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Interactive whiteboards, art and young children

Lisa Terreni
School of Education Policy and Implementation
Victoria University of Wellington College of Education
E mail: lisa.terreni@vuw.ac.nz

Abstract

This article presents the results of a small research project which examined how an interactive whiteboard (IWB) was used in a New Zealand kindergarten to support young children's visual art learning experiences. The findings of the research indicated that when an IWB is integrated into a kindergarten visual art programme it can be a useful tool for motivating and assisting children with visual art learning experiences. The digital affordances of an IWB allow for some new art experiences to occur that are different from those of traditional art media. It was observed, however, that creative art ideas developed with an IWB can be translated into traditional art media and vice versa. Problems and issues identified in the study, in particular the need for appropriate professional development for teachers to help them maximise the potential of the IWB for early childhood teaching, are discussed. Some recommendations are made for best practice with an IWB for supporting young children's visual art learning experiences.

Introduction

Early childhood educators, researchers and policy-makers are increasingly recognising that visual art learning experiences are important for developing young children's thinking, learning and communicating (Danko-McGee & Slutsky, 2007; De Vries & McArdle, 2007; Wright, 2003). As suggested by *Te Whāriki,* the New Zealand early childhood curriculum (Ministry of Education, 1996), the majority of early childhood centres in Aotearoa New Zealand provide programmes that encourage children to freely use a range of media for traditional art-making activities, such as painting, drawing, clay modelling, construction, collage, and printmaking (Ministry of Education, 1996).

These provide a basis for young children's visual art learning experiences. However, over the past decade there have been rapid advances in the development of information and communication technologies (ICT) and a marked increase in their use in early childhood settings in New Zealand. Consequently, the provision of "materials and technology" (Ministry of Education, 1996, p. 80) suggested for supporting visual art learning experiences in early childhood contexts has now started to include digital technologies.

As a result of a literature review undertaken as part of my Master's research that examined the use of an interactive whiteboard (IWB) in a kindergarten setting (Terreni, 2009), I found, like Siraj-Blatchford and Siraj-Blatchford (2003), that research literature describing the impact of ICT on young children's visual art learning experiences in New Zealand and international early childhood settings is minimal. Nevertheless, what appears to be a predominant theme in some of the literature that examines visual art education across a range of education sectors is that the use of ICT is changing the nature of visual art (Koster, 1997; Long, 2001; Loveless, 2007; Terreni, (2010); Vecchi & Guidici, 2004). As Vecchi and Guidici (2004) put it, "New technologies have ... introduced new and different elements that are bringing changes to the environment of art and artists as well as that of children. We are dealing with a new landscape of possible mental images and technical and inventive action…" (p. 141).

The IWB is one ICT that is slowly gaining currency in early childhood settings in New Zealand. It has the potential for creating new possibilities for young children's visual art learning experiences (Kuzminsky, 2008; Terreni, 2010). To examine the effects an IWB can have on young children's visual art education I undertook a small case study in a New Zealand kindergarten with children aged two, three and four years old (Terreni, 2009). This article summarises the methods used in the research, and identifies key themes that emerged from it in relation to the children's learning. It also identifies some of the issues and challenges that the IWB created for the teachers in the kindergarten, and finally, makes some suggestions for maximising the potential of an IWB for young children's visual art learning experiences. An overview of the place of visual art in the early childhood curriculum, and a brief description of the research process, are provided to establish the context and parameters of the research.

An overview of the place of visual art in the early childhood curriculum in New Zealand

Te Whāriki (Ministry of Education, 1996) guides early childhood teaching practice in regard to visual art provision through identified learning 'strands'. For example, the Communication Strand suggests that in early childhood settings children need to develop "familiarity with the properties and character of the materials and technology used in the creative and expressive arts" (p. 80) and experience "an environment where they discover and develop different ways to be creative and expressive" (p. 74). *Te Whāriki* recognises that children need to be able to confidently use both verbal and non-verbal strategies for expressing their understandings and experiences of the world, and that visual art education plays an important role in their learning process.

Visual art is a domain of knowledge and learning that is generally integrated into all early childhood programmes in New Zealand, and visual art exploration by young children in early childhood is usually done in the context of holistic, play-based programmes (Ministry of Education, 1996, 2005a). In this context, teachers encourage children to freely use a range of traditional core art media, such as painting, drawing, clay modelling, construction, collage, and printmaking. Increasingly, however, digital technologies have begun to be incorporated into many early childhood settings and are being used to enhance children's art-making opportunities, for example, through the provision of basic art-making software packages (such as Kidpix and Microsoft Office Paint), and also for the documentation of children's art learning experiences. The types of ICTs commonly used in early childhood centres include computers, digital cameras, video cameras, and DVD players (Ministry of Education, 2005b). The internet is also increasingly being used by teachers to assist children's inquiry-based learning or to find information that builds on their interests (Hatherly, Ham & Evans, 2010). As noted, IWBs, a relatively new and emerging technology, are also being used in early childhood settings.[1]

[1] In 2009, as part of a professional development contract with the Ministry of Education, I established and facilitated an Interactive Whiteboard network where seven Wellington and Wairarapa early childhood

Due to their multi-convergence ability and interactivity, IWBs are particularly suited to visual art-making (see *ecARTnz*, issue 1, http://www.elp.co.nz/ecARTnz/ecARTnz_issue_1.pdf) and for internet visual art investigations (Terreni, 2009). IWBs revolutionise traditional computer practice by enabling children to manipulate objects on the screen directly with their hands, fingers, or a special pen, rather than using a traditional mouse. This attribute is particularly suited to early childhood contexts where the provision of kinaesthetic opportunities is fundamental to enhancing young children's learning. As Wright (2007) points out, a child's drawing and meaning-making is often "a synthesis of thought, body and emotion" (p. 48), and IWBs offer children a range of interactive opportunities.

A case study

My research took the form of a qualitative case study (Creswell, 2003; Yin, 2003) where I investigated the use of an ActivBoard (Promethean) IWB that a New Zealand kindergarten had introduced into their programme. Data were collected through participant observations, which were important for gathering descriptions of teachers' and children's use of the IWB; through focus group interviews, which were essential for capturing the points of view of teachers and parents; and finally, by examining teachers' learning stories, a form of narrative assessment (Carr, 2001), which gave further insights into the children's use of the IWB. These were examined in relation to socio-cultural theory and practice, which provided a framework for analysing and interpreting my research data.

The kindergarten where my case study was undertaken serves a particularly diverse and multicultural community. The centre is situated in a small suburban settlement in New Zealand, which is a low socio-economic area, attracting targeted government funding to assist with its operations. Parents can choose sessional or all-day care for their children. At the time of this study, the kindergarten had a client group of 66 children aged

centres with IWBs participated in meetings to share information and ideas about best practice. However, due to a change of professional development funding this network has now ceased to operate formally.

between two years old and nearly five years old. The gender mix of the children attending the kindergarten was relatively equal, while the ethnic composition of the kindergarten was very mixed, with a high percentage of Māori and Pacific Island children. The teaching team comprised five teachers who all had early childhood qualifications but the length of their teaching experience varied.

Research methods

Qualitative research methods were used in my research, and these enabled me to explore how the IWB was used authentically in the kindergarten setting (Denzin & Lincoln, 2005). A case study was used because this mode of inquiry is useful for small-scale research projects (Yin, 2003) and is also useful for investigating "organisational change, or implementing a new programme" (Burton, 2000, p. 177). In this study, the introduction of the IWB involved some changes to the kindergarten's visual art programme. As previously mentioned, data were collected through participant observations, focus group interviews, and by examining and analysing teachers' documentation through learning stories.

A participant observation approach was used to examine the children's and teachers' use of the IWB specifically for visual art learning experiences. A focus group of nine children was determined to create a purposive and quota sample (Denscombe, 1998). The group comprised two four-year-old boys, three four-year-old girls, two three-year-old boys and two three-year-old girls. However, other children who actively used the IWB were also observed and included in this study. Observations were conducted during the kindergarten's morning sessions over a four-week period. The majority of the observations were video recorded and/or photographed, and stored digitally on a laptop computer. Field notes were also taken, and the data were made available to teachers and children throughout the research process.

Focus group interviews were used in this research as a means of accessing information, opinions and viewpoints of the entire teaching team at the kindergarten in relation to the use of the IWB for visual art learning experiences. This approach to interviewing was a good 'fit' with the management of the kindergarten where staff regularly discussed issues relating to the programme and/or the children as a team. The focus group

interview with teachers took one and a half hours, and the session was tape recorded and later transcribed. A focus group interview with the parents of the nine focus group children was also undertaken to examine how they felt about the children using the IWB for art activities. The interview was held during a morning kindergarten session so that the teachers could assist with childcare, which enabled the parents to participate in the interview without being concerned for their children's wellbeing.

Another source of data collection used in this case study was the analysis of teachers' documentation that assessed young children's engagement with the IWB for visual art learning experiences. The kindergarten teachers use learning stories (Carr, 2001) to examine and assess children's learning. The learning stories include written text, photographs and/or other visual images, such as scanned or digitally converted drawings or artwork created by children. Four out of the five teachers provided me with learning stories they had done on individual children using the IWB for visual art learning experiences – four had been done prior to my research being carried out, and three were done during the time I carried out my research.

Data were analysed by closely examining the data accessed by the different modes of inquiry, and from this analysis I was able to identify key themes. Because the research was a small-scale case study, the pool of data was very manageable and did not require complex coding for themes to be extrapolated; themes became apparent as I was guided by my research questions.[2] Each type of data elicited a range of key themes or phenomena which sometimes were similar to those found in other data sources, or the themes were specifically identified by that particular mode of inquiry. The three types of data collection activities used in this study formed a sound base for triangulation and established the validity/credibility of research. Member checking, another variant of triangulation, was done regularly with the teachers, parents and children at the kindergarten, and this was useful as it supported the reflective practice teachers used at the kindergarten.

Themes that emerged from the data analysis

A number of key themes emerged from the data that demonstrated that the IWB was a digital tool that supported children's visual art learning experiences. These themes are described in the following sections.

Interactivity, drawing and physical movement

Throughout my participant observations it was evident that both the interactivity and the size of the board were very attractive to the children, and I regularly observed the delight they experienced as they used large, sweeping movements to shape their images (see image 1). Teachers, in the focus group interview, also commented on the fact that drawings on the board involved a higher degree of physical movement by the children than with traditional drawing, and being able to provide children with a large drawing surface was useful as it added diversity to their drawing experiences.[3] I also observed that sometimes children enjoyed the sound of thumping the IWB with the pen which created both sound and a digital mark, and that the physicality and interactivity in the drawing process were relished by many of the children. These features were noted in one of the learning stories about a child with special learning needs, where the teacher considered this to be a reason he enjoyed the IWB art experience.

Figure 1: A child using a big sweeping movement to create lines and circles

Digital affordances of an IWB provide new tools for art-making

The case study kindergarten's IWB was loaded with ACTIVprimary software which was used for art-making activities that were primarily drawing based. The digital affordances of the IWB and the ACTIVprimary software offered children some new experiences in drawing that were significantly different from those offered by traditional drawing materials. For instance, the software's pens, pencils and highlighters that children used for their drawings, which were activated using the mouse pen, were repre[4]sented by icons that were pictures of standard felt pens, pencils and highlighters. Children could choose three different thicknesses of pen, pencil and highlighter by selecting from a range of icons displayed at the bottom of the flip chart and tapping them with the pen. They could then choose the colour to be used with the pen by selecting from a standard range of colours also located at the bottom of the flip chart underneath the pens, pencils and highlighters. Interestingly, the children often used the thicker pens in their work, possibly because many of them seemed to enjoy the ease with which they could cover the surface of the IWB with colour in an abstract way. Nonetheless, some children were more discerning in their use of pen width, particularly if they were doing more detailed work (see image 2).

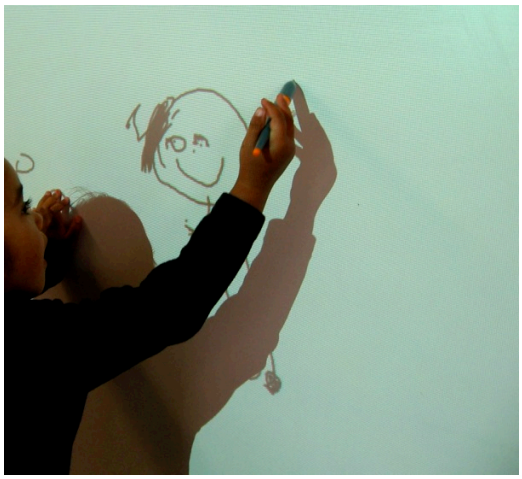


Figure 2: A thin pen was chosen by a child to draw a detailed portrait of the researcher

The erasing tool was another interactive feature that the children explored extensively. They were frequently observed using the digital pen to create a drawing and then using the erasing tool to remove it. This affordance seemed to give the children immense

satisfaction and they would often spend considerable time and effort removing every single bit of their drawing from the IWB. This appeared to be the digital equivalent of children doing a complex and detailed painting and then covering over the image entirely with paint, something that I have observed frequently as a teacher in early childhood settings and something which can dismay teachers, but which satisfies children. For some children, using the erasing tool meant that they could adjust their drawings if they felt something needed altering or improving, which is much more difficult to do with traditional art materials. The tool, which has the option to be used in three different widths, could also be used as a drawing tool and children were observed using it to inscribe into an existing image or block of colour, with the negative space becoming a white line or shape (see image 3).

Figure 3: Using the erasing tool to create negative spaces that appear as lines or shapes

The software included an image library. Children could choose images they liked and insert them into their own flipcharts. They then either drew on the image, around it, or used it as a model for their own drawings. Children would sometimes employ the images as backgrounds to their drawings, or use the images for creating increasingly complex collages, combining their own drawings and the software images. The animal images, which were much enjoyed by the children, were often manipulated and moved around the IWB with the pen. A toddler (aged two years exactly) found this option very engaging, often providing a running commentary about her discoveries and drawings.

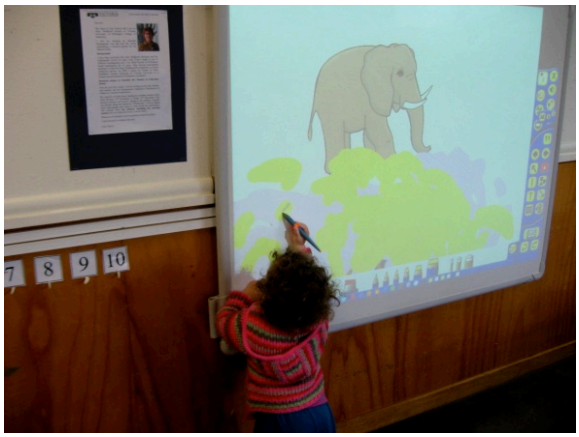
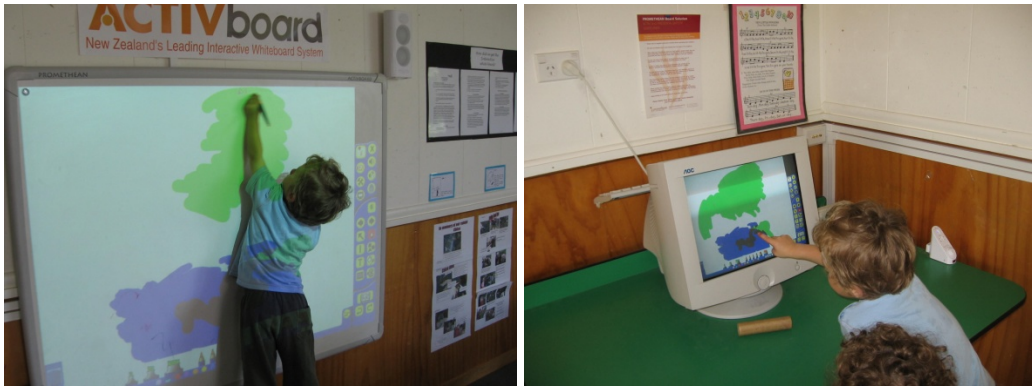


Figure 4: A toddler covers a camel in purple and yellow but can't quite reach the elephant

A 'fill' tool enabled children's drawn shapes and/or images from the library to be coloured in digitally. Occasionally this resulted in some very psychedelic explorations, especially if the children were working fast. By tapping on the 'fill' icon and then choosing a colour from the menu this tool could also be used, for instance, to change the white background of children's drawings to a colour of their choosing or to change the colours of the animal images in the library. To use this affordance in their art work required children to have a deeper understanding of what the IWB and the software were capable of. Rather than being located along the bottom menu bar with the basic drawing tools – which most children were able to manipulate – the fill tool was located with other more complex tools on a sidebar menu. A further affordance of the ACTIVprimary drawing software involved the ability for 'parts' of the children's own drawings to be moved around the IWB. The separate 'parts' of children's drawings were able to be arranged into different configurations, or deleted by putting them into the rubbish bin. This also required more in-depth knowledge of what the software could do and, from my own observations and discussions with teachers, only the more experienced children were able to perform this function effectively.

A small computer screen was set up next to the computer that operated the IWB. This was used frequently by the children as they progressed with their drawings on the IWB (see images 5 and 6). The children would often move from the image on the big screen to look at it on the small screen. As the children were physically small, I felt this

enabled them to see their whole drawing more clearly and, because of the amount of lighting in the kindergarten building falling on the IWB, the colours on the smaller screen were much brighter and more intense than on the big screen. The monitor also allowed for greater participation by the children who happened to be observing as they could see progress on both the big and small screens. Watching a drawing progress on the small screen was quite intriguing and had a magical dimension due to the drawing appearing to be creating itself or being made by an invisible hand.



Figures 5: A child checks his drawing on the small monitor after working on the IWB

The importance of children using the IWB without time constraints

What is sometimes apparent in early childhood settings is that teachers often limit children's time using computers (Oldridge, 2007). As an early childhood teacher for many years, and as a professional development facilitator working closely with early childhood centres on issues relating to ICT, I have observed this phenomenon regularly and recognise that this happens because the equity issue of ensuring computer access is fairly distributed amongst the children which is often considered by teachers to be of the highest importance. At the case study kindergarten, however, children were given unlimited time to explore the IWB for their visual art learning experiences, just as they were with traditional art media.[5] The teachers reported that they felt that this gave the children an opportunity to fully explore their creative ideas as well as allowing them to become fully conversant with how the drawing tools worked and to remember how they worked, and to play and experiment with them.

IWB as a tool for transferring ideas into other visual arts experiences

As an artist with an interest in the use of mixed media, I was particularly interested in the way in which the IWB appeared to sometimes motivate children to engage in other visual art learning experiences using traditional art materials, as the children were often able to transfer their ideas developed with the IWB into other art media. One of the teachers enthusiastically reported this phenomenon in a learning story in which she described a child's interest in using the IWB to draw flowers and how, after a session on the IWB, the child immediately went to the art area and recreated her drawing of the flower on the IWB using collage.

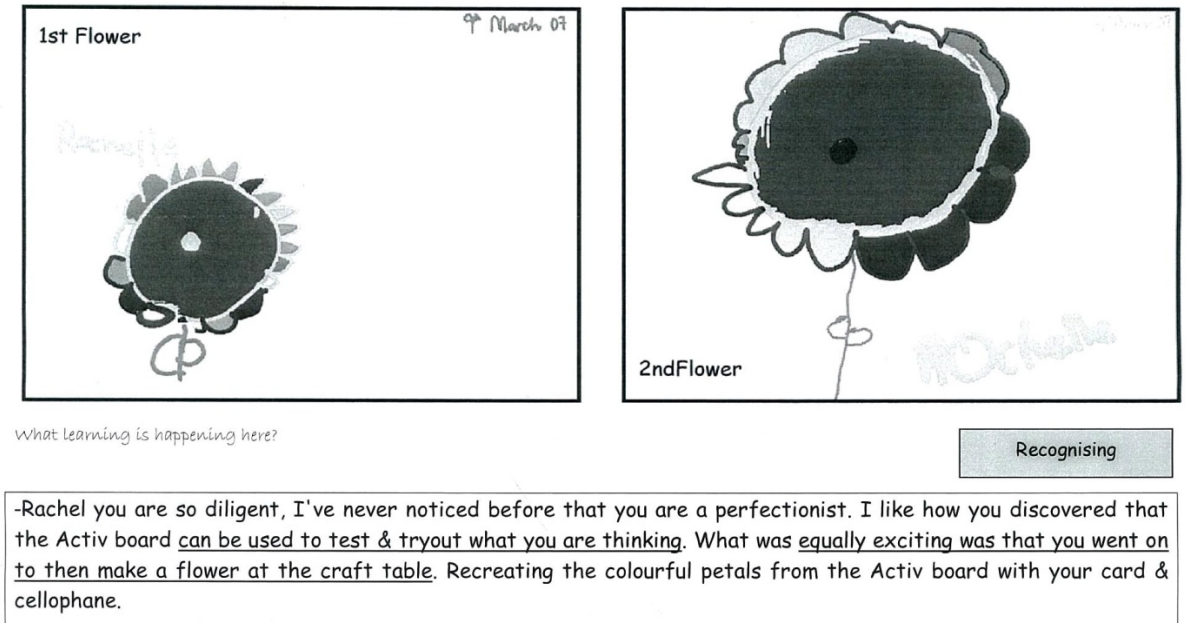


Figure 6: Excerpt from learning story showing drawing and teacher's comment

I also noticed this when observing a focus group child, who was a regular user of the IWB, as she created a large purple drawing, literally filling the page with a pile of purple colour, which she described as a purple rock. A few days later I noticed a painting on an easel done by the same child that appeared to use paint in a comparable manner, exploring similar ideas in relation to colour and construction of the image.

Collaborative and peer support in visual art learning experiences using the IWB

In the focus group interviews with teachers and parents, and from my observations of teachers' engagement with children at the IWB, it was clear that teachers were vital for scaffolding and facilitating children's skill development with the IWB. However, another key theme identified in my study was the way the IWB supported socially constructed learning between the children. The IWB offered children an opportunity to work together and, in the process, discuss each other's drawings and give each other support with using the IWB tools. It was not unusual to see children creating a drawing or design with their friends sitting beside them on the little chairs, engaged in lively conversation with the artist and/or each other. Children who were not actually physically participating in the work were 'active observers'. They did not sit passively watching; they were often actively engaged through dialogue, critique, and/or by offering technical support. was positioned – appeared to facilitate and encourage this process.

Figure 8: A child assists her friend by pointing to a tool that is needed for the work

Whilst children discussed work together in the other art spaces in the kindergarten, the large size of the IWB – compared to the small size of traditional painting easels (designed for use by one child at a time), plus the clear and central space in which the IWB. The teachers also talked about how when they recognised children as having

strengths and specific skills in certain areas, they were named by the teachers as ‘experts’. Expert users of the IWB were encouraged by the teachers to guide other children’s explorations on the board.

The IWB as a tool for generating feelings of confidence and competence for children with special learning needs

One of the first learning stories from the case study kindergarten that I analysed documented Henry’s work on the IWB for visual art learning. Henry, a deaf child with special learning needs, had not participated in drawing activities at the kindergarten before using the IWB. The board appeared to motivate him to engage in this drawing activity but also prompted him to tell the teachers about his work on the IWB, using his repertoire of non-verbal gestures to communicate the meaning of some aspects of drawing. The following day the teachers found that Henry had painted a picture of Spiderman at the painting easel, which was something that he had never done before. They felt this was significant, and a direct result of his successful explorations on the previous day at the IWB.

Figure 9: Henry’s drawings on IWB and his Spiderman painting

The enthusiasm for using an IWB by deaf children has been identified by Carter (2002) who, in her work as a teacher of deaf children, found an improvement in the concentration for some of the children when they used an IWB. During my time at the kindergarten I noted that Henry, now an old hand with the IWB, sometimes took a

leadership role on the IWB when he was with his friends, demonstrating not only his skills but also a high degree of concentration.

A learning story about Tanya, a Down Syndrome child, documents her collaborative engagement with another child through drawing on the IWB. Tanya helps this child to use some of the icons by making gestures, tapping, and verbal grunting to convey instructions to him. What is significant in this observation is how Tanya, like Henry, was able to use her skills with the IWB to take a leadership role with other children. Tanya's developing skills and mastery of strategies for using the IWB and her resulting confidence enabled her to become what the teachers described as an 'expert', and she wanted to share her knowledge with other children. The IWB was not only a drawing tool but had also become a vehicle for communication and interaction with other children. Black (2008), writing on the use of ICT and Down Syndrome children, asserts that IWBs are part of a quiet ICT revolution that is happening (in schools in the United Kingdom) that can make a difference to Down Syndrome children's learning.

My own observations of these children and the learning stories about Henry and Tanya, children with two different types of special learning needs, showed that their visual art learning experiences were extended with the IWB. The IWB appears to have acted as a mediating tool for both children, enhancing their skills in drawing that enabled them to access an important visual language. The teachers also felt that for Tanya and Henry, their ability to communicate with others was enhanced through their drawing processes and explorations on the IWB.

Story-telling and drawing with the IWB

A final theme that emerged from data analysis highlighted the importance of the relationship between drawing and story-telling on the IWB. Drawings created on the IWB were sometimes used by the children as a vehicle for story-telling. Children would often discuss what was happening in their work if I asked them about it, and I noticed they often told each other stories as they worked. Research by Colbert (2006) has noted that ICT has a powerful ability to extend children's interest in story-telling. The children's enthusiasm for linking their drawings to a story demonstrated that the IWB

could be used not only for enhancing visual art learning experiences, but also for encouraging oral and written literacy experiences.

Problems and issues

Overall, I observed that the IWB functioned remarkably robustly throughout the high energy kindergarten sessions. I did, however, observe a few technical problems that sometimes impacted on the optimum functioning of the IWB. For example, the positioning of the IWB was too high for many of the smaller children, particularly in relation to the use of software drawing tools and utilising the whole space for their drawing. To give children better access to the whole board, it needed to be lowered or a small platform installed.

In the focus group interview with the teachers, it was noted that there was sometimes a problem due the vulnerability of the ACTIVboard's digital pen. If the fibreglass nib of an interactive pen got lost, which happened if children removed it from the casing, the IWB could not be used until the nib was found or replaced. The ACTIVboard pen was also quite thick and at times I felt that the thickness of the pen made it hard for the smaller children to manipulate, making their drawing movements clumsy. Nonetheless, despite this, the children were not deterred from using the technology and most were able to manipulate the pen tool effectively, creating successful artwork on the IWB.

Another problem that occurred with the IWB was the accidental disabling of the computer by the children. This sometimes happened because the keyboard and mouse attached to the computer were adjusted by other children not working on the IWB. This was extremely annoying for children who were working on the IWB itself. Sometimes children incapacitated the computer because they did not have the literacy skills to know what program to open on the IWB; consequently they sometimes randomly opened several programs at once. Staff could not always be near the computer to support children opening or shutting programs.

Perhaps the most pressing issue that emerged from the study was that the teachers identified, in the focus group interview, that they found the IWB technology complex. They noted that as they worked with the technology with the children there was a huge amount that they needed to learn about the IWB so that it could be most effectively used

for their teaching. They felt that not having enough time to explore the potential of the IWB and practise using it was a problem for them as they had sometimes found when they were working with the children that they often forgot things that they had previously learnt. They felt strongly that there was a need for professional development specifically targeted for early childhood teachers to help them use the IWB to implement the principles, strands and goals of *Te Whāriki*, and provide support for developing their pedagogy in relation to integrating the IWB more widely into their teaching in an early childhood setting.

Discussion

It is important to recognise that my study was very small (a case study of one kindergarten) and that the focus was limited to the area of visual art learning experiences in a kindergarten setting. Further, only one type of IWB (an ACTIVboard) was investigated. This means that the study can make no claims to being typical (Yin, 2003) in the use of an IWB for visual art learning experiences in the wider range of New Zealand early childhood contexts, and the findings about this particular type of IWB cannot be generalised. Nonetheless, some of the problems and issues raised by teachers, and those I observed, are important to consider in light of a growing use of IWBs in early childhood settings in New Zealand.[6]

Having access to professional development with the IWB that was relevant to the early childhood context and improving their use of the technology in relation to their pedagogy were identified as significant issues for the teachers in this study. This view concurs with a BECTA (2007) report which states: "Teachers require continuing professional development in higher level use of interactive whiteboards to bring about the kind of pedagogical changes that are possible with interactive whiteboards" (p.12). Initial training with the IWB can often be accessed through the companies from which an IWB was purchased, but this can sometimes be costly. Teachers need to be aware, therefore, that factoring in training costs needs to be considered when purchasing the technology. Equally important is that programme planning needs to accommodate

[6] My professional connections with the sector – as a university lecturer with a research interest in IWBs and ICT and as professional development provider who established an IWB network in 2008 – keeps me informed about new centres that have purchased IWBs.

opportunities for staff to practise, hone and develop their skills with an IWB in relation to their pedagogy. Another way that this can be done is through the establishment of cluster networks where participants work together themselves, or with a professional development facilitator with understandings about IWBs and ICT.[7] Such networks enable participants to share their individual skills, knowledge, successes and challenges with using IWBs. This knowledge and experience has the potential to generate new ideas and information about best practice with IWBs for the early childhood sector.

The digital convergence ability of an IWB can enable children to use more than just the mode of drawing in their art work. One of the exciting features of an IWB is that it allows for the inclusion of written text on children's work, and enables recorded sounds and speech, photographs and video clips to be inserted into work. As a result of this study, I feel strongly that as teachers develop their own skills and knowledge about how to maximise the potential of the IWB, they need to begin to work with children to extend their visual art making to include an increased range of communication modes. This would add new dimensions to children's work, add complexity to their learning, and enable them to bring in greater references to the types of media and subject matter that interest them (Long, 2001). Creating access to the internet via the IWB also gives children the opportunity to find information that supports their learning interests. The internet also offers some excellent visual art learning activities that are suitable for young children and that can add to their range of art learning experiences. For example, an activity site developed by the Tate Modern art gallery in London specifically for the use of IWBs (Terreni, 2009) – Tate Games (http://kids.tate.org.uk/) – has a range of suitable art-related activities.

The teachers in this study had adopted a 'process rather than a product' approach to the children's use of the IWB for drawing. This approach was mainly driven by a concern for the cost involved in printing children's work although children's work on the IWB was sometimes saved in a file on the computer and/or used as assessment evidence for learning stories. These were sometimes printed off in hard copy for the children's

[7] Changes to priorities for Ministry of Education funding for professional development means that professional development may need to be sought from private providers.

assessment portfolios, but on the whole children's drawings on the IWB were not saved consistently on the computer or printed off. Generating hard copy prints of the children's work is not a necessary part of helping children critique, discuss or be reflective about their art work.[8] However, having some way of digitally saving work is important so teachers, children or parents can look at work. Other methods of making access to children's digital art work created on the IWB more effective can include storing the images in individual children's computer files which they have free access to, uploading them to a kindergarten blog or website, or sending images in an email to the child's home computer once it had been completed.

Whilst this study provided some important understandings about the use of an IWB for visual art learning in New Zealand kindergarten, I feel strongly that there is a need for future research to examine the use of an IWB across the whole early childhood curriculum and in a variety of different early childhood contexts.

Conclusion

Many of themes that emerged from study suggested that the IWB is likely to be a useful tool for extending young children's visual art learning, adding richness and variety to an early childhood art programme. The interactivity of the IWB and the digital tools that the software provided enabled children to explore new ways to create art. The IWB appeared to facilitate children's discussion about their artwork with others as they created it, and skills that the children learnt from using the IWB, particularly children with special learning needs, sometimes enabled them to take on instructional leadership roles with other children – and even their teachers. Nonetheless, ongoing research would further benefit our understandings about what constitutes best practice for enhancing young children's learning with IWB technology in visual art and across the curriculum.

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[8] Nonetheless, printing children's art work done on an IWB can be useful for exhibiting children's digital work alongside traditional art work.

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Footnotes

[1] My key research question was: How do teachers and children use an IWB for visual art learning experiences in a kindergarten setting? This guided my research focus but there were also a number of sub-questions: What knowledge and experience did teachers and children bring to their use of an IWB for visual art learning experiences? What teaching strategies did teachers employ to assist children to use the IWB for visual art learning experiences? What learning strategies did children use when using the IWB for visual art learning experiences? What evidence was there of socially constructed learning for both the teachers and the children using the IWB for visual art learning experiences?

[1] The IWB measured 1170 x 890 mm, which was significantly bigger that the range of drawing paper used in the kindergarten.

[1] To ensure fair access to the IWB, teachers instigated a name tag system. When children wanted a turn on the IWB they would get their name tag and take it to the IWB and hang it on a numbered hook. They needed to remove their name tag once they had finished so that the next child could have a turn. Overall, the system worked quite well but the teachers did say that they sometimes needed to remind children about the access process and reinforce the system when they observed it was not working properly.