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Title

Technology as a doorway to literacy in the early years of education: access, equity and quality in literacy education

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Abstract

This paper presents an interim report of a study which explores the integration of technology into the English curriculum in the early years of education. The key research question was *How can technology be a doorway to literacy in the early years of education?* Traditionally literacy and technology have been considered pedagogically opposed, but this study suggests that the pedagogies surrounding the teaching of literacy and technology are mutually inclusive because of the symbiosis of literacy and technology. Early findings confirm the symbiotic relationship between literacy and technology for children in pre-school and the early years of primary education. The findings raise important equity issues for quality literacy education and highlight appropriate pedagogical practice to support literacy development in the context of access, equity and quality in a rapidly changing and technologically advancing world.

Keywords

Technology, English curriculum, early years of education, equity issues, pedagogical practice

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Technology as a doorway to literacy in the early years of education: access, equity and quality in literacy education.

Introduction

Historical perspectives imply a mutually exclusive relationship between literacy and technology. Bigum and Green (1992) highlight historical tensions between literacy and technology pedagogies in a political climate of economic rationalist viewpoints, where literacy and technology were tied to employment opportunities and work. Within an historical context three main literacy paradigms exist- functional, critical and cultural. A functional literacy paradigm promotes essential skills to be mastered for the world of employment and work. In contrast, critical literacy "is about the distribution of knowledge and power in contemporary society" (Luke, 1993, p. 4) thus embracing the exploration of the power relationships existing between literacy and knowledge in society. The final paradigm, cultural literacy, acknowledges the influence culture and community have on literacy learning and a belief that "reading and writing can be understood and acquired only within the context of the social, cultural, political, economic and historical practices to which they are integral" (Lankshear, Snyder, & with Green, 2000, p. 26). It is argued that a functional literacy paradigm has prevailed as having the strongest nexus between literacy and *prescriptive* or skill based technological discourses, through measurable outcomes and skill based content well suited to a "culture of compliance" (Bigum & Green, 1992, p. 7).

Through recognition of the "plurality of literacies" (Comber, 2001, p. 168) and the work of The New London Group and others, the critical literacy paradigm expanded to include multiliteracies (Unsworth, 2002) . Rhetoric advocated an evolving critical cultural perspective embracing changing literacies and the changing dimensions of literacy (Kalantzis, Cope, & Harvey, 2003; Lankshear & Knobel, 1997; Unsworth, 2002) or the need to recontextualise literacy (Durrant & Beavis, 2001; Goodwyn, 2004; Kalantzis et al., 2003; Unsworth, 2002; Zammit & Downes, 2002) and transform curriculum (Kalantzis, Cope, & The Learning by Design Group, 2005; Zammit & Downes, 2002) to meet the needs of the emerging knowledge society. It was argued that globalization and continued advancements in information and communications technology (ICT) gave rise to new literacies; visual and digital literacies (Kalantzis et al., 2003; Labbo, 2006; Lankshear & Knobel, 2006) and these new literacies required new skills and understanding and new ways of teaching and learning.

In the Victorian context, the introduction of the Victorian Essential Learning Standards (VELS) in 2005 highlighted a key aim to prepare students for

> …a world which is complex, rapidly changing, rich in information and communications technology, demanding higher order knowledge and understanding, and increasingly global in its outlook and influences. (VCAA, 2005, p. 2)

Within VELS English is identified as a *disciplinary strand* of which traditional disciplines are a part. Technology however, is labelled as an *interdisciplinary strand*; functioning within other disciplines and beyond the school (VCAA, 2005). This distinction between English and technology highlights key Victorian government strategy to interweave technology across the curriculum. More recently, with development of the National 0-5 Framework and Victorian 0-8 Framework underway, the relationship between early childhood care and education further challenges the logic of pedagogically opposed perspectives of literacy and technology within an emerging context of lifelong learning. In the current rhetoric, a view of lifelong learning that is "driven by the goal of ensuring every citizen an informed engaged and meaningful life" (Edgar & Edgar, 2008, p. 198), begins in the early years of education where access, equity and quality for all can be realised through mutually inclusive literacy and technology pedagogy.

Research study

Tensions associated with the integration of literacy and technologies are not confined to the Victorian context. Prevailing views of literacy that maintain deep roots in functional literacy perspectives and print based pedagogies remain pervasive. Arguments for the recontextualisation of literacy as social practice imply a need for new pedagogies embracing a mutually beneficial relationship between literacy and technology and recognition that technology through social and cultural dimensions, like literacy, is social practice (Beavis, 2001; Durrant, 2001; Durrant & Green, 2000; Lankshear, with Gee, Knobel, & Searle, 1997; New London Group, 1996; Snyder, 2001; 2007; Street, 1984; Unsworth, 2002). Labbo (2006) notes that a push forward to embrace the new literacies of the digital ecology and to incorporate print based literacies has occurred (Labbo, 2006), but there still remains the challenge for educators to embrace pedagogy that fits with the rapidly changing nature of ICT and benefits student learning(Andrews, 2004b). The need "for conceptual studies that theorise the nexus between ICTs and literacy-centred practices and which project a vision of what a technology infused classroom may look like" (Locke & Andrews, 2004, p. 146) is apparent. Some theorists believe this nexus may be found in 'holistic' technological practices described as 'craft like' and process orientated (Franklin, 1992) and socio-cultural literacy perspectives embracing meaningful and communicative literacy practices (Bigum & Green, 1992).

Uptake of technology by educators, in the early years of education, is of ongoing concern as practices such as the use of ICT, as a tool for print based skill drilling or as a reward, are commonplace and examples of effective integration of technologies and literacy are scarce

(Labbo, 2006; Turbill & Murray, 2006). It is argued that pedagogical change will not occur unless early childhood educators develop technological competence and value the use of technology beyond a tool for practising print literacy skills. As key mediators of technology, teachers control student use and access to ICT in the classroom (Andrews, 2004a; Freebody, Reinmann, & Tiu, 2008). Andrews (2004a) emphasises that "teachers are more important than the technology within schools that they mediate for learners" (p.62), as schools differ in the way technology is mediated and many variations of policy into practice exists, highlighting variation in access within schools and communities.

Children come to school with different literacy and technology experiences and orientations (Andrews, 2004a; Edgar & Edgar, 2008; Green & Bigum, 1993; Marsh, 2006; Turbill & Murray, 2006). In an education system that undervalues these experiences and orientations, disadvantages are exacerbated in groups with low access to ICT at home and school (Meiers, 2009). In a world where technology is becoming central to all learning (Goodwyn, 2001, 2004; Kalantzis et al., 2005; Lankshear & Knobel, 1997) denying students appropriate access to ICT is an equity issue.

Children's widespread use of and exposure to technology does not equate to understanding (Elkind, 2007) however the integration of technology and literacy in a way that harnesses the natural curiosity of the young learner in the early years of education can lead to deeper understanding (Marsh, 2006) and implies a need for technology to influence literacy aims and pedagogy (Bigum, 2002; Durrant, 2001; Lankshear & Knobel, 2006; Snyder, 2001). In this sense equity extends beyond access to technology, to pedagogy that allows young people to develop deep understanding of the meaning-making potential of technology and new literacies (Sefton-Green, 2001).

Teacher and student experiences with technology vary and translate in the classroom as a mismatch. This dissonance Green and Bigum (1993) liken to the 'generation gap' where students in the digital ecology are described as 'aliens in the classroom'. Furthermore, dissonances between home and school worlds and between children's experiences with technology are far reaching. Not all children have the same resources to draw on or interact with technology in the same way (Hansford & Adlington, 2009) highlighting the need for new pedagogies to respond to a changing learning environment (Goodwyn, 2004; Walsh, 2006). In addition, 'authentic' learning experiences need to be recognized as those that connect learning in and out of school (Lankshear et al., 2000) and in valuing these experiences, educators need to re-evaluate teaching practice to address the mismatch and ensure access, resources and skills that will enable full participation in society (Luke, 1999).

A consideration of the above issues raised questions for this study. The overarching question guiding the study was: How can technology be a doorway to literacy in the early years of education? A series of sub-questions were developed to feed into the overarching question: What are the values, ideologies and assumptions about literacy and language practices that teachers bring with them to the classroom before and after the study? What are the students' attitudes and assumptions about literacy and technology before and after the study? How do children in the early years of schooling engage with technology in the literacy session? How

do teachers interweave and mediate use of technology and literacy? What evidence of transformational literacy learning occurs?

The research study explored the potential of a mutually inclusive relationship between literacy and technology in the early years of education, in which pedagogy and curriculum, or the how and what of learning, work together to educate students for the future, in which they will function as adults.

In this research study the term 'literacy' refers to the ability to function effectively in "culturally, linguistically diverse and increasingly globalised societies"(The New London Group, 1996, p. 1). To be literate requires the ability to create, communicate and critically reflect on language in order to function effectively in society. The term 'technology' refers to tools, equipment or techniques used in processes. For example, a book at one point in history was viewed as technology for the reading process just as today we view information and communications technology (ICT) as technology for communications processes.

Conceptual framework of the study

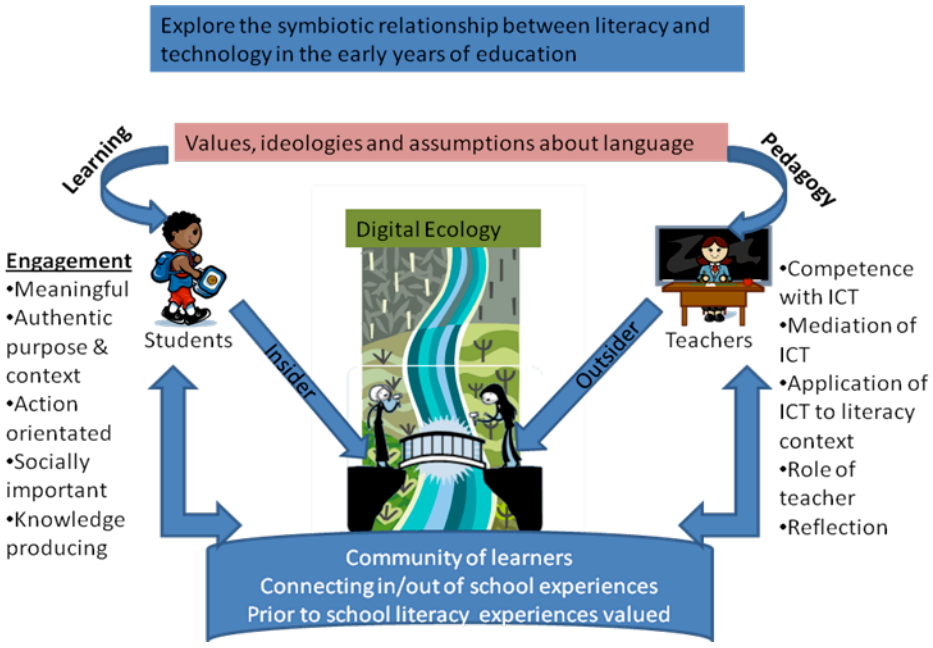

Figure 1: Conceptual Framework
An exploration of the symbiotic relationship between literacy and technology in the early years of education: bringing literacy to life through information and communications technology, creativity and community.

Figure 1 (above) represents a conceptualisation of this research study through the key themes of the literature review. It highlights the way in which values, ideologies and assumptions are at the core of this study and how these are translated into the literacy context of the classroom.

Within our current existence in the digital ecology, theorists argue that as educators we are 'outsiders' to the digital ecology and 'insiders' to the technology that existed when we were born. In contrast, the children in our classrooms are 'insiders' to the digital ecology and 'outsiders' to the technology that is no longer a part of the world they were born into (Gee,

1993; Green & Bigum, 1993; Lankshear & Knobel, 2006). This relationship has been likened to the 'generation gap' that many of today's adults experienced with the introduction of rapid transport technology. As 'outsiders' to the digital ecology we assimilate and accommodate new technology, but our children as 'insiders' have been immersed in these generational characteristics from birth and it is a part of who they are (Green & Bigum, 1993). Many of the challenges associated with symbiosis of literacy and technology can be thought about in a similar way to the generation gap enabling educators to recognize the need to engage this difference rather than to be alienated by it. Through engaging this difference, it is argued that we can "bring to bear new understanding and resources, but also a proper sense of humility together with recognition of the ineluctability of difference" (Green & Bigum, 1993, p. 137). In essence, as educators we can bring a deeper level of understanding of our existence in the digital ecology to our students if we embrace the difference.

Values, assumptions and ideologies about literacy and language are at the core of 'engaging the difference' and teachers bring these to the classroom as in their pedagogy. Children enter the education system having a myriad of experiences at home and in their communities that differ greatly (Zevenbergen, 2007). These experiences contribute to the values, assumptions and ideologies about literacy and language that children bring with them to the classroom (Beavis, 2001; Snyder, 2001; Turbill, 2003; Turbill & Murray, 2006; Unsworth, 2002) and subsequently influence engagement in literacy learning.

A review of the literature suggests that 'engaging the difference' in the classroom requires an expanded view of literacy. It challenges educators to reconceptualise literacy within the current literacy and societal context and to accommodate and assimilate this recontextualisation into values, assumptions and ideologies about literacy and language that influence pedagogy (Beavis, 2001; Durrant, 2001; Durrant & Green, 2000).

For educators to transform new understanding into practice teacher competence in using technology is important (Lankshear et al., 2000). In the classroom the teacher is the mediator of technology use and access, thus an expanded notion of literacy and competence in using technology are intertwined in new pedagogy. It is argued that professional learning processes that encourage critical reflection, provide educators with opportunity to determine the best way to infuse literacy with technology in a mutually beneficial way (Andrews, 2004b). Critical cultural literacy perspectives and 'holistic' technology perspectives provide a nexus between literacy and technology that is beneficial to student learning (Bigum & Green, 1992). Within this nexus there is an emphasis on student control over 'process' or the application of technology to the literacy context. Learning activities should provide opportunity for student input into learning design and process if students are to become 'knowledge producers' rather than 'knowledge consumers' (New London Group, 1996). A key implication of this perspective is the changing role of the teacher.

'Process orientated approaches to teaching and learning situates the teacher as a co-learner, guide and facilitator of learning. Student needs, interests and diversity are catered for in learning experiences that provide authentic context and purpose through engagement in socially important, action orientated, meaningful learning (Comber, Reid, & Nixon, 2007). In

this context designing learning has been described as learning for social futures (Kress, 2000; 2006).

The bridge over the 'digital divide' (figure 1 above) signifies the connection with and new understanding of the symbiosis of literacy and technology that can be achieved through 'engaging the difference'. The bridge symbolises new pedagogy that embraces the notion of a learning community extending beyond the classroom walls, connecting school learning with out of school learning (Beavis, 2001; Lankshear & Knobel, 2006). Within the learning community, prior to school literacy experiences are valued and built upon and learning has reciprocal benefits for student and teacher through knowledge building, sharing and creating in the learning environment.

Study research design

This study involves two case studies in the early years of education; one regional 4 year old kindergarten class and one junior classroom in a regional primary school. Within each classroom three children were tracked through interviews and work sampling, providing multiple case studies. The participants were one kindergarten teacher, one teacher in the early years of primary education, one principal and 45 children in the early years of education (kindergarten– year 2) in regional Victoria. Teacher participants were volunteers and signed parental permission was provided for all child participants.

The research process consisted of the following methods of data collection:

- Individual semi- structured interviews with teachers
- Individual mediated interviews with children
- Learning story reflective journal
- Student work samples
- Reflective researcher journal
- Video footage of classroom literacy/play session.

Interviews focusing on literacy values, ideologies, and assumptions were carried out before and after the study. These interviews were in the form of semi-structured interviews implemented to provide responses without intrusion from the researcher, but with opportunity to redirect focus if needed.

Within each case study focus children were selected using stratified sampling procedures. Stratified sampling "offers increased possibility of accuracy by ensuring all groups are represented in the sample in the same proportions as they are in the population" (Burns, 2000, p. 91). In this study stratified sampling was used to ensure that the children that were tracked were representative of gender and perceived level of literacy achievement.

Teacher participants kept a reflective journal in the form of a learning story. Learning stories, are a form of narrative assessment commonly used early childhood and represent process orientated reflection that considers the learner-in-action and in-relationships (Carr, 2001). For this study the learning story was modified for teacher participants and used to help identify the interrelatedness and connection between the individual, the activity and the community and

to provide insight into children's interests and engagement, and the way in which teachers teach (Williamson, Cullen, & Lepper, 2006).

Teacher participants followed the Action -reflection model used in the Victorian Partnerships in Information and Communications Technology Learning (PICTL) project (McNamara, McLean, & Jones, 2006) to plan, implement and reflect on the literacy focus and use of technology within this context. Focus questions used in interviews conducted at the end of each cycle were open-ended, requiring teachers to reflect on the way technology was used in the classroom setting and how student access to technology in the literacy context was mediated. As part of the reflective process teachers were asked to draw on their own observations and monitoring of student behaviours to evaluate the effectiveness of the teaching and learning cycle. In this way the learning story journal was used to provide snapshots of participatory learning for teacher and child participants, to inform future planning and focus, and to identify areas for further development of competence in technology.

A comprehensive reflective researcher journal was kept throughout the study to ensure that the researcher voice was captured, and behaviour, values and understandings were part of the rich data analysis and interpretation. A key advantage of observation is that behaviour can be recorded as it occurs (Burns, 2000). To support researcher observations video recorded footage of classroom sessions was collected to provide the advantage of being able to repeatedly replay the footage and check for details that may have been missed during the initial observation, providing opportunity for "detailed behavioural analysis" (Greig, Taylorand, & MacKay, 2006, p. 81) and insights into the literacy experiences of the children and mediation of technology in the natural setting.

The qualitative data collected in this study sought to provide depth of understanding of the overarching research question: How can technology be a doorway to literacy in the early years of education? Lichtman (2006) describes the richness of a case study as more important than scientific generalisability (Lichtman, 2006) as it is the circumstantial uniqueness of the case study that contributes to understanding (Burns, 2000). Results of this research study may be limited to each case under study, however it is the extent in which the results can be transferred to other settings that is important (Creswell, 1998). "Rich, thick description allows the reader to make decisions regarding transferability" (Creswell, 1998, p. 203) or the extent to which the study applies to another situation. The dependability of the case study was established through clear steps for replication, multiple sources of data, and an audit trail (Burns, 2000; Creswell, 1998).

Semi- structured and mediated interview frameworks were piloted prior to commencement of data collection and the multiple sources of data described above were collected over a 6 month period from July to December (inclusive) 2008. The researcher reflective journal was used for self reflexivity – "consideration of subjectivity and bias"(Lichtman, 2006, p. 196) for clarifying researcher bias throughout this data collection period and documentation of all activities, involvement and observations. Boundaries placed on the study to ensure manageability included a limit of two classrooms at two sites in the early years of education, a one hour time limit for each semi-structured interview and a 30 minute time limit for mediated

interviews. The study was conducted over Victorian school terms 3 and 4 to ensure enough time for rich data to be collected and for patterns and themes to emerge in a natural setting, and to ensure enough time had been allowed time for young children to settle into kindergarten and school routines.

Discussion of initial findings

Teacher as mediators of technology.

Throughout the discussion section of this paper pseudonym names are used for participants. In the initial interviews classroom teacher participants, Susie and Molly, self identified as having a personal interest in technology and a good level of technological competence. Susie and Molly described technology as part of the children's world and therefore important in classroom programs; however there was a significant difference in individual understandings of the relationship between literacy and technology, and subsequent educational implications for early years literacy education.

Susie described a holistic approach to literacy:

> It is usually the home corner where it [literacy] comes out. I put in a remote control and I put it in one of the drawers and the children found it and of course they knew it was a remote control but they didn't have a TV. Some were pretending and pressing it to the wall then another group decided that they actually needed a TV so they went to the pasting table and made themselves a TV. They were talking about where the numbers go and what buttons they've got. When they came back [home corner] they set it all up and watched a few programs and then all of the sudden it didn't work and they had to find the phone to ring the electrician and they also had to find the phone book. I've always got a phone book in there [home corner] so they were looking up the numbers and then when the electricians came they fixed it all up. Then they had their note pads and their paper and they wrote out the bills for them as well, so it's all this literacy that's happening just from what's available. Just having paper and pens and the phone book in the home corner, just having those things there for them that they can use in their play. Whereas if it was all just at the writing table it wouldn't come into any other part of their play because they'd have to go and get. (N1I4:49)

Susie described literacy in the context of children's play in which literacy experiences were carefully scaffolded or layered into the program to be part of the play. A similar broad sweeping view of technology was encapsulated by Susie in her description of technology as "a communication tool". (N1I17:44).

A social view of technology was further articulated in Susie's comments about technology in the kindergarten:

> I can still remember when the children stopped using the cash register for pressing the numbers and started scanning. It was just a sign. They're used to scanners whereas when we were younger it was always pushing the buttons because that's what we grew up with. So a lot of what their play is here at kinder is reflective of what they know and what's in their lives and technology is a huge part of it. (N1I127:40)

In this example Susie placed high importance on the use of technology in the kindergarten in a socio-cultural context.

Susie articulated, in essence, literacy and technology beliefs that may be required for a mutually beneficial relationship between literacy and technology to be realised in the education setting. In response to 'How do you think technology should be used in the kindergarten?' she responded:

> I think it should be like literacy *(pause*) part of the whole program. Not just this is the computer corner, this is where technology is and that's where it stops. It needs to be involved in everything but not overtaking it. It should be a part of everything that we do and available for the children who are interested in it but not pushed on those who aren't. But I have to admit there are not many. I haven't come across a child that is not interested in it. (N1I128.10)

The response demonstrated a holistic approach to technology whereby technology is embedded in early years program. She further described her understanding of a strong connection between literacy and technology and a perceived implication for teaching and learning:

> I think the underlying thing is that with literacy it is the meaning behind the symbols, behind the words and with technology it's the meaning behind why you use it, what's the use for it. So there is similarities there and it [technology] also strengthens a lot of literacy …children who aren't confident in writing may be confident in using a keyboard because it is what they are used to doing. I'm not saying that writing is not important as they do need to learn those skills but having the keyboard to type things out can raise their confidence and move on to the writing part. (N1I28:54)

Molly described literacy beliefs which extend beyond a traditional view of literacy as reading, writing and spelling:

> It [literacy] is beyond just reading and writing … being able to communicate (N2I7:26)

This communicative view of literacy was not evident in her initial description of classroom literacy. Molly's description of development of language and literacy in the classroom reflected a traditional approach where technology was a tool for print based literacy (Comber, 2001; Turbill & Murray, 2006):

> We have the literacy elements of modeled reading, looking for strategies, guided reading and they still do groups …it's similar to a lot of other classrooms. They still have their groups where they're doing their reading and looking at writing. A lot of the things are the same but I try to use the I-touches as much as I can to support listening. Last week they were listening to a song and they had to highlight the words they knew on a sheet. So instead of just having the song and then the sheet and highlighting any of the high frequency words they could listen to it as they go…just listening to themselves read. (N2I12:49)

Molly described the relationship between literacy and technology as being one where technology could support the development of print based literacy skills:

> I think it [technology] is really good to be able to support their reading particularly, and the speaking and listening. I'm yet to find good ways to use it, I know there is plenty out there, with writing other than just typing on the computer. (N2I22:44)

Although this signifies a print based belief system of literacy learning, Molly acknowledged a willingness to expand on this understanding given the right support.

> I need to find some way to use technology to improve writing because we can do it with the reading. We use it for reading and speaking and listening. Somehow rather than using technology just to type up whatever you've created…At the moment it is sort of like the

> technology is a reward for the hard work of the draft and the pencil and paper…If there was a way that you could use it throughout the [writing] process rather than just at the end. (N2I23:22)

Final interviews with teacher participants revealed a significant increase in depth of understanding of the relationship between literacy and technology and the importance of technology in the classroom.

For Susie it was the insights into early literacy gleaned from the children that were significant:

> Seeing the children find things out for themselves like the orange photos when they learnt that it was their finger over the lens. The social side of it in organizing their friends for group photos. I thought it would be more taking photos of what they've done and what they've made so that they've got a record of it. But the children took it more to the social side of having photos of their friends (N1F15:28)
>
> They've all taken their own initiative and their own learning styles and incorporated it into their play. (N1F19:00)
>
> I think it's continued in the oral language and the following of instructions with the printer and the digital frame and in the sequence of what comes next. The type writer brought out more of letter recognition some used it to write their names and some to see how fast they could get it to go across. The oral language of expressing their ideas to each other of who can do what and expressing their thoughts of what to do next and working out if too many stand behind the camera you can't see and there is no-one in the front to hold the TV up. (N1F17:34)

The affordances of technology for early literacy were widespread and extended beyond Susie's expectations and understanding to an extent that it has changed the program:

> It is really beneficial to include it [technology] in the kinder program because it is so much a part of children's everyday life and how the children have incorporated it into their everyday play rather than this is our time to use technology…with the technology it just encompasses everything. (N1F18:20)
>
> With our information night I spoke about what we'd been doing and how the children had taken it on board…one parent actually questioned she was worried that she hadn't introduced her child to a computer and so was he going to be behind everybody else? I spoke about how the children learn from each other and how some come in using a computer since they could sit on their parents lap right through to only seeing them out in the shops and that kind of thing and how it doesn't matter where they come from they all go at their own pace. (N1F12:30)

Molly described extensive growth in understanding of the relationship between literacy and technology through and early literacy lens:

> I don't even think of it [technology] too much now. It's just become a part of it [the program]. I don't even think am I using technology or not because it is just something that we do. The only reason I have really noticed it was that I'd looked at all the literacy things we'd done this term and I thought I've got a lot podcasts and things that have used computers …and there's more things that I could put on [CD] but didn't because there's just so much. In the projects that we did there is just so much and we've used technology several times throughout each one. (N2F126.15)

In particular she noted that in the beginning stages of the study technology use in the classroom was forced (N2F27.30) and that over the course of the study it had become more free-flowing:

> Quite often it's not a planned thing. I knew that I wanted them to record their voice and have an e-book but the rest of it I didn't really have to think too much about how to do it. It depended on where the kids were at. The recording of their voices for the sharing was a spur of the moment thing…The recording of the tasks… it's all taking away me and allowing the kids to be immersed in it (N2F27.33)
>
> Thinking about the things we did in term 1 and term 2 it has been a change. When you were initially here it was like what can we do for Ka but now I didn't even have to think about what I was doing I reported on what we have done. (N2F28.40)

In the final interview Molly articulated a holistic approach to technology that demonstrated deep understanding of the interrelated nature of literacy and technology across the curriculum:

> The last thing that we've just done was an interview to record their understandings about the maths that they'd been doing. Some of the preps had done it with the spud maths…and we had done some number problems and we were doing some things with thinking mathematically and they were reflecting on the problems and some of the challenges and the discoveries and they recorded that with a partner as an interview rather than writing it. (N2F29.50)
>
> At the start it [research study] encouraged me to do a lot more with technology and now I don't even think about it so it's really helped with my growth as a literacy/technology teacher. (N2F32.05)

For case study teacher participants, the realisation that depth of learning was more significant than breadth of experience with technology was considered profound. Susie described the need to go deeper and further into an area of technology with children:

> Technology has always been a thing I have been interested in…but in doing this [research study] I've had to make myself bring it out more and think further as in what can we do? How can we extend on this? Whereas beforehand I still would have included the camera…but how I would have used it may not have been as advanced. (N1F14:21)
>
> The novelty of the camera wore off after a period of time and it became just another learning centre within the room – I think this allowed the children more time to explore what they wanted to do with the camera…It was through looking at the photos that the children took that I was able to develop a deeper understanding of what the children were exploring and learning through the use of the camera (N1LS2p.1)

For Molly this realisation was articulated as teacher professional learning with ICT and understanding of what is valuable learning for children:

> The one last term [learning story] helped with this term…too much happening and I thought okay we need to take a step back… the focus for the term became the school story… it was a big narrative and the narrative was based on across the road [building of the new school]…why keep forcing lots of little things? (N2F32.33)
>
> There would be a lot in terms of what other opportunities there are [podcasting]. With what we've got other than i-movie we've got a handle on it… I guess it's what other opportunities there are for us to use the technology…with the movies it's like a developed podcast, putting in

> the music, the background and all that sort of stuff, Now that I am comfortable, get me outside that comfort zone to learn something new. (N2F37.13)

This underlying belief about the importance of deep learning as opposed to breadth of learning for teachers and children found similar support in Pete (principal):

> If you get too much information…in offering alternatives as to how we might be using the Macs suddenly we were feeling pressured to do something different rather than refine the podcast process even further. (N3F12.29)

Apparent in both case studies was the view of teacher as co-learner and part of the learning community. Susie described interactions with the children as being important for curriculum development:

> The interactions with the children, being part of the program with them rather than setting it up and letting them go for it…so that comes back to the curriculum and the way you've set it up. (N1I1.12)

Molly also describes a learning community brought to the surface through the study:

> It's [research study] been really good in our growth and understanding and has helped bring the kids with us because the kids have been part of it and helping to drive a lot of the things that we are doing as well. A lot of their questions have been driving where we've been going…bringing the kids together we've sort of been on the same journey so it's been good. (N2F34.10)

Children as learners

The rich, thick description provided through the learning stories of each action reflection cycle identified key elements of learning for the children in each case study. Children participated in a diverse range of early literacy experiences in each case study.

Early findings suggest that the seamless integration of technology within an extended literacy focus may benefit student learning. In the kindergarten the digital camera was incorporated into the play based curriculum for the duration of term 3 and into term 4. Throughout the extended focus using the digital camera, cameos of child learning emerged. Impetus for the introduction of the digital camera came from student interest in photography stemming from a visit to the art gallery. The use of the digital camera in the play based curriculum provided several insights into student learning. Susie described two major benefits of the technology:

> It was interesting to see how the children worked together not only to share the camera, but also to share the experience. Small groups of children organized their friends to pose for a picture and then after taking the photo quickly looked to see how the picture turned out. (N1LS1p.5)

> I was thinking they would take more photos and they would print their photos off and they'd like to write a story, but they're more interested in talking to each other about what's going on and what they're doing and the social aspect. That's why I chose these ones [cameos] in particular, how they're organizing their friends and posing for photos. (N1LS1Review27.25)

The social benefits and the child engagement in conversation were welcomed, but not expected benefits of the focus. In the school setting similar benefits for social learning were noted by Molly:

> The students hadn't really been skilled at working together, and for some groups it became a bit of a problem and a power struggle. It was interesting to observe Ja and Je working together and learning to compromise. Je, a normally quiet girl was in a group with two naturally dominating boys, one of which is quite intelligent and confident in his abilities. We watched her first of all verbally correct a sentence that didn't make sense as he was writing it. Then after he didn't listen to her, she proceeded to fix it up herself when it was her turn to write. (N2LSp.5)

The importance of scaffolding learning experiences with technology was highlighted in both case studies. Molly described the dangers of trying to do too much with young children:

> ...too many options, too many photos to choose from, too much stimulation for them and they just couldn't focus...they hadn't had any exposure to it before and then I was expecting too much from them so next time to make a simpler task, not so complex where the kids can still extend themselves if they want to but they've got support. (N2LS1Review2.19)

Susie described the scaffolding of the use of the technology to support student independence and learning needs:

> I found that I had to re think the use of a single memory card for the camera, digital frame & printer – once the card was taken out of the camera by one child to use in the printer ...then the camera couldn't be used by anyone else until the printing had finished. Lucky memory cards are rather cheap – I went out and bought three … one for the camera, one for the printer and one for the digital frame. This has worked well as the children are now taking the card out themselves and using in the printer as needed (they still ask for my help but are able to do much themselves). (N1LS1p.8)

Another significant theme emerging form early findings relates to authentic learning experiences using technology. Molly found that children were enthused about creating a newspaper article about the construction of the new school:

> The important events along with the dreams and hopes from the site plan we created a newspaper article. The students were given the job of being a newspaper reporter writing about the new school. This was drafted and then published in the word processing program 'Pages', which gave the students templates to help them look legitimate. They looked awesome! (N2LS1p.6)

For Susie the child directed play with the digital camera resulted in new early literacy experiences:

> The children have taken a new path with the camera & printer – rather than just printing out their photos to discuss, write about or just take home, they have now used it to create something which they felt was needed in their room … a locker for snack bear...Using the camera the children took snack bear's picture, printed it and typed his name on the computer to

> make his locker name...they then found him a locker... The children then decided that his bag needed a name tag like the ones they made earlier in the year so they typed out his name again, decorated it and laminated it. (N1LS1p.8)

The learning experiences described in these examples show that an authentic child interest and need drove the literacy learning and the use of the technology, and resulted in a perceived high level of child engagement.

Discussion with children about their literacy learning in these educational settings supported teacher claims that the children were highly engaged in literacy learning. When asked to describe the learning behind the creation of a lifecycle animation the child participants described the authorial process they had been through and identified the life cycle of the butterfly with reference to the technology, as it fitted within the process or the experience rather than overtaking the learning:

> We recorded it [podcast and animation]...We helped each other we gave each other ideas on how we could make things for it...I learnt about the chrysalis (MSI3.40)

In the kindergarten a computer and projector was set up to project onto the wall, and the children created their own story about the visit to the local vet using the digital photographs that they had taken on the excursion. Molly noted that the use of technology in this way encouraged a deeper level of talk about the literacy and technology than had been evident in the past:

> In the past after an excursion we have created books using photos from the excursion – this can often be tricky as a large group experience as not all children can see. I thought a great way to address this issue was to use the projector and laptop and put in on our white board for all to see. 'We have our own Smart board' Ja said as I was setting it up, this then lead to a big discussion about smart boards and brothers and sisters schools and what they use them for. The children all became involved in the discussion with lots to recall about the excursion …They all thought it was pretty funny when my typing went over the page – I asked if I should make the writing bigger or smaller to address the problem and got a big response SMALLER from the children. At the end of creating the story I told the children we could photo copy it so they could take it home. The next day with the children we laminated and bound the book which the children then took into the vet corner and often used it in their play to revisit their visit to the vet. (N1LS2p.6)

Findings in the context of access, equity and quality in literacy education

Initial findings suggest that pedagogy embracing a symbiotic relationship between literacy and technology may benefit children's learning in the early years of education. Of course, acceptance of these findings raises important access and equity issues for quality literacy education. When describing the access to technology that children had in the primary school case study Pete noted:

> The philosophy isn't centred around having lots of computers…it is not desirable and counter-cultural to what we are trying to do. The philosophy is more centred around using the technology as a tool for personalized learning… not all will need a hammer [computer] at the same time but they will need access to them regularly. (N3F00.42)

This view encompasses a pedagogy that is child centred, and where the learning community works collaboratively and caters for individual interests and differences, and diversity in the learning group. In the kindergarten case study Susie describes a play based teaching and learning philosophy where access to technology is also driven by student need and interest.

> ...the novelty has worn off and now the camera is more available. Whereas before one would have it and they had to put the timer on it so that they could share it...whereas now they can extend on it...so that they can go and get the camera to enhance what they're doing. (N1LS1a12.36)

In both case studies it would seem that access, equity and quality through a mutually beneficial relationship between literacy and technology was closely linked to teacher mediation of technology. In other words, it was how the teacher used the available technology and provided access to the children that had the most significance for student learning. Rather than access to wide-scale current technology it would seem that the opportunity for children to engage with technology at a deep level beyond the supermarket sampling style experiences that are commonplace in out of school experiences, has the potential to benefit learning(Edgar & Edgar, 2008).

Viewed in this way access to appropriate choice and use of technology to match the learning needs and interests of the children is important. Access to a computer for every child or an electronic whiteboard in every classroom may be of little benefit if literacy and technology pedagogy is not mutually inclusive. Holistic approaches or new ways of literacy teaching and learning would not require access for all children to the same technology at the same time. As Pete clearly articulated, "technology is a doorway to literacy but there are different doorways and we as teachers need to find the right doorway" (N3Researcher Journal, 1st November 2008). The realisation that is voiced in this statement is that for one child the doorway may be from oral (podcast) to screen to written, for another it may be written to oral to screen and for another oral to written to screen. The point being that when working with technology there are different layers that can result in deeper learning for different children at different times in their education. In Molly's following reflection there was recognition that these layers needed further exploration:

> ...the kids that were good readers and good writers and good listeners that really were able to achieve and that was not what I was aiming to do. I didn't feel that the other children were able to be as engaged as they could be. They were at the start but quickly grew tired of having to seek assistance to be able to get their work done and they didn't have the satisfaction from the computers as they should have (MollyLS1Review7.09)

The initial findings of this study would suggest that access, equity and quality in early literacy needs to be considered alongside teacher professional learning. The action-reflection model

(McNamara et al., 2006) and the use of learning stories (Carr, 2001) adapted for teacher professional learning, provided teacher participants with a supportive framework to reflect both on their own individual learning needs alongside the children's, and highlighted the importance of positive professional relationships:

> Your [the research's] advice and assistance has been very beneficial too with the ideas of where to go and understanding what's happening in it and reflecting. The whole learning story has been really good because looking over it and doing it you think, 'Right, where to next?' (Molly,N2F33.10)
>
> When you get a chance to work with professional colleagues where you've got a similar vision as to what could happen and what might happen that's a really helpful thing. (Pete, N3F11.38)

In addition, the teacher professional learning model enabled support on different levels to be accessed by participant teachers. Sometimes the support needed was technical, sometimes it was in the form of a critical friend, sometimes it was to brainstorm ideas or just to listen. In the school setting sometimes it was the support of the principal and in the kindergarten it was the support of the whole community. Traditional 'top up' models of teacher professional learning do not cater for ongoing and shifting needs, however early findings from this study would suggest that teacher access to sustainable forms of professional learning is pivotal to providing equitable and quality literacy education.

Technology is evolving at such a fast pace that preparation for the 'knowledge society' requires more than access to the most current forms of technology on a wide-scale. The reflective approach to teacher professional learning used in this study emphasized not the quantity or the up-to-date status of the technology in the early years of education, but the ways in which technology was used as a doorway to deep literacy learning. From this perspective access and equity in early years literacy education is not so much about expenditure on technology, as it is about creativity and the provision of learning experiences that challenge children to use the technology they are exposed to in their everyday lives, in order to develop the complex understandings necessary to be literate in the society they will function in as adults.

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