers involved in this project found that over the course of the year more and more teaching colleagues were taking an interest in what was happening with the IWB project group. Enquires were made about future courses or IWB options. Time frames were also being discussed as to when other classrooms would be fitted with an IWB. This interest was evidenced by reports of both teachers and children stopping to watch IWB activity through their classroom windows. Clearly there was a ripple effect which emanated from the project teachers commitment to IWB learning. The project teachers have become
school based leaders and mentors developing IWB pedagogies. Miller and Glover (2007) have referred to such teacher experts within school sites as “missioners” and suggest that their role is vitally important in assisting whole school IWB development.

The teachers’ commitment to their learning journeys has been captured through the project activities and can now through this report be shared with the broader education community. The case studies are a rich source of examples of IWB use and teachers’ reflections on their own professional learning that could be employed by teachers in the wider education context to assist in their own IWB development.

The observed ripple effect is ongoing and also affects the project teachers as they continue to reflect and move forward with their IWB practice. The Project Team’s thinking about ways to move forward with IWB research and practice featured the notion of children as the creators of IWB activity. This is captured in the following quote.

*Children could construct a model with a friend, photograph it, edit and present it to the class on the interactive whiteboard. They could even publish their interactive materials online for other students to use. Imagination and creativity can explode with what is possible!*

This shift from teacher’s creativity to the children as creative users of IWB technology was also evident in recent research by Wood and Ashfield (2008). They stated that *creative teaching, which aims to develop pupils’ own creative thinking processes, could be said to move the focus away from the teachers’ delivery and towards the pupils’ learning (2008:94).*

In conclusion, the teachers in this project moved from being IWB novices to critical practitioners. This required time, planning and collegial collaboration which is evident throughout the IWB literature (Armstrong et al, 2005; Hall & Higgins, 2005; Kennewell & Morgan, 2003; Miller & Glover, 2007). These Teaching professionals understood the importance of innovation and creativity for evolving their practice. The IWB was a medium for exploring their teaching and allowed them to expand their effective practice. Although the project focussed on the IWB it was evident that the board was only a tool, which had
the capacity to support effective teaching and learning. This is further supported by the following quote:

*Good teaching remains good teaching with or without the technology; the technology might enhance the pedagogy only if the teachers and pupils engage with it and understood [understand] its potential.*

*(Higgins, Beauchamp & Miller, 2007:217)*
References


Glover, D. & Miller, D. (2002). The interactive whiteboard as a force for pedagogic change: the experience of five elementary schools in an English Education Authority Information Technology in Childhood Education Annual (2002), 5-19


## Appendix One: IWB Questionnaire

**BOY / GIRL**  Birthday: ______________  Class: ______________

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Working on the IWB makes me happy.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>2. Our school should have more IWBs.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>3. My teacher should use the IWB more often in class.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>4. More time using the IWB would make school better for me.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>5. School would be boring without the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>6. I get excited when I am asked by the Teacher to work on the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>7. Learning is fun when we use the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>8. I have more energy for learning when we use the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>9. Maths is easier for me on the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>10. Reading and writing is easier for me on the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>11. The large space on the IWB makes working out problems easier.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>12. I like using the IWB because I can rub out easily.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>13. The IWB helps me understand in class.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>14. I can do my best work when I use the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>15. I am happy to have a go and try out an idea when working on the IWB.</td>
<td>😊</td>
<td>😊</td>
</tr>
<tr>
<td>16. I listen to the teacher when they use the IWB to explain new ideas.</td>
<td>😊</td>
<td>😊</td>
</tr>
</tbody>
</table>
Appendix Two: Pre and Post project Attitude to IWB

Figure 33  Children’s levels of agreement across time on question 1 of the IWB Questionnaire

Q1 Working on the IWB makes me happy

<table>
<thead>
<tr>
<th></th>
<th>Pre-IWB</th>
<th>Post-IWB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Neutral</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Disagree</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Frequency

Figure 33  Children’s levels of agreement across time on question 1 of the IWB Questionnaire
Figure 34 Children’s levels of agreement across time on question 2 of the IWB Questionnaire

Q2 Our school should have more IWBs

Post-IWB

Pre-IWB

Questionnaire

Frequency

Agree

Neutral

Disagree

44

14

20

15

13

0

10

20

30

40

50

60

70
**Q3 My teacher should use the IWB more often in class**

![Bar chart showing children's levels of agreement across time on question 3 of the IWB Questionnaire.](chart.png)

*Figure 35 Children's levels of agreement across time on question 3 of the IWB Questionnaire*
Figure 36 Children’s levels of agreement across time on question 4 of the IWB Questionnaire

Q4 More time using the IWB would make school better for me

<table>
<thead>
<tr>
<th>Agreement</th>
<th>Frequency</th>
<th>Pre-IWB</th>
<th>Post-IWB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagree</td>
<td>10</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Neutral</td>
<td>21</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td>Agree</td>
<td>45</td>
<td>42</td>
<td>45</td>
</tr>
</tbody>
</table>

Figure 36 Children’s levels of agreement across time on question 4 of the IWB Questionnaire
Figure 37  Children's levels of agreement across time on question 5 of the IWB Questionnaire

Q5 School would be boring without the IWB

Questionnaire
- Pre-IWB
- Post-IWB

Frequency

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>47</td>
</tr>
<tr>
<td>Neutral</td>
<td>37</td>
</tr>
<tr>
<td>Disagree</td>
<td>14</td>
</tr>
</tbody>
</table>

Figure 37 Children's levels of agreement across time on question 5 of the IWB Questionnaire
Figure 38 Children's levels of agreement across time on question 6 of the IWB Questionnaire
Figure 39  Children’s levels of agreement across time on question 7 of the IWB Questionnaire

Q7 Learning is fun when we use the IWB

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Pre-IWB</th>
<th>Post-IWB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagree</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Neutral</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Agree</td>
<td>58</td>
<td>56</td>
</tr>
</tbody>
</table>

Figure 39 Children’s levels of agreement across time on question 7 of the IWB Questionnaire
Figure 40  Children’s levels of agreement across time on question 8 of the IWB Questionnaire

Q8 I have more energy for learning when we use the IWB
Figure 41 Children’s levels of agreement across time on question 9 of the IWB Questionnaire

Q9 Maths is easier for me on the IWB

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-IWB</td>
<td>15</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td>Post-IWB</td>
<td>4</td>
<td>11</td>
<td>58</td>
</tr>
</tbody>
</table>
Figure 42 Children’s levels of agreement across time on question 10 of the IWB Questionnaire

Q10 Reading and writing is easier for me on the IWB
Q11 The large space on the IWB makes working out problems easier

Figure 43  Children’s levels of agreement across time on question 11 of the IWB Questionnaire
Figure 44 Children’s levels of agreement across time on question 12 of the IWB Questionnaire

Q12 I like using IWB because I can rub out easily
Figure 45  Children’s levels of agreement across time on question 13 of the IWB Questionnaire

Q13 The IWB helps me understand in class
Figure 46  Children’s levels of agreement across time on question 14 of the IWB Questionnaire

Q14 I can do my best work when I use the IWB

- Disagree: Pre-IWB 16, Post-IWB 5
- Neutral: Pre-IWB 17, Post-IWB 22
- Agree: Pre-IWB 40, Post-IWB 46

Frequency

Questionnaire
- Pre-IWB
- Post-IWB
Q15 I am happy to have a go and try an idea when working on the IWB

Figure 47  Children’s levels of agreement across time on question 15 of the IWB Questionnaire
Q16 I listen to the teacher when they use the IWB to explain new ideas

Figure 48  Children's levels of agreement across time on question 16 of the IWB Questionnaire
Appendix Three: Project Teachers’ Case Studies

Action Research
Interactive White Boards 2007

Emerging from the sand pit

Karen Shenton

Coolbellup Community School
Purpose

- At the beginning of 2007 a team from Murdoch approached the staff on my campus, with a proposal for a collaborative enterprise between Murdoch University and Coolbellup Community School.
- The purpose of the project was to involve a team of teachers, who would form a collegial group, document their learning, collect evidence, share their experiences and reflect on the impact Interactive White Boards had on the student outcomes, as well as any change in their pedagogy.
- I was reluctant to volunteer, and took note at the information session that many of my colleagues seem to shy away from volunteering. As I sat listening to the proposal, I reflected on my time as a Post Graduate student in 2002 and how I felt overwhelmed at times with taking on the extra study, and also how eventually I came away feeling mentally refreshed and inspired to try new ways of teaching.
- I volunteered to be involved, with some hesitancy, explaining that I was not confident, had no prior experience with IWB and that I was on campus in Support and job share roles, so therefore not attached to one Learning Area (LA) aka classroom.
- I was encouraged to participate. I was nervous and unsure as to how effective a member of the study I would be, and if I would develop the skills and confidence to enable me to take this new technology onboard as a teaching and learning tool.
- Technology is an area of interest for me, even though I do not consider myself an expert in any aspect of it. I was keen to discover if the IWB would be as engaging for the students, as effective as a learning tool and means of reinforcing ‘at desk/mat’ concepts as I had experienced desk top computers and E-books to have been.
- I knew it was important to expose myself to this new technology. From my reading and discussions with others, it was part of the future in classroom practices.
- I chose to work in the context of Literacy development. After discussion with the Murdoch team, I decided to make my focus group the ITAS (Indigenous Tutor Assistance Scheme) Year Six students. They were a small cohort of seven students, all identified in the 2005 WALNA as being below the benchmark, and therefore at significant or severe educational risk. The choice to focus on basic Literacy was in response to the needs of these particular students, and meshed with the aim of the ITAS support role I was in.

Strategy

What did I already know? What did I need to find out?
How competent and confident was I with this new resource?

I felt I was in the shallow end of the sand pit, without even a bucket and spade. I knew what an IWB looked like and had a vague idea of some of its capabilities. I didn’t know how to turn one on, or even which components I needed in order to make one work. I was a novice, I needed to use all resources available to help get started on my learning journey.

Firstly, I needed to apply for a laptop in the next round from DET. I applied in the February, and after delays finally was issued with my laptop in June, with it
I then approached a colleague who was happy to give me time with her Education Assistant to help set up the mobile board. She also photographed which cord went where, mounted it onto card with labels and instruction with a laminated finish. I had intended to use the mobile IBW in the senior foyer, which had not been in use by staff since mid Term One. This became apparent when I went to use it and there were no connection cords to be found in the store or Library, and no current foyer staff knew of their whereabouts as they had not used the IBW. By this time I was wondering why I had volunteered, as it seemed to be an ongoing waiting game for the necessary hardware to come together. I notified Administration of the missing equipment and was asked to report the matter to the Library, which I did. Meanwhile, with the assistance of my colleague who was also an IBW project participant I was able to ‘play’ with the mobile board by borrowing her connection cords when they weren’t in use in her area. This only happened on a couple of occasions.

With the lack of cords available for the senior foyer mobile IWB, I was restricted in my access to a functioning board. It was not until the boards became mounted onto classroom walls in August, that I was able to really start practicing and using the IWB as a teaching tool. Until that time I had continued to use online sites as a source of motivation and reinforcement of the concepts I had covered with the students.

These sites became the foundation of the sites I used once I had greater access to the IWB. The level of interest and engagement of the students was noticeably higher when using the online resource.

I formalised my Action Research Plan with the assistance of the Murdoch Team at our P.D. day at the beginning of July. I had also begun using the Wiki on the EdNA site to communicate and feed back to other members of the Action Research. I understood that eventually the site could possibly provide some guidelines and feedback to others who were to embark on their own IWB discoveries in the future.

In the classroom, I developed the practice of modelling, at desk activities or written work, and reinforcement of concepts covered using the online resources. The site I found the most valuable for me was the Woodlands Kent site, which has an array
of bright engaging online activities and games suitable for my program and the developmental stage of my students. It also has links to many other relevant online sites. Ref: http://www.woodlands-junior.kent.sch.uk/

I used many of the phonetic based reinforcement games online and also a Look Cover Write Check program, that seemed to engage the children in this teaching strategy with greater enthusiasm than the at paper version was doing. The children enjoyed the competitiveness of some of the games, comparing their word building scores and challenging themselves to go to higher levels. I continued with the use of online sites and using the IWB when possible. The children in small groups enjoyed the IWB and interacted with the same enthusiasm they had shown with the online learning through the computers. Many times they became frustrated with the board not responding to their touch, and would be happier to sit at the laptop to manipulate the graphics on the IWB screen. With use of a cordless mouse and a cordless keyboard, I believe their interactions would be more effective. The children going back and forth to the board to use ‘touch’ were engaged, but often those not directly involved become passive and lost interest or became assertive, calling out to the participant as to what to do and which area of the board to manipulate. I realised I was still in the shallow end of the sandpit with regard to using the medium effectively, though now I felt I at least had the bucket and spade, the tools with which to experiment and trial the IWB.

One student in particular became very engaged with the online technology and the use of the IWB on the occasions we were able to gain access to it. At the beginning of the school Year I assessed him against the Commonwealth Literacy Net, and placed him at end of Year One. As a Year Six student most activities within the main classroom, especially those that involved Reading or Writing, were not within his capabilities. My objective under his IEP was for him to develop and retain the basic building blocks of Literacy. He was not able to write his full name, he did not know all his initial sounds or any blends. With using the Phonic based Fitzroy Readers, by using word and sentence construction activities and games, by modelling and practicing his writing, by using online resources via computers and the IWB, to engage and reinforce his new skills and knowledge, he made significant gains. At the end of Term Three, he was confidently identifying all initial sounds and most common blends, and applying this to his Reading and Writing.

Once I had some confidence using the IWB to engage students with available online resources, I decided to experiment by developing my own specific activities using the Notebook. I decided to design a series of simple activities to introduce and hopefully demonstrate the correlation between Multiplication and Division. After demonstrating to the children, and discussing the correlation of Addition and Subtraction, I opened up the IWB activity. This enabled students to be hands on and manipulate items into groups, to sort and divide them. They were then able to write on the board a number sentence (after I had modelled) to represent what they had done. Students were also given the opportunity to do the same at desk, with counters.

The students seemed to engage in the manipulation of the sets with great enthusiasm and many who were often passive when it came to sharing ideas,
contributed to the discussion. They were eager to tell what they had done and what they had discovered about the pattern and relationships of the numbers.

Outcomes
Each time I used the IWB or observed a colleague using one, the children’s level of engagement and enthusiasm has been high. Their body language often changes, from slouched or ‘away with the fairies’ to more upright, leaning forward and eye focus to the teacher, the board and the activity. They all volunteer to be an active participant in manipulation on the board.

Providing the IWB is working well, the level of focus remains during the lesson. When the board is not working well, with glitches with alignment or server problems, then understandably the effectiveness of the resource was diminished. In subsequent uses of the IBW I have utilised it to display information text, for shared or group reading. I have used a few online sites, with relevant clock and time activities, to reinforce the telling of time using analogue and digital clocks, comparing the time readings between the two. The children who were having difficulty with time, showed greater confidence when it was presented in a bright ‘game’ like way, with the ‘Try again’ prompt giving them multiple attempts to practice and learn the telling of the time. The lesson was reinforced with concrete aids in the classroom and with a worksheet to follow up.

The availability and stability of the IWB once permanently place, affords greater accessibility for use in class room practice. I find myself now searching for relevant IWB resources to use in my teaching programs, and integrate these as much as I can into the learning experiences in the classroom. Whether as a modelling tool for Math, a Reading or research tool in Literacy or as a reinforcer of known or covered concepts in any Learning Area, the scope of the IWB is only limited by confidence, time and imagination. (and power or server failures). I took note after the IWB became permanent fixtures in three class rooms on campus, that these were the three classrooms to engage the children in their use on a daily basis, across the curriculum. The teachers were willing to experiment and incorporate this medium as apart of the learning experiences. In the classrooms with no IWB attached, where one would have to find time to move the mobile board from the upstairs storeroom, locate missing cords, connect it up and the projector, align the screen, train the children in the safe movement around the mobile board with all the cords crossing over the floor….I knew why they were not using the mobile board. Apart from not have the time to set it up, most were not aware of how to operate the technology, nor had found time in their busy teaching time to simply ‘play’ with it. What is needed to gain confidence with IWB? To ‘play’ in the sand pit, to have someone parallel play with you, to have a mentor who is able to afford the time to help when needed, to gain the confidence needed for pedagogy to evolve. What is needed, is time.

With four members on campus involved in the Action learning it came to pass that we would on occasion get into staff room discussions about our journeys, what had we tried, what worked well, what problems we encountered etc.

It was interesting to observe over the course of the year that more and more staff were taking an interest in what was happening with our group. Many started
enquiring if there were courses or options available to them and also time frames were being discussed as to when each class would be fitted with an IWB. During one staff room discussion, an experienced teacher whom I hold in the highest of regard for her professionalism, pedagogy and rapport with staff and students, commented to me, “I hope I don’t get one of those, I wouldn’t know how to turn one on.” I smiled and said, nor did I several months ago. She was still resistant to the thought of one, and commented that she was only just becoming confident with computers after all these years. I told her not to worry, she wasn’t alone, everyone would be learning together. She then leant forward and semi whispered, ‘No they scared me, please don’t tell anyone I said that’.

Fear is what almost held me back from jumping into the sand pit at the beginning of this project. I wasn’t sure what I could contribute, I wasn’t sure if I would find the board of value in my Support role, which has me move through different classes and age groups throughout the week. Fear is what the children at risk face every day they enter a classroom. The feeling of inadequacy when they don’t ‘get it’, the attention seeking or the withdrawal to their silent world, the fear of not being able to do.

In order for IWB to be used effectively, a collaborative approach has to be developed and supported on campus. Time must be set aside for teams to play, brainstorm and develop skills with the technology. Time for mentors needs to be available for the IBW to begin to make a difference in pedagogy and in learning environments. The team I worked with in the project on campus were supportive and happy to share with each other. The obstacles were many, with time being the short fall in which to collaborate. Many discussions were held around the school, over staff room tables, climbing staircases together or during other incidental meetings. The PD days on the Murdoch campus were invaluable as far as reflecting on our journeys and defining our next steps. Constructive collaborative time and support is imperative for the successful implementation of IWB into class rooms.

A Way Forward
I believe the IWB will become an ongoing resource in my teaching and certainly has influenced my pedagogy. The use of IWB does not stand alone as a teaching tool but has become apart of the diverse resources available to assist my programs. If the IWB or any resource enables a child to know success, to see themselves as a learner, to see themselves as having control over the learning experience, immerses them in literacy, allows brainstorming, has them as a positive participant in the processes, then for me the IWB has its place in the classroom.

I know I still have a lot to learn with integrating the IWB into my daily practice. I know I have only come a short way on the journey, but I am prepared to hold out a helping hand (as best I can) and encourage my colleagues to take their own leap into the sand pit, and come and play with me. We could build sandcastles in the air, providing we can find an online site with a relevant jpeg. ! Or better still one that has been animated.

Maybe, we could have the children design their own sandcastles! They could write a procedure including quantities dimensions, descriptions and illustrations. Then construct it with a friend, photograph it, edit and publish it online to a class site,
allowing their peers or other schools to post comments on the online blogs. Imagination can explode with what is possible!

I’m not sure what I need to know about using IWB in the future. As I venture forward and encounter problems or discover new ways to use the medium, I hope I continue to find the time to share with my colleagues. The greatest resources are we, those who support us and time.

There were significant moments during my journey so far. These included, gaining confidence in the setting up, the use of Notebook, the use of online sites, resolving glitches, self reflection, working with a fabulous collaborative on campus team, and an awesome, motivating, supportive team at Murdoch University in Karen Murcia and Susan McKenzie.

The highlight however has to be observing my ‘special’ child who I worked with in the ITAS role, gain such inroads into his literacy development, and his enthusiasm when working in the small group with computers and the IWB. To see his smile when he worked his way successfully through literacy based games was the greatest highlight of the year. I shall remember that smile.

Traditional methods and new technology can effectively work along side each other.

Karen Shenton 2007
Coolbellup Community School
Action Research Case Study

Literacy Hour and IWB - Literacy from an Interactive Whiteboard Perspective

Matthew James
Coolbellup Community School
Year 2/3
Literacy Hour and IWB - Literacy from an Interactive Whiteboard Perspective

Class Background
- 21 students of Year 2/3
- 66% Year 2 students
- a complete range of emotional and intelligence quotients
- 19% Indigenous Australians
- 4% English as a Second Language
- Multi-age grouping without separation
- Classroom divided into two distinct sections – desks and floor
- 4 networked computers with access to plain and colour printers
- two teachers who team and tandem teach (Getting it Right – Literacy GIR-L teacher maintains continuity for one day per week)
- Aboriginal and Islander Education Officer - AIEO support for two mornings per week
- TA support for one morning per week

Preparation
1. I chose working in the literacy area because of the structures already in place within the classroom. My class is lucky enough to have the support of a GIR-L teacher. As such the routines and developments of a dedicated Literacy Block have been well established for several years. The students are familiar with and well rehearsed in the 1.30hr time slot and the requirements of the ability based groups and associated Literacy learning tasks. Following social studies / science or language themes, scope and sequence charts and First Steps learning tasks are devised to generate particular skill development and consolidation.
2. Both the GIR-L teacher and I moved from a previous school which had participated in a technology awareness initiative. Equipment, networking and training were provided over a period of two years. As such before arriving at Coolbellup Community we were already aware of the potential that technology in the form of computers, digital cameras, multimedia projectors and Internet could give to Literacy Hour. We saw the IWB as an extension of what we had and was already occurring within the classroom.
3. A large part of our reflective discussions on the progress of students in the Literacy Development centred on the question ‘Are we doing enough?’ Whilst the students were engaged in meaningful, directed learning tasks that looked good there was still the underlying sense that there should be more progress, more sustained and repeated success. We discussed different ways in which to modify literacy learning tasks. The IWB was viewed as a means by which to motivate students further by encouraging them in their learning. It was also seen as a means to increasing teacher effectiveness in delivering activity tasks and ultimately student performance.
4. Whilst Literacy was the primary project focus I found completely impossible to contain it to just this area. From a junior school perspective much of our day is spent alternating between Literacy and Numeracy type learning tasks. Whilst other subject areas are covered it is done with the intent to embed literacy and numeracy skill development and consolidation. The IWB seemed to flow easily as an extension of the laptop, the computers and the whiteboard.
5. As mentioned my previous school was an ASP Trial school. A general observation, supported by other ASP schools and those with our own children, noted a dramatic increase in motivation and interest of students with the involvement of technology, particularly computers.

Strategy

1. In mid 2005 the school invited interested teachers along to a lunch time display of a ‘new’ technology. I went along without really knowing too much about an IWB or what it did. I watched the presentation and whilst interested was not really aware of the possibilities or impact that IWBs could have. The school purchased four mobile IWBs with the intent that they be placed in each foyer. It had been decided that the IWBs would be mobile in order increase accessibility of what was a very expensive resource. An after-school PD was arranged and we were shown in more detail how to set up an IWB with a projector and computer and the basic ‘how-to’. I remember that there was an initial burst of enthusiasm, particularly from those teachers with their own laptops (those who were most likely to be computer savvy). Most teachers took the time to experiment. This required negotiating between the other teachers in the foyers. All of us experienced similar type of problems – learning how to switch the laptop screen, forgetting to turn the laptop screen back on, accessing the wireless network, positioning the projector for maximum space and the constant realignment of IWB. There appeared to be quite a lot of sharing and help occurring between teachers in my foyer. From the beginning and under these conditions they tended to be used mostly as ‘rainy day’ activities or Friday afternoon rather than for any serious planning and thought. I remember even then that the students were enthusiastic about using the IWB and were all eager to have their go. Thinking back I can see the students monopolising the IWB rather than working co-operatively and productively as they tend to do now.

A sample of early day activities (rather than learning tasks).

- Using the ruler to develop measuring skills
- A simple cloze activity

2. Despite the initial teacher interest and the apparent student buzz I noticed by the end of 2005 there reached a point where IWB usage dropped away. For myself I attributed it to ‘time’ – the time needed to solve problems. My reasoning being that there was enough to do with ‘normal’ day-to-day programming without adding the IWB element. It was easier to concentrate on using the conventional whiteboard and the computers that were already
available. So even before the move to the new school site in mid 2006 most of the IWBs had been put aside.

3. During the PD days at the beginning of 2007 one of the agenda items was a discussion by researchers from Murdoch University. I remember NK looking across the library and asking ‘well?’ My response was ‘Yes, BUT ….’ Yes I was interested but I felt I needed convincing that it was possible to overcome the earlier problems. And so after hearing more of the action research I began to put more constructive thought into the incorporation of IWB into learning tasks.

   a. The first big step was in convincing myself first and then sharing my thoughts with the GIR-L.
   b. As there was only four teachers willing to participate the second thing I did was to go and ‘acquire’ one of the IWBs and projector to keep permanently available in my room. There was some resistance to this because of the initial notion of sharing and the security of the projectors.
   c. The third thing I did was to put more thought into the placement of the IWB and to keep a table ready for the projector to be brought out. It seemed to work better by placing the IWB in front of the front door and using the space in the Reading Corner. By following the format of Literacy Hour – whole class activity, small group activity and class sharing, the IWB began to be used for the initial whole class activity. As the students moved back to their desks the projector could be quickly packed away and the lesson carry on. Having two teachers each with their own roles assisted the flow of this transition.
   d. The fourth thing that occurred was the thought that was now being put into learning tasks not the IWB. A major thought shift that moved activities from being activities to learning tasks.

A sample of these learning tasks.
The theme was Australian Animals.

Using the internet and an interactive quiz by another class.

www.siec.k12.in.us/west/proj/emu/emuquiz.htm

Using youtube to watch emu chicks hatching

4. One of the first Murdoch Days organised was a half day session with a visiting UK expert Dave Miller. From memory he spoke about the notepad software. He showed us the camera, text boxes, ordering, grouping and the clipart. He also showed us many UK websites that were now accommodating the growing
interest in IWBs. But what I really took away from this day was his concept of ‘On the Board, In the Head and On the Desk’. That three pronged approach dramatically altered how I saw IWBs and their integration into learning tasks. That a task could incorporate all three learning styles at one go – aural learner hearing the discussion, the kinesetic learner moving pieces around and the visual learner writing on paper. Interesting enough it was the impact of Dave Miller that directly led to the IWBs being permanently fixed. Up until then the school had firmly held onto maintaining the IWBs mobility. But Dave Miller insisted that their true potential lay in their permanence.

The sorting box learning task utilising On the Board, In the Head and On the Desk

Exploring the Big Ideas found in a Chinese fable. Ideas went into the house if found in the fable.

Labelling parts for a handwriting task

5. One of the most beneficial aspects of this whole learning process was the continued support and interest given by the Murdoch researchers. Their encouragement and presence in the classroom made this learning time very exciting. It placed value and recognition on what was occurring in each of our classrooms. In particular the opportunity presented itself that I could discuss successes and disasters on a weekly basis with one researcher. Our daughters happened to be attending the same afterschool music/dance program. She helped me realise that simple was best. Not to put too much into IWB learning tasks. She also leant me her expertise in dealing with a number of very difficult teaching situations I was finding myself in another school.

6. During second term I was experiencing a number of continuing problems with my laptop. Having to reimage and then reinstall just seem to make persisting with the IWB just all too much. The crunch came when writing semester reports I got a blue screen on the laptop and it immediately shutdown. The laptop would not start again and I was told that the only way to solve it would be to reimage AGAIN!!! Most of my report comments were lost and needed to be rewritten. It was then I decided enough was enough – I put everything away and made arrangements for my laptop to be returned to DET. They refused to accept it stating contract obligations. But then in the midst of all this the first Murdoch Session appeared like a shining light. I went with dragging feet but returned skipping inspired with thoughts, dreams and coffee.

7. When returning to school I was told that the relief teacher (someone supplied by Murdoch University) was impressed with the behaviour of the class, the
work that was left for her to complete and the appearance of the classroom. She asked permission for copies of tasks she could see on the Wall of Fame. And in so doing gave value and recognition to what was occurring in my classroom. All too often there is an expectation that you will just get on and do the job as required – nobody acknowledges the effort or thought. You work with your neighbours and assisting staff on a day to day basis – but sometimes there is a need for something a little more substantial than knowing that you are doing a good job yourself. This is what I found from the researchers at Murdoch and from the other participants.

8. Having the IWB mounted I believe was a pivotal moment in our IWB development. It is then that the IWB really launched itself and activities clearly made that transition to learning tasks. True to departmental style the IWBs were mounted during the first week of Term 3. For two days we had to move out of our classroom as they installed the IWB, projector and speakers. There was some question as to the placement of the computer connection points. I asked that they be placed near the teacher’s desk arguing that I did not want to be moving around with my laptop every time I wanted to use the IWB. After some discussion all parties agreed. However this meant an extension USB cord was required. This took several weeks to arrival. Despite this I was able to use the IWB but without interactivity. In hindsight perhaps a better placement of the connectors would have been near the bank of class computers. I will discuss why later.

9. It wasn’t until the fourth week of term that I experienced a ‘Damascus Road’ in the form of Book Week. In looking back it seemed a fantastic week where learning tasks, IWB and the class all seemed to merge together. I remember thinking ‘If this is what it is going to be like – WOW!!!’ There was one particular day – Tuesday where the whole day just seemed to flow.

a. First we listened and watched an interactive story from CBeebies. We were able to listen and enjoy a talking book. Discussing it as we turned the pages. I was able to ask simple and complex comprehension questions. By choosing different students to turn the page they were motivated to participate.
b. Using Word the students called out words that were connected with the theme Book. I wrote them down one at a time. The students then gave me a sentence using these words. This too was written down. The students were then asked to copy down the word and sentence to form their very own mini spelling list. After each word and sentence the text was converted to print and saved.

c. At the end of this activity the page was enlarged, the font changed to Victorian cursive and printed to form a very unique handwriting worksheet. The students watched me make these changes from the IWB. In so doing were informally exposed to Word editing techniques. The students then completed the worksheet using textas in order to encourage fine hand motor skills and pinned it to their Wall of Fame.

d. During the Book Week Assembly photos were taken of the students in their costumes. At recess these photos were uploaded on to the computer.

e. After quiet reading the students were given large sheets of paper. They were asked to design a poster showing their chosen character and the name of associated book. To encourage the students the photos taken earlier were put on continuous slideshow. They could watch the slideshow as they worked on their poster. For children (and some adults) there is always something magical about seeing yourself on the screen.

f. Later for maths we conducted a tally of the class’s favourite stories. First the tally was written down using the conventional whiteboard. A blank graph sheet was displayed on the IWB. Each student was given their own. When reading the blank sheet one student (Donatello) realised that with the boxes numbered in twos it wasn’t possible to show an odd number. He declared that we could show one by only colouring in half a circle. Together we counted the tally and coloured the appropriate number of circles. Students were asked to ensure their sheet looked like the one displayed on the IWB.

g. After watching the prearranged Book Week play the class settled down at the end of the day to watch a book related DVD – Shark Boy and Lava Girl. An audio cord connected the speakers and turned the IWB into a mini-cinema. Turning on the subtitles exposed the class
to words in context and encouraged them to read. Stopping the DVD at times allowed us to discuss aspects of the story. The only difficulty I have found using the laptop has been in the timeout security measure. It locks out at vital times and it takes a few minutes to log back in.

**Everything that is or was, began with a dream.**

**Lavagirl**

10. On the Friday of that Book Week I decided to show the class an Italian booklet I had made. It would show them a book in another language. I explained to them that they would understand some of the words because of the similarity between Italian and English. I was able to display each page on the IWB. I circled words and wrote down translations. Students copied what I was doing. At one point I was explaining the meaning behind the word ‘liberia’ – it is very much like ‘library’ but actually means ‘bookshop’. As I wrote down bookshop Corrado declared out loud that he didn’t have to look at the word ‘book’ because HE remembered it from when I wrote it down earlier in the week. Corrado requires assistance for literacy learning tasks. He is more comfortable being present than leading or adding suggestions in learning tasks. He is also part of the group for whom the initial action plan was written for. So what makes his comment so remarkable? First he spoke out – in front of the class, out of turn in order to engage me. Second he linked the present word to a word he had seen in the past. Third he linked the word to the IWB. Fourth yes he had remembered the word and had correctly written it down without assistance. Surely one giant step!

11. The ICT Day at St Helena’s was truly a great experience. The only disappointing aspect of the day was that I was the only one from the group there. The organisation of the presentations forced you to make a choice. I chose Literacy based presentations simply because of my action plan. However having a numeracy person at the others would have allowed us to exchange ideas. St Helena impressed me on two levels –
   a. it was a total MAG school across the year levels. Working in a MAG class myself I am always interested in seeing how others work the craft.
   b. the school had installed IWBs in every classroom (and I mean every classroom – from pre-primary all the way to the music room and library).

Most of the presenters were teachers from St Helena and even though they were well within their first 5 years of practice I did not find them intimidating or lacking in knowledge. Despite only one presentation following the Dave Miller model of Board, Head, Desk I found that I knew enough to ask the right ‘how to’ questions. I was able to come away with ideas about interactive PowerPoint using KidsPix, sound files, movies, and organisation. All of which I was able to feed back to the group.

12. From this the ICT Day I sat down that night and designed an interactive PowerPoint that made use of hyperlinking. In our weekly Literacy planning discussions the GIR-L teacher had suggested that I focus on onset and rime with the study group. We decided on four common spelling routines.
a. introduction of weekly words and word shapes. I designed an IWB page that placed the onset letters around the page and the rime in the centre. We would use DI principles and say the letter combinations slowly and fast and several times. The students would then write them down. The list would include one difficult word. At the end of the list the students were then asked to draw word shapes. During this time I also drew word shapes on the board for them to complete. I noticed the students calling out encouragements and suggestions. Even the more timid of the small group.

b. interactive PowerPoint which presented the onset as a picture. By using hyperlinks the whole word was presented. Students were selected to advance the PowerPoint. St Helena reminded me that PowerPoint images could move. This added an extra dimension to these sessions. This was followed by a word search.

c. word sentences – students were asked to write sentences using the words. This was done individually or as a group. When completed as a group the words and sentences were written on the IWB and then converted to print. The students then received their own copy to read.

d. general revision and another word search.

Despite being originally written for study group I used the learning task when asked to have something ready just in case the Premier and his party decided to enter during the official opening. The whole class engaged with the activity. There was no ‘this is easy’ ‘this is for the other group – not us’. Unfortunately no one from the Premier’s party arrived. Since following this spelling pattern I have noticed a consistent high spelling results for this study group. For the first test all students except for Dino achieved 100%. Dino achieved 99% having misspelt the ‘tricky’ word included in the list (‘what’ in the group of ‘at’ words). Now whether this is a combination of events or the impact of the IWB it is hard to differentiate – it could very well be the DI strategies; the Primary Movement; the emphasis of onset and rime; maturation; or perhaps even the lowering of spelling level.

13. Two of the things I took from the ICT at St Helena were the introduction of sound and movie content. In the literacy presentation the St Helena teacher showed an advanced sorting box using a layering technique with the IWB.
software. She had placed a picture of a toilet in the centre of the page. Students were asked to select ‘sh’ words and drag them to the toilet. If they went inside they could flush the toilet. What made this complex was that she had placed two images in front of each other so it appeared that the words were actually going into the bowl. She had also attached a sound file to the handle. She said her students had given her suggestions to help them learn.

My initial experiment was to take scanned pages from our reading book and place them in notepad. Using Audacity I recorded myself reading the text. Initially I used a mini-tape recorder but the quality was poor. I then ‘found’ a headphone set and attached it directly to the laptop and recorded there. I used Audacity (recommended by St Helena) and found it very easy to use. This program actually allows you to change pitch and tempo – making it possible to disguise the voice. Once I learnt the steps the process became easier and easier. The students were really engaged – especially when they realised that it was me reading. At the end of the task I noticed students going up to the board and replaying the story over and over again. The following day I decided to record the students reading the story. They really like this. I was able to record an audio book using all of the students within the hour. I particularly noticed the class quietened down during recording.

During the At Risk presentation the St Helena teacher showed how she videoed students for learning tasks and also assessment purposes. I liked this idea. I decided that with my core group we would present our weekly reading book to the class as a visual book. I set up the videocam and noticed an immediate change in the students. They became concerned with accuracy, reading with expression, being clear and staying together. This gave us ample opportunities to practise oral reading. They enjoyed being videoed. My first problem occurred when I began to try to edit the video. My own personal videocam is a new DVD type. I could not load the video into MovieMaker in order to edit the file. An internet search told me that I needed to convert the file. Unfortunately there was no free program so I ended up purchasing one (ImTOO DVD Ripper Platinum). The second problem occurred when trying to insert the avi into notepad. Once edited and saved I needed to convert this to another format, a flash file. My first program did not do this – and I had to buy another one (Movavi Video Converter). Because I wanted it for the next day – all this took time. But in doing this once I now know the necessary steps and the next time will be just that little quicker. The whole class enjoyed watching the book and the core group were over the moon with what they had achieved.

None of this information was really given at the ICT Day. Rather they gave the obtuse direction of ‘look on the internet’.
14. The St Helena pre-primary teacher spoke about how she placed her roll and class jobs on the IWB. In the morning when the students arrive they place their name next to the job they would like. This allowed them to practise using the IWB and allowed the teacher to mark the roll. This gave me the idea of allowing the students more free play time. However in being linked to my laptop the students could not access the IWB when I needed the laptop. I was able to obtain a second laptop from the library for this free play purpose. Being the end of term and going off on LSL I haven’t been able to fully set it up but I haven’t abandoned my idea. I have noticed that when given time on the IWB there is a greater sense of co-operation and shared learning. eg In the mornings I put up a uniform tally. As the students enter they drag the star across. Later we enter the results on a table. I have noticed the way in which they help each other. If someone doesn’t drag it just right there are always suggestions of ‘how to’.

During a transition period I looked up to see Dino (core group) showing Scolastico how to use the air mouse and make it move the spelling PowerPoint. Listening in to their conversation I could hear Dino asking Scolastico ‘Now what do you think this word might be? Look at the picture and then add these sounds.’ He was modelling me and how I had presented the learning task to him and the core group. Scolastico is certainly the more able of the two – with far more developed literacy skills and yet here he was listening and participating – without any of the ‘I’m smart – you’re not’ attitude. I have been aware of this attitude far more since working with IWBs.

15. SMART offered a repeat of the network meeting run earlier in Term 3. I was invited to attend the SMART Bugs at Rostrata Primary. Once again I was the only one from our group to attend. I have found it far more powerful in having a group with which to share ideas and IWB discoveries. We were given the option of attending either a beginner, intermediate or advanced group. Initially I had thought my skills lay with the intermediate group but at the last minute decided on advanced. I’m glad I did. I was able to bring back to the group the magnifying glass, the use of shaded boxes with coloured text, hyperlinking to show transitions and time. Straight after the network meeting I went home and recreated the techniques I had seen. The next morning I shared them with the group.
16. Just after attending this network meeting I suffered a major catastrophe. For some reason my laptop stopping recognising the IWB. It would give an error message every time I tried to connect and so everything came to a grinding halt. Nothing I did seemed to solve the problem. I tried reinstalling the software, reinstalling the driver individually, unplugging the USB cords, checking the connections at each point. I phoned IWB support and they told me how to locate the problem. After testing another laptop everything pointed to my laptop. So then started the hours of trying to convince the helpdesk that there was a problem. The IWB support said they would only support their whiteboard. The DET helpdesk said they would only support their laptop. But I said I’m using a DET laptop to access an IWB – HELP!! I was finally given another laptop – probably just to keep me quiet. Under the terms of the contract they could only give me a similar mode and not the latest model (I believe that this is one of the sources of the problems I have experienced. I’m sure one of the new dual core duo laptops would have more accessible access memory to handle the rather large multimedia files that I have been producing.) To my disbelief and HORROR after reinstalling all software the same problem occurred again but this time with the new laptop. All my ideas and learning tasks stopped. Fortunately I discovered that if I waited until the laptop had logged in, stood on one leg, turned around twice and held my breath one USB port seemed to recognise the IWB. Ahhh, success and learning tasks could start again. Just at this time an IWB technician arrived and even though not meant to he tried to solve the laptop conflict. After working for half the day he left scratching his head. He put it down to then type of laptop– something I have no control of.

At the beginning of the year I remember hearing one of the Murdoch researchers saying they couldn’t imagine a classroom without an IWB. My response was ‘Oh for goodness sake, please’. But now after spending the year moving between two schools one with computers and one without, one with conventional whiteboards and one without and now my own classroom with an IWB and without a working IWB – I can see her point. I definitely felt lost without being able to access the IWB technology – not so much being dependent on the IWB but rather feeling limited in what I could do. That extra element to my learning tasks. This is much the same way as coming from a class with a large bank of computers to being in a class with only three. Straightaway the choices that one is able to make have changed. It is simply not possible to have exactly the same learning tasks. I noticed this when
moving from my previous school to Coolbellup. Straightaway students using PowerPoint, Word and Explorer just dropped away over night.

17. My last words I give to Soccorso. Soccorso has many difficulties especially when it comes to reading. Even in Year 3 he still comes up at lunch time and asks me to read what he has ordered. So it was with surprise and delight that when I was reproducing some of the screenshots needed for this report he wandered up and declared ‘I love reading books. Books have lots of colourful pages.’ I said what? He said it all over again. But then added ‘It’s there on the whiteboard’ and he pointed to the IWB.

Outcomes
So what are the things I have learnt from my year of IWB action research?

a. Over time I have been able to see a change in the way the IWB has been used. This I think is represented by the definite movement from simply just presenting isolated activities and games to the integration of IWB into learning tasks on a daily basis. I believe that this is developmental – a stage necessary for the complete development of the IWB potential and capabilities for the class. Both the teacher and class need ‘sandpit’ time in order learn the necessary ‘how to’. If you consider how computers were first introduced – this is virtually the same developmental path. The use of computers for games and then as confidence grows and ideas form using them as learning tools.

b. I have seen the gradual impact of the IWB on all aspects of my curriculum delivery. In the early days when they were mobile it simply wasn’t possible or convenient to have it set up all day. It was a matter of practicality. It was much easier then to contain it to the area of the action research – literacy. But in having it mounted, available at any time the use of the IWB as grown incrementally. So much so that I now feel lost without having an IWB.

c. With the increased availability achieved through mounting I have discovered that it feels to me that I have always been using the IWB. That there is a complete naturalness in its use as if it has always been there. During the course of the day we can move from the floor in discussion to using the IWB to enjoy a book to finishing off a maths practice sheet at our desks to using the IWB to count coins for marking and then to actually sit down for a pre-planned learning task involving the IWB.

d. Despite their potential in achieving learning success computers are essentially one person (or two at the most) tools. Because of this they can be quite isolating. Their very nature seems to discourage co-operative learning and to encourage singleness. IWBs on the other hand seem to engage all in what is at times the biggest co-operative learning task – I don’t even think having the same worksheet for the class for example achieves the same level of co-operation. Computers encourage the development of individual skills and whilst you can learn these skills from others it is mostly your skills. IWBs seem to encourage group learning. Time and time again I am amazed at how there seems to be an automatic sharing. No one seems to dominate, taking over and influencing the direction learning will take. When students are using the IWB there are suggestions from all students on ‘how to’ or solutions to problems or even assistance in recognising words and sentences. Outside students seem to gravitate towards the IWB and are intrigued by what they see.
e. Over time I have noticed a change in skill development of the core group, students who have been identified as SAER. Essentially there appears to be a marked difference in presenting learning tasks on the conventional whiteboard as to presenting the same tasks using the IWB. This could be because of its electronic factor, its movement, its intractability, its ability to engage. I now have students who seem more confident, more willing to have a go, who are eager to try out the IWB despite the possibility of being wrong. As a direct result this has impacted greatly on literacy (and numeracy) development. e.g. Dino at the beginning of the year could barely write more than a couple of words for creative writing. He is now writing up to three quarters of a page – sometimes with minimal assistance. Running Benchmark reading records whilst showing minimal increases in spelling ages all show (whilst still at risk levels) an increase of two to five months in reading ages.

f. One of the comments given by the opening presenter at the ICT Day highlight the daily growing complexity of the technological world in modern life. But yet many a classroom exists in a state of pre-technology. In a world of emails, iTunes, youtube, Facebook, internet banking, eBay and online Domino’s, much of classroom practice still grounds itself in pen and paper activities. This is not to say skill development is not important or necessary or that we throw the bathwater out with the baby. But. But classrooms need to keep abreast with technology rather than lagging behind to ensure their continued relevance and maintain credibility.

g. Naturally enough there will be problems with the use of any new technology. In the early days of computers programs were fairly simple, there were many cords and switches, and there was probably only one per foyer. With time computers became cheaper and easier to use and programs became better. We now have classroom computers with far more capabilities that were dreamt about ten or even fifteen years ago. With the introduction of the Internet into classroom practice often learning tasks failed because the Internet had crashed or the modem wouldn’t connect. I remember hearing of teachers who would regularly copy webpages and links to ensure their availability and the flow of their lessons. I can also remember the excitement and buzz when the school purchased a scanner, then later a digital camera the size of a large student dictionary, and then a CD burner and then we were given a thumb drive. There are many times even today when the computer crashes, the scanner doesn’t seem to want to connect or the server is down and the Internet unavailable – but it doesn’t mean we pack everything up every time this occurs (mind you there have been many a time where I have felt the urge to hurl my laptop out the closed window). We persist and try again. The same applies to the IWB. I am really pleased I persisted with my efforts in using the IWB. I know with certainty that I wouldn’t be where I am today in terms of my own skill development or have watched the development of my student’s confidence if I had given up. In the relatively short time I have been using IWBs I have felt challenged and encouraged. I also have a better idea of where I will be going to.
A Way Forward
What next? I’m not really sure what to write for this conclusion

Naturally I am eager to see what the future will bring in the continued development of IWB technology. Large screens, smaller projectors, improved features. Already because of the positive results of our action learning our school is considering the purchase of more IWBs – one for each classroom. As such we are now being asked to be leaders within our school community. In some respects I feel a little jealous in that my classroom will have one of the older boards and not a new one.

On another level I hope there will be further developments in terms of software. When compared with other programs such as Word and PowerPoint notepad is fairly basic. There are some things I would like fixed or added eg correct sizing of images and image editing. Adding of additional pieces of hardware as they become more practical. Already the school has given permission for the purchase of a slate to be used in conjunction with the air-mouse and keyboard. They agreed with my reasoning that students particularly from the lower years can find the keyboard difficult and would respond to being able to write down instead of typing. At the ICT Day they demonstrated a group census device – and with thought the possibilities of this are huge.

Whatever the future may bring I do see a place within my class for IWBs. I need no further convincing of their relevance in daily classroom practise.

My last last last words I give over to a verse from Revelations 3. Something I feel is very appropriate in this case. “I stand at the door and knock. Whoever hears my voice and opens the door I will enter and I will be with them.”
Going Mental with Interactive WhiteBoards
2007

A Journey of Technological Discovery

By Nyree Kirby
Background

The first time I laid eyes on an IWB I immediately began to see some potential uses for the classroom. However, once the cost was mentioned it became a dream I thought would never be realised. Little did I know then, that 4 years later I would be the proud user of a wall mounted IWB in my own classroom.

The new school I was working for, ‘Coolbellup Community School,’ purchased four mobile interactive whiteboards which were moved around the school as needed. I got my first use in my role as Getting it Right Literacy Specialist teacher when I was asked to demonstrate the set up and use of the IWB with Kindy and Pre-Primary staff. I agreed to come back that afternoon and complete the demo.

That’s when I went into panic mode and had to find out how to do all this – and fast. Thankfully I had a good friend and colleague (Tanya Miller), who was already a whiz at it, and she gave me a quick lesson. She even knew where all the cords went and after this I felt confident I could complete the task.

I wheeled the board to the far end of the classroom, dodging obstacles and little people along the way. Next I brought in the projector and lap top and while connecting all the cords continually answered the inquisitive students who wanted to know what it was that I was doing. An education assistant came to see if I needed help however the class teachers used it more as a time for them to collaborate and stayed well out of the way. They would pop over from time to time and say ‘wow this is amazing’ however none seemed to be really interested in learning how to set it up.

I began to use the IWB interactively using websites to allow these students to touch and move the board as needed to complete activities. As these students learned what this board could do, whenever I walked in wheeling it into the class room they would quietly come sit in front of it and wait for me to set it up. As all the students enjoyed having a turn I had to organise a way of fairness about using the IWB. I used this opportunity to talk about alphabetical order and have continued to use this system now 18 months later. If someone misses their turn there are instant protests of things like, “Isn’t ‘i’ before ‘n’? Daniel should have had his turn before Danny? It’s great when protests are made by students who would usually resist engaging in lessons.

Whilst the board was being used one day I looked around and noticed every student sitting quietly on the mat looking at the screen waiting for their turn, cheering along their class mates when they made a good choice. That was no mean feat for this group of 4 and 5 year olds. I remember one Education Assistant at the time commenting to me that she had never seen this group of children so attentive and enjoying themselves this much. I left the Early Childhood Unit that day feeling on top of the world.

-From this and other similar sessions I quickly began to realise the power this new technology had over these students.-

Early in 2007 when Karen and Sue visited our school and presented their research project to our staff I was excited at the prospect of becoming involved. At that stage I thought the project was about them teaching us new ways to use the IWB in our classrooms. My hand went up like a shot as I was not going to be left out of this new learning and let others who had previously shown little interest in becoming familiar with the IWB’s take my place.
The first time project participants got together I was interested to see what the IWB guru “Dave Miller from the UK” was going to show us. I was feeling quite good about what he was demonstrating and as a frequent user of IWB in my classroom I was pretty familiar with what he was doing, until he showed us the sorting box created using a layering technique with the IWB software. He showed us how to use ordering and layering of objects to allow or not allow them into the auto shape box. It was a simple idea and I was hooked. Immediately I began to think about ways I could use this simple technique for creating new and interesting activities for my classroom. At this stage I hadn’t had much experience in making my own lessons using IWB and had really only used it for games, consolidation of skills using websites, and as time fillers—especially on Wednesdays after lunch as the students went home early and we had a 20-30 min session before they left. Not enough time to do anything too meaty so the board became a good wind down before home.

Until the wall mounting of the IWB was completed we (The Project Group Teachers) found it easier to claim a board each and keep it handy. I kept mine in the resource room with the projector in the reading store room. We had to keep the projectors in locked storage when not in use. Due to having to leave the class to fetch the projector it was difficult to set up without another adult willing to accept the duty of care in the class. I wasn’t able to lock it in one of my classroom cupboards as they are all keyed the same and I needed the others unlocked for access during lessons.

Setting it up before lessons was a real hassle. First you had to rearrange the classroom, moving desks, chairs and children so that we could make a pathway for the board and so all the cords would reach where they had to. (This was often while students were trying to complete work from the previous lesson.) Once the cords were in the right place the children had to constantly be reminded not to knock the board or projector table as they moved around the classroom. I decided to do what all educators do when things get too hard, delegate. I taught my education assistant how to set it up which became part of her Performance Management goal. This freed me up and gave me more control of the class during the lesson changeovers.

One day when we were setting the IWB up for a lesson, the screen had turned a bright red/pink colour. Figuring someone had changed a setting, the assistant and I began to troubleshoot. Checking cords were plugged in properly, looking at colour settings, changing computers etc. We reported the problem to the relief IT coordinator at school who said she would ring the company that supplied the boards. These situations are often disappointing and call for immediate thinking on your feet. In collaboration with the Education Assistant we improvised and changed to another activity. After spending 2 hours the night before preparing and formatting new activities to try I felt quite disheartened by the situation. Meanwhile a colleague (Matthew James) suggested trying different cords. We tried the smart board cord he had been using and Bingo the problem was found. I gave the cord to the relief IT coordinator for replacement and asked if it could be replaced with a longer one as it was too short to reach my laptop while it was locked to my desk. I was told that she would make sure the IT coordinator got that message on her return the following week. Meanwhile I borrowed one from a projector kit that wasn’t being used at the time.

We carried on with setting up the board in this way until Term 3 when the IWB was mounted onto my classroom wall. The finishing touches were added (changing non-
working speakers, installation of gyro tools – air mouse & wireless keyboard etc) and the board was fully functional by Wednesday of week 2. Unfortunately I didn’t get to use it much as I still had cord issues, the small parallel cord needed to be about two metres longer than it was and we still had no audio cords.

I was to take long service for six weeks after this week and the relief teacher seemed keen to have a go at using it so I quickly showed him the basics of the IWB. He assured me he would have a go at using it with the class when he had time to have a practise on his own first. He did. He even went and bought an audio cord for which he was reimbursed by the school, so he could use the sound feature.

When I came back from long service I found we still had the issue of cords being too short to reach my desk without creating an 80cm high step over. At this time I wasn’t feeling very supported and was grateful for my fellow project colleagues. They became my sounding board, shoulder to cry on when things went wrong (which they often did), mentors, guinea pigs for new ideas and a wealth of knowledge when it came to great websites. If it hadn’t been for their collegial comrade the determination to improve my skills when interacting with the IWB may have waned long before now.

Interestingly, around this time my thoughts of transferring to another school were quickly forgotten when I thought about moving to a classroom with no smart board. It was then that I realised that my whole style of teaching was having a shift towards using the smart board more than less and that I was well and truly hooked!

**The Project Focus Group**

My Action Research Plan was developed for a group of four year 2 girls and six year 2 boys. These children make up part of a bigger group of twenty one year 1 & 2 students. They attend school in a fairly low socioeconomic area where a large number have single parent or extended family members as primary carers. The remainder make up a variety of backgrounds including: parents currently completing higher education studies, English as a second language families, parents with low educational achievements and professional parents. Whilst regular attendance and tardiness are issues with some students from this group they are in the minority.

Academically this year 2 group of students consisted mainly of those that will struggle to achieve state standards in literacy and numeracy unless intervention programmes are established. In numeracy, standardised outcome assessments conducted earlier in the year, produced a stanine average of 1. (see fig 1) That meant that earlier in the year, in Mathematics, they were judged to be in the bottom 10% of students across Australia.

(fig 1) Test 1 2007. Completed February
At this time the focus group of students chosen demonstrated only one strategy when solving mental mathematical problems and that was to use their fingers. While I agree this is a useful strategy for numbers under 10, as bigger numbers are introduced, using fingers to solve mental problems becomes very inefficient.

**Aims of the Project**

The main aim of this project is to increase the repertoire and use of mental strategies used by students to solve mathematical problems. I was pretty confident that I would have a positive impact on these students as I was using something of which I had already become aware was very motivational. During this time I also expected development of my own skills as an IWB user by: trial and error while incorporating lessons, collegiate discussions, and professional research. I expected my knowledge and confidence when using the IWB, in ways previously unexplored by me, to increase.

**Strategies and Activities**

After seeing the ‘sorting box’ created by a layering technique using IWB software at work, I was keen to use it in my plan. I saw this as a simple way to begin using the IWB interactively. I made up activities that allowed students to see patterns in numbers and practise skip counting using the ‘sorting box technique’.

**Sorting box—Skip counting in 2’s, 3’s, 4’s, 5’s & 10**

Using the idea of the sorting box (learned previously at PD), I created a box that only allowed Mathematical Instruments inside. (This effect is obtained by formatting numbers using the order command of the drop down menu.) Then I made one that only allowed multiples of 2. Very quickly the students were able to identify that every second number was going into the sorting box. Using discussion and questioning they were able to make accurate predictions of possible numbers and then confirm using the IWB. At the end of the activity there were only odd numbers left. We read through them and discovered that you could use the skip count in 2’s pattern to count odd numbers too. I made a mental note to reverse the numbers allowed into the box so that target numbers are left behind.

Now that I’d discovered how to use the clone command there was no limit to the sorting boxes I could make. Actually there was as it took me a while to work through all the little glitches that would happen. *Every evening I reflected on how I could achieve an effect on the board better.* Matthew in the next door class was a great sounding board when verbalising my thoughts as he always availed himself and gave me ideas on how I could achieve what I was trying to do.
My use of the sorting box using the layering technique developed over the course of the project (see fig 3). It began with just one interaction needed by students and evolved into a more complex activity, (see fig 4), where I would try to include as many concepts as I could.

I made more sorting boxes for multiples of 3, 4 & 5. Discussions during these activities were exciting as some students were interacting trying to find patterns in the numbers without being prompted. This was a big leap forward in terms of the students directing their own learning. Previously three of the students from the larger group passively attended to most lessons. All of the sudden these normally quiet students were showing confidence and calling out answers and things for others to try. With this activity I was hoping for students to increase in familiarity of small number multiples with a view to using them to solve simple mental problems. I believe I have achieved most of this as all but two students can skip count in 2, 3, 5 & 10. (Multiples of 4 have proved a little more difficult and need more work to consolidate.)

**Calculator - Constant Function**

Previously a few students, with my assistance, had discovered the constant function on the calculator. Some students didn’t seem to understand how it worked – or its applications. Using the ‘answer cover’ idea I made the IWB more interactive by allowing students to check their answers by moving a coloured shape. Again I used the order functions to achieve this. My plan was for the students to use the interactive calculator’s constant function to count through multiples. (See fig 5) Students also had their own calculator to make a multiple number paper strip. Unfortunately this interactive calculator didn’t have a constant function which I discovered as we began
the lesson. It made it difficult for students to interact in other ways aside from moving the shape to find out the answer. I could only use it to point to the calculator which, as I reflected I decided, was still a valuable resource as all students could see the larger than normal calculator and copy actions I made. The activity was moderately successful. Most activities that give students practise at working with numbers are successful however mine didn’t allow for a great deal of interaction with the board.

**Number Lines**

I made my own number line after searching unsuccessfully for one that met my needs amongst my resources. We completed it using the interactive pens. Students were required to draw links to each number in a skip count sequence. (See fig 6)

![Fig 6. A number line utilised the interactive pens.](image)

**Hundred’s Chart**

Using the clone function I devised a way to make an interactive hundreds chart for use to look for patterns in multiples. I cloned lots of transparent stars to use to cover the numbers to make it interactive. (see fig 7) Of course this would have been easier to make if I had of used the infinite cloner function however I wasn’t aware of it at the time. We repeated the activity when I discovered the interactive hundreds chart. The students liked the way the numbers turned when they pressed them.

![Fig 7) I made this hundreds board myself however you can find one that spins and changes colour when you click on it in the gallery.](image)

**Subitizing**

The next activity I tried to incorporate into the IWB was subitizing. This is where students were given a brief look at a number of items and were required to say how many in the set. For this I made a series of circles in various number patterns and used the pull down to cover number answer. (See fig 8 below)
After completing all of the shades students were sent to play subitize snap and memory at their desks to give further practise.

**Outcomes**

By becoming a research teacher and completing this study, in terms of my own learning, this project has taken me on a huge learning rollercoaster. I have persisted and have been able to develop some interactive activities to use on the white board. This makes me feel very proud as I couldn’t of imagined completing such things this time last year.

My observations during the project exceeded my expectations. I expected to see an increase in the students’ use of mental strategies when faced with problems. What else I found was:

- an increase in motivation and self belief;
- students who were willing to share their learning with class mates;
- and there was an increase in the speed of answers given.

This indicated to me that the students were not only increasing in confidence, but had also begun to increase their repertoire. Other observations I made during this project were:

- Confirmation that the IWB is a very motivational tool.
  - The student responses to using the IWB were extremely positive. Whenever the screen came on someone volunteered to turn off the lights and they all come like programmed robots to the front mat. Sometimes I’ve had to send them away to finish activities with the explanation that although the IWB was being set up it wasn’t needed until a later lesson.
  - Whenever we used the IWB students were all willing to have a go at interacting at the risk of being incorrect. Where as if they were at their desk and the work was written some didn’t like to commit pencil to paper.
The Results

I used an outcome based standardised testing before (February) and after the project (November) to help give an understanding of the overall skill development. The expectation was that incorporating the use of IWB would help to increase value adding of students’ results. This is where students exceeded expected results. Throughout the year students are expected to move one stanine up with natural growth. Anything over one up from the starting stanine is value added. These results speak for themselves.

Year 2 SOS Mathematics Test 2007

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<th>Stanine</th>
<th>Students</th>
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<td>Test 1</td>
<td>Test 2</td>
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Test 1 average = stanine 1                      Test 2 average = stanine 4

There are two students who have not reached expected levels. While this is very disappointing I believe factors beyond my control have contributed to this result. One student has a high level of absenteeism and misses out on valuable learning. The other student has a special needs assistant and has a learning difficulty. He is on the autism spectrum and finds working with numbers difficult.

A Way Forward

My way forward includes continuing on with helping others to develop the skills I now have when using the IWB. In the past, during DOTT times, I have invited other junior classes to come and experiment with the IWB in my classroom. I still love to see the students’ faces when they see how it works for the first time. I’m sure I will continue to use the IWB as an integral part of my teaching. I plan to visit the IWB supplier’s site for further learning over the summer holidays.

Working on this project has been a fantastic experience. I have made huge gains in my own learning and my students have reaped the benefits. I have enjoyed every part of it.

My thanks to
Karen Murcia
Susan McKenzie
Who have made this journey possible.
Valuing The Place of Interactive Whiteboards in Teaching Mathematics

By Tanya Miller, 2007
Background

In February 2007 our school had 4 mobile electronic white boards and I had been using one of them sporadically. Although I enjoyed planning lessons using the board and the children definitely enjoyed participating I was reluctant to go to the effort of booking out the equipment, setting it up and returning it often for a very short period of time. My ideas and expertise in this area was limited and although I was one of those at the forefront of ‘board use’ at my school I knew I was really only scratching the surface.

Karen Murcia and Susan McKenzie presented a session on interactive white boards at one of school development days at the beginning of the year. Being the first day back at school and knowing that I had a very difficult class that year I was less than an active listener. At the end of the session they announced they would like our school to participate in an action learning plan using the IWB’s.

I sat back to see what the reaction was. Mathew was interested immediately. A few minutes later Nyree also expressed an interest. I was concerned at multiple levels. Firstly I was calculating how many IWB’s the school had and watching my access to them disappearing with every minute. Secondly I could see a potential gap growing in my experience. I was not happy about this and decided the only way to keep my position in the ‘heard’ was to also jump in. I slowly put my hand up and with many reservations, volunteered.

Purpose

For my IWB project I decided to concentrate on Numeracy. The main reason for this is that the school already has a GIR-L specialist who supports my students for 3 x 20m sessions a week and an AEST teacher who provides support for 3 x 90m sessions a week. I was confident that Literacy would be covered adequately and I would be able to access resourcing and current thought in this area.

I was concerned about Numeracy. When I undertook the project I was the only provider of mathematics teaching in my class and I saw from initial contact and standardised testing that I had a huge range of abilities and levels of understanding. These factors and the thirty three students enrolled in my class made numeracy a very easy choice.

After examining all of the available data I decided that much of the difficulties the children were having, was due to their lack of understanding of place value. It was then I decided I would start by covering place value at approximately level 2.

Further investigation of the data showed that there were 13 points allocated to Place value in the SOS mathematics test at the year 4 level (Appendix 1). Some of these also lead into calculate but required the underlining PV understandings to attain a correct response. I decided I would use these along with numeracy net (Appendix 2) to assess the effectiveness of using the IWB in achieving the outcomes.
Strategy

It was around this time that another teacher was appointed to help me in mathematics. She was to come in two mornings a week for one of the 90min sessions and one of the 60m sessions. This was the perfect opportunity to split the class and obtain a control group. The class was split so as the other teacher took a small group containing those children who needed more attention at a level the rest of the class had already obtained. There was the necessity for two very specific IEP’s for children who still could not correctly identify numbers to 20. They joined my group so that the support teacher could focus more intently on her small group. The remaining 20 students stayed with me and made up the learning project’s focus group, this group would use the board to help them address the learning criteria.

Strategy

I now had my focus group, results showing me where they had started, a goal to guide me through the journey and over three terms to achieve it.

Class Groupings

Being an IT project I started my search by turning to the internet. I knew how I would normally teach ‘understand number’ but was unsure how the whiteboard was going to help me. I found hundreds of sites that proclaimed to teach and re-enforce the concepts I was aiming for. I spent night after night playing games, shooting aliens, duelling pirates and rolling virtual dice. Every time I found a site that looked stimulating I would bring it into the classroom and spend the proceeding half hour teaching the concepts behind the game. We would then play the game as a group.

Although my students thought this was fun I wasn’t satisfied. I had no real ‘thread’ holding everything together and there was no progression or development of ideas. I was jumping all over the place from the concepts of 1’s, 10’s and 100’s to non standard partitioning through to rounding and size decimal numbers. I had the belief that in every lesson I needed to include the board and by doing so tended to skim over lots of important concepts. I did not give the students a chance to explore and consolidate any of these in any depth.
I had to take time to sit back and reflect on what I was doing. I spent a couple of weeks returning to my previous teaching style. I felt much more satisfied with this and it made my life so much easier not having to rearrange the room and set up equipment every morning only to find that something was not working properly and all of my planning had gone to waste.

The conclusion I came to was this experience was not unlike that when I had began teaching all those years ago. I thought back to the days when I would sit in the resource centre until late a night looking through black line masters for activities I thought were good and then wrap my teaching around these. Although I knew it was wrong, I would teach what I was comfortable with and find how it fitted into the syllabus. I did this ‘treading water’ until I caught my breath. As I grew as a teacher I gained the confidence and experience to start from the point of knowing what I had to teach and then developing my own resources to achieve this.

The next time I undertook this type of journey was when the Curriculum Framework was introduced. Once again I taught from the point where I was comfortable and found how and where it fitted into the outcomes. Slowly my starting point and focus in teaching evolved so as the children could confidently demonstrate the outcome rather than mindlessly reciting what I had taught.

I came to the conclusion that this was again one of these ‘shifts’ in teaching practice moments and I suspect it will not be my last.

While I had been undertaking this little sojourn in my journey the others had attended a PD on the IWB, everyone else seemed to be making great leaps in their abilities. Nyree showed me what they had learnt, using the notebook program that I had previously avoided, they had created ‘sorting boxes’. These boxes could be used to make your own resources and basically give students instant correct/incorrect feedback on an activity.

Realising that my journey would only progress if I took the steps to actively try out new ideas I had a go at developing resources that fitted my teaching rather than the reverse. I was now starting to take ownership of my own learning journey.
I created a virtual cheque book and children needed to complete each cheque by dragging the matching correct amount in either words or numerals onto the cheque. Incorrect responses slid behind the cheque while correct ones sat over the top. The children responded positively when it was their turn and generally for the first 15 to 20 minutes of the lesson. Although they enjoyed the activity, this was probably the first time I encountered problems such as the attention span of a whole group for an extended time and the difficulties children had in moving items around the board.

It was now that I adopted the “on the board, in the mind, at the desk model” on a regular basis. I found this to be much more productive. I guess that it really equates to the old “do, talk, record” model.

This step was a big one and one that I needed to take to make use of the whiteboard as a tool to support what I wanted to teach instead of driving it. I found I needed to reduce the time spent on the board and make what we had done more individual. I found the activities didn’t need to be elaborate and have found since that the more simple graphics and fewer words help emphasis what I am teaching. I no longer ‘had’ to perform on the IWB each lesson but would often use it to review a concept before children undertook a written activity.

By early third term my IWB had been wall mounted. This was the biggest factor in its successful use. I no longer had all the troubles associated with booking it out from the library, setting up, and alignment when children knocked it, and the endless miles of cables across the working area. It was now that the board truly began to become an integrated tool in all my teaching.

I had branched out and was making many of my own resources which were not only being used in mathematics but in all of my teaching. I started mixing the way I used the board within lessons. I had become reasonably proficient in notebook and could create my own activity that had links to internet sites built into the pages. For example by doing this we could flick between learning about large numbers in resources I had created and internet sites which used large numbers in context. This was meeting my needs of making children numerate not just able to understand what large numbers were but actually using them in real life situations. My whole practice of teaching had shifted focus. I now had all of the resources of the ‘real world’ right at my fingertips which were able to be used by large numbers of students at a time.

At the time we were learning about large numbers we were also working on ‘our place in space’ in science. I felt as though I had become ‘super teacher’. I was doing all of those things that you know you should. I was integrating across learning areas, I was using real life situations to teach maths in context and my program was interesting, varied, visually stimulating, I was using all that was new and at the forefront of technology. We were taking photos of practical sessions we had completed on the oval to compare how distance can affect perceived size of astral bodies. I could import the photos into notebook and using the pens we could draw over the top of the images and write the distances between our objects. We could then compare these to actual distances between the bodies that we had found using internet sites. We then wrote in our findings into our science journals. This was an example of just easy it was to prepare and present a lesson where we were actually addressing outcomes in science, measurement, ratio, scale, large numbers, speaking and listening, reading and writing.
I am now at the end of my first year journeying with the IWB project and I think I have completely changed the way I teach. I use the board every day in almost every lesson. I tend to follow the, ‘on the board, in the mind, at the desk’ model and have learnt that the resources I create on the board need to be simple without visual clutter.
Although students seem to be more attentive while working on the board they do not attend infinitely. The board sessions need to be short to be affective and have real purpose. In hindsight this is no different to all teaching, just because the IBW is new and visually engaging does not mean it is the panacea.

**Outcomes**

Over the course of the year the control group made significant gains in both the SOS mathematics test and in the relevant item numbers in numeracy net while the smaller group also made gains they were not as great. The graph below compares the growth in the two groups using Numeracy Net.
Students numbered 1-18 are those in the control group, students 20 – 29 are the small group and numbers 30 and 31 are the two specific IEP’s. Through natural attrition two students from the focus group are not included due to transferring schools.

The students in the focus group seemed to make greater improvements than those in the small group. It must be noted that the students in the focus group were the more able students and therefore most probably had a greater capacity for improvement.

The second measure of growth used was the SOS mathematics test. Again the focus group has made significant gains. I initially planned to test and retest the students in only 13 items of the test that referred to place value. However I had completed this part of my action plan mid term three. I tested both groups and found that the focus group had performed significantly better than the small group.

Again both groups made progress but the results of the focus group show a ‘value adding’ of approximately 1.8 in the raw score of 13.
I then continued my work with the IWB in all areas of mathematics except measurement where Karen Shenton (fellow team member) was working. I therefore can compare the complete results of the SOS test.

The end of year, results show that the focus group had an average stanine of 4.3 compared with their February result of 2.3. The small group had an average stanine of 1.5 compared with a score of 1 attained in February. The focus group had an average growth of 2.2 over their February score while the small group only grew by 0.5. It is expected that the growth of a student over the year will be approximately 1 stanine. I have generally found this to be the case however this year the focus group has made improvements of 1.2 stanines on average above the expected growth. The only difference in my teaching this year has been the IWB. From this I could assume that the IWB has been the significant factor in the perceived improvements.

The other notable observation is that children in the focus group improved a significant amount on the scores received in the working mathematically section of the SOS standardised test. I am tempted to assume that this is a direct result of the newly acquired ability to explicitly teach numeracy with ease rather than mathematics.

Besides measurable outcomes of the students I have noticed that they are more attentive and less distracted during IWB sessions. They are actively engaged not only when they are working on the board but when either myself or other students are driving it often to the point of standing up at their desk and physically trying to manipulate objects in the air in front of them. We have overcome the problems associated with moving objects that seem to get stuck by using the back of our fingernails as they seem to move more smoothly and are less ‘sweaty’. This also eliminates the dirty fingerprints that often appear.

All children are keen to ‘have a go’ and ‘take risks’, they are not so worried about making mistakes. An obvious mistake is often covered up by ‘I didn’t mean that I just had problems dragging it into the correct spot’ or ‘are you sure you lined the board up this morning?’ Using pen and paper doesn’t give the participant the same ease of change and somehow seems more permanent.
On a more personal level participating in the project has ‘refreshed’ my own philosophy on teaching. It has made me take time to reflect and regain the focus of why I’m here and what I can do that really makes a difference. This process can become lost all too easily in the busy every day demands of teaching. I don’t think I actually learned anything new about teaching numeracy but I definitely took the time to evaluate what I was doing and sharpened my skills lesson planning, delivery and reflection. Without the action learning project I would probably have learnt how to use the board and simply used it as a stimulus as I would with posters or a video. Having a ‘team’ at my school all working through the same difficulties made me reflect at a deeper level and strive to try new ways of using the board effectively.

By having the ability to more readily teach and evaluate true numeracy in children via real life use of maths I have discovered that many of the children I would have assumed were numerate were not necessarily so. I think over the years I slowly began to teach maths rather than numeracy and by having the IWB I found that I have now started teaching numeracy again. The board allows me easy access to the internet which is ‘real life’, I find it so much easier to explicitly teach how to be numerate and use my knowledge of maths to do so. Children can see how the big picture fits together and begin to ask mathematical questions thus having a reason to learn mathematical concepts.

Although the board had produced all of these wonderful ‘light bulb’ moments it has also been the cause of many headaches. I couldn’t possibly start to list all of them however the main problems I had were before the board was mounted. It is almost impossible to use it as an integrated part of the class while it needs to be set up for each lesson. The space needed is the first obstacle, secondly if you have managed to locate all of the necessary cables and then continue to hide them in your room for future use, you need to be mindful of the hazards they pose when running across the floor, often suspended at knee height. If you can get past these and have reached a power outlet and blue cable point while the network is actively running the only problem you have left is to make sure the board is aligned and no child bumps it or touches it too firmly while it is in operation or you will spend nearly half of your lesson playing the ‘touch the crosses game’. Although children love this I’m not sure if it is teaching them more than fine motor control.

When my board was wall mounted most of these problems simply vanished into thin air. New problems began to pop up but I think they are reasonably specific to my location. I found that my board was great until the weather started to warm up. When the air conditioning was turned on the board started to ‘shudder’. I had fears of my special needs student suffering an epileptic fit as he began to shake his head in time with the movement. After a week my board was no longer in focus and my tool bars dropped off the bottom of my screen, the right hand side had become projected onto the notice board. When children touched the projected image on the notice board they couldn’t understand why the board did not respond.

When a technician attended they said the air-conditioning unit was located above my ceiling. Unfortunately this is the case with all of the second story classrooms. The air-conditioner had caused vibrations in the projector and the resulting vibrations shook the bolts loose and changed the alignment. After three days of fiddling with the board the technician padded the ceiling cavity with wood and foam. This has stopped much
of the movement however it still has a ‘wobble’ and will need regular attention to keep focus and alignment. When the ceiling was being put back a section fell down and has deeply cut the surface of my board (and the technicians head). So I am now at the point of waiting for a new board once more. Our class voted to continue using the injured board because we have come to the point where we can’t bear to be without it. We have likened it to a speed hump in the shopping centre car park, it still works but needs a bit of a run up to get over the scratch.

A Way Forward

I definitely feel richer for the experience of being part of the IWB project. Although I have had problems, frustrations and on occasions felt pressured, overall I feel refreshed and rejuvenated as an educator. I will definitely continue to use the whiteboard and further develop my skills in this area.

I have come to depend on it in all of my teaching to the point where I have made career choices on the ability to keep it. Recently the job I have long aspired to own became vacant. I considered my options and the temporary ‘ownership’ of the board out weighed the benefits of my dream job. I find that the first thing I am doing every morning is connecting my board and checking the alignment. The board is always on stand by for use in every learning area. I have found when I have been absent the children will often say things like ‘yesterday we couldn’t even check with the internet’ when referring to a problem they have experienced during the day with a relief teacher. Other comments have been such things as ‘...and she drew it on the board with a texta! So she couldn’t even move it!’ (referring to a lesson on fractions). I find these comments a type of compliment. Children are so adaptable and take on new technology so fast that they can’t even imagine going back to the chalk (marker) and talk days. Obviously what I am doing has become second nature and they now expect to use the IWB.

I am looking forward to our whole school being fitted with IWB’s. At least I will be able to move between year levels when this happens. I can see many problems developing, and unfortunately I can see the project team being depended on to help. I am a reluctant participant in much of this role, not because I don’t want to help but rather I think you have to help yourself if you really want to learn. If the effective use and implementation of the IWB had been handed to me on a plate I don’t think I would have developed the same understandings and philosophy. I think the most effective way to introduce teachers to the new technology is to provide mentors to guide and support, not provide all of the answers. Other important contributing factors are to make sure that others are taking the same journey. If you are working alone it is all too easy to put it to one side to ‘work on later’, it is easy to become stalled. With collegiate support you tend to persevere when faced with problems. The final thing you need to effectively use the board is time, time, and more time. Time to play, time to talk, time to experiment and time to think, devise and reflect. Time is what I found the hardest thing to find. Especially valuable is time to spend with colleagues discussing problems and working through them. We were lucky in the fact we were all close friends and could find time to talk in the staffroom, on the stairs and in wet areas during DOTT and any moment we could steal away.
Overall I have loved this journey and think I am a better teacher for it. I am not saying it is easy, quite the opposite, it is probably one of the most challenging things I have done in recent years. But if you stick to it, it is rewarding and now I am looking forward to next year so I can ‘do it better’. I really can’t wait for my next challenge which is to start to convert wave files and make my own talking books.
Student Outcome Mathematics

Test 4A

Version 3

Name: ________________________________

School: ______________________________

Class: __________________ Date: ________

Practice Set

1. Tick the square.
   1  □ □ □ □

2. Tick the number of corners in this shape.
   2  □ □ □ □ □ □

3. 3  42
    21
    + 13

4. 4  75 78 76 66

Use your ruler to measure the length of the line in centimetres.

6 cm 7 m 7 cm 8 cm

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1. Tick the shape located at E,3 on the grid.

2. Which island lies to the North of Australia?
   A. Rottnest
   B. Papua/New Guinea
   C. New Zealand
   D. Tasmania

3. How many intersections can you count? (Intersection - a point where 2 or more lines meet)
   4 7 1 6

4. Tick the shape that has 5 faces, 6 corners and 9 edges.
   A  B  C  D

5. Tick the shape that does not belong in a set of prisms.
   A  B  C  D

6. Which shape could you fold to make a small box?
   A  B  C  D

7. Tick the set of shapes you would make if you cut the arrow on the dotted lines.
   Set A  Set B
   Set C  Set D
8 Tick the shape that is described below.
My shape has four corners.
My shape has four sides.
All sides are the same length.
A oval
B triangle
C pentagon
D square

9 Which shape is congruent (the same size and shape) as this shape?

10 Which picture shows this shape rotated for half a turn?

11 Which dotted line is a line of symmetry?

12 Tick the white shape that is double the length and width of the black shape.
1. Set out the sum and add to find the total.
(Use your working paper)

12. \[455 + 34 + 160 = \]

13. \[\text{- 343} \]

14. Emily got prices for 3 different bikes.
BMX Bandit: $554
Road Racer: $729
Mountaineer: $699
What is the difference in price between the least expensive bike and the most expensive bike?
(Use your working paper)

15. About how many dollar coins could you count in five minutes? Tick your best guess.

16. What is the dollar value of 4 ten dollar notes and 7 one dollar coins?

17. Which number has a 5 in the hundreds place?

18. What is the decimal number that is missing in this pattern?

An adult fare to town on the train is $2.85.
A child fare is $1.25. How much would it cost for mum, dad and one child to travel on the train?
(Use working paper)

Rounded each number to the nearest 10 and add.

Highlights:
- Number: 115
19. Which number will 5 divide into evenly?
   501  305  58  553

20. What number goes next in the pattern?
   1  2  4  8  —
   10  18  15  16

21. What is the number missing from the number sentence?
   2 x — + 4 = 14
   2  5  10  6

22. What fraction of the set of shapes is shaded?
   ♦ ♦ ♦ ♦ ♦ ♦ ♦
   4  10  3  10  10  6  10

23. 23 x 3
   A 26  B 29  C 69  D 66

24. 16 x 4
   A 20  B 44  C 50  D 64

25. Estimate: Which problem has an answer between 100 and 200?
   49 x 5 = 43 x 5 = 29 x 5 =

26. 5 children want to share $85. How much will they each get?
   $20 $11 $88 $17

27. 4 \[ \sqrt{88} \]
   A 42  B 22  C 24  D 18

28. Four children used a bar graph to record the money they had collected for a raffle. How much has Brad collected?
   $20 $25 $21 $24

29. Peta has 3 T-shirts and 2 pairs of shorts to wear. How many different combinations can she choose to wear?
   6  3  8  7

30. What are the chances of rolling a dice and having a 3 come up?
   Impossible  Certain  Fifty-fifty  Unlikely

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Case study: APPENDIX 2

Numeracy Net Overview year 4

<table>
<thead>
<tr>
<th>Numeracy Net Checkpoint</th>
<th>Activity</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Uses the 1-9 pattern in the number system to read, write and say numbers through the hundreds to 999</td>
<td>Oral Counting</td>
<td>Individual</td>
</tr>
<tr>
<td></td>
<td>Read, Write and say Numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number Grids 1</td>
<td></td>
</tr>
<tr>
<td>2. Uses standard place value partitions of two digit numbers.</td>
<td>Lollies</td>
<td>Group</td>
</tr>
<tr>
<td></td>
<td>Dinosaurs</td>
<td></td>
</tr>
<tr>
<td>3. Reads the decimal point in money and familiar measurements as separating larger units from smaller units</td>
<td>Money tasks</td>
<td>Group</td>
</tr>
<tr>
<td></td>
<td>Measurement tasks</td>
<td></td>
</tr>
<tr>
<td>4. Separates objects and collections into equal parts to show and re-divides to show and name halves, quarters, eighths.</td>
<td>Bags of Flour</td>
<td>Group</td>
</tr>
<tr>
<td>5. Understands and uses the relationships between addition and subtraction to represent and solve all additive problem types.</td>
<td>Collecting cards</td>
<td>Group</td>
</tr>
<tr>
<td></td>
<td>Empty boxes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Story Problems</td>
<td></td>
</tr>
<tr>
<td>6. Uses multiplication number sentences to represent familiar equal grouping or sharing situations.</td>
<td>Story Problems</td>
<td>Group</td>
</tr>
<tr>
<td>6. Mentally partitions and rearranges and uses some known facts to add and subtract one and two digit numbers and keeps track of a double count to solve multiplicative problems.</td>
<td>Number Tiles</td>
<td>Individual</td>
</tr>
<tr>
<td></td>
<td>How Did You Do It?</td>
<td>Group</td>
</tr>
<tr>
<td>7. Chooses to use informal written methods to calculate the addition and subtraction of 2 digits whole numbers and a calculator when beyond current scope.</td>
<td>How Did You Do It? Set B</td>
<td>Small Group</td>
</tr>
<tr>
<td>9. Recognises, and continues a pattern involving counting and grouping.</td>
<td>Lamingtons</td>
<td>Group</td>
</tr>
</tbody>
</table>