Australian Government
Department of Education, Employment and Workplace Relations

Exemplar Schools

Using Innovative Learning Technologies

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The Exemplar Schools project was funded by the Australian Government Department of Education, Employment and Work Place Relations.

Website: http://www.deewr.gov.au

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Published by Faculty of Education, Monash University

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ISBN: 978-0-646-50994-5

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Executive Summary

The aim of this study was to identify and document exemplary use of information and communication technologies (ICT) in Australian schools. Six schools were identified in consultation with the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) and included sites from Melbourne, Perth, Brisbane, Sydney, Adelaide and Hobart. At each school interviews were conducted with principals, teachers, parents and students. The data collected were analysed to identify effective, sustainable and embedded applications of ICT across all curriculum areas with a particular focus on the key areas of literacy and numeracy.

Project Outcomes

In order to present the findings of this project in an engaging and easily accessible manner, a series of online 'digistories' was developed. The features of these digistories include:

- Streaming video interviews with school principals and teachers
- Demonstrations of exemplary school practice
- Examples of student work
- Links to useful resources

In total, eleven digistories were developed to highlight exemplary applications of ICT in the following areas:

(1) Student Generated Digital Video

(2) Virtual Learning Environments

(3) Interactive Whiteboards

(4) Digital Newsletters

(5) WebQuests

(6) Local and Global Connections

(7) Futures Perspective

(8) Professional Learning

(9) Leadership and School Organisation

(10) Community Engagement

(11) Digital Resources

The digistories can be viewed at: http://cemm.educ.monash.edu.au/exemplar.

In addition to identifying and documenting exemplary ICT practice in Australian schools, this study provides further evidence to support the view that each school is an unique learning community and that educational research should not focus on trying to identify a 'one size fits all' approach to using ICT in schools. Instead, we advocate an approach based on adopting 'appropriate practice' as determined by the particular needs of each learning community.

Introduction

The purpose of this project was to demonstrate, via a case study, effective use of information and communication technologies (ICT) to improve student learning. Data collection strategies included individual interviews, focus group interviews, scrutiny of school artefacts, observation, and video recording of participants. Six case study sites were identified in consultation with the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) and included sites from Victoria, Western Australia, Queensland, South Australia and Tasmania. Participants included principals, teachers, parents and learners from each site. Data were coded and analysed thematically focusing on the effective, sustainable and embedded use of ICT across various curriculum areas to engage students with learning for improved educational outcomes. As well, various 'digistories' of school leaders and classroom teachers, from a variety of learning areas, articulating the pedagogical strategies they use when integrating innovative learning technologies with their students were produced.

ICT (computers) in Education

An important element of this project is making clear the background and context within which the work has been conducted. Computers have been used in Education for nearly five decades. In much of that time their use has been underpinned by the dominant learning theory of the time. For example, the dominant theory underpinning classroom instruction in the 1950s was *behaviourism* thanks to the application of Skinner's theories to human learning. *Programmed instruction* was also conceived and developed during this period. Both are premised on the idea of *stimulus/response* so it is not surprising that initial attempts to adopt technology for instruction were premised on the idea of the computer as a teaching machine giving rise to computer assisted instruction (CAI) (Romeo 2008).

Gagne was influential in the 1960s. He introduced the notion of task analysis and employed the term instructional system (Kearsley 2007). Task analysis breaks down the instructional task into a hierarchical relationship of tasks and subtasks and was used to add layers of sophistication to CAI. In 1963, IBM and Stanford University established the first CAI elementary school curriculum and it was implemented in California and Mississippi and in 1967, the Computer Curriculum Corporation was formed to sell the materials developed (McNeil 2007).

During the 1970s cognitivism with its roots in cognitive psychology and information processing theory dominated. This marked a shift away from behaviourism and the works of Ausubel, Bruner, Merrill, Gagne and others were very influential. The identification of the internal processes of learning and on how the learner comes to know rather than respond in an instructional situation became important. The theory represented a major paradigm shift from Skinner's behaviourist approach to learning (McNeil 2007).

The 1980s saw the beginning of the rise of personal computing. CAI became more sophisticated and continued to flourish as did offshoots such as computer based instruction (CBI) and computer based training (CBT). In the classroom, however, there was a backlash against the stimulus/response - drill and practice nature of CAI. There was encouragement for the use of computers to help establish learner centred approaches to teaching and advocacy for curriculum integration and inquiry learning. By the mid 1980s the dominant view in Australia on the use of computers in

education was that computers should be used by learners for inquiry, analysis and problem solving (National Advisory Committee on Computers in Schools (Australia) and Commonwealth Schools Commission (Australia) 1985).

The 1990s was the era of constructivism, which is a psychological and philosophical perspective contending that individuals form or construct much of what they learn and understand (Schunk 2004, p285). A basic principle is that people are active learners, build knowledge for themselves, and that the interactions between people and situations are very important in the learning process. The ideas underpinning constructivism were increasingly applied to teaching and learning during this decade (Schunk 2004).

This decade also saw the arrival of the WWW, the growth of multimedia, and the rise of networked technologies leading to an abundance of educational software, learning management systems, digital communication tools, and websites designed to take advantage of the online world. In schools the focus was on the *construction* (rather than the consumption) of digital artefacts; the generation of *the PowerPoint presentation* by students became very popular.

Constructivism has continued its strong influence into the first decade of the new millennium and continues to have important implications for the design of learning environments (Schunk 2004). Other instructional strategies or frameworks such as cognitive apprentice, modelling, scaffolding, project based learning and problem based learning, along with supporting strategies such as cooperative learning, multiple intelligences and learning communities have also been influential in the design of technology rich learning environments during this time (Romeo 2008).

This very brief overview of the development of technology juxtaposed with the development of learning theory has led to an interesting point in history. There is *not* a shared vision about how technology should be used in the classroom, indeed, for some teachers there is still much bewilderment, reluctance and tokenism. There is a wide variety of theories and instructional designs that confront teachers and teachers are also bombarded with confusing, even romantic views of what the technology is capable of delivering.

Does research support the idea that technology improves teaching and learning? Freebody (2005, 2006) states that there is now a reasonably well-established body of empirical work on the nature and efficacy of ICT in education pointing to improved outcomes for a whole range of learners, and it represents a prima facie case for concluding that the introduction of ICT into education can improve learning. So what instructional strategies/designs should teachers adopt? This is not an easy question to answer. Many argue that the ideal instructional environment for 21st century learners – is underpinned by the ideas of constructivism and built on the knowledge, accrued over decades of research, of how it is thought people learn (see Romeo 2008). This is often referred to as *engaged* or *transformative* learning. The role of technology according to Brown, Bransford et al (1999), in this, *lies in bringing exciting, real-world problems into the classroom, in providing scaffolds and tools to enhance learning, in giving students and teachers more opportunities for feedback, reflection, and revision, in building local and global communities, and in expanding opportunities for teacher learning*. This is a *technology as tool* view and is a view shared by many. Others see the function of technology differently.

Technology has become part of our culture and in a socio-cultural sense the cultural *tools* that we now have available to mediate learning are inextricably linked to, and shaped by, technology; new and emerging technologies will impact on education in ways we have not yet imagined.

> *This … challenges us to think about the impact of technology on contemporary culture and how this in turn is impacting on learning, rather than thinking about how ICTs can facilitate a traditional view of learning. [It] also challenges us to think about the way technologies have changed learning, not in a procedural sense, but in a psychological and cognitive sense. In turn this then challenges the corpus of knowledge on how people learn and the theories sustaining it and, the basic principles underpinning the design of effective learning environments* (Romeo 2008).

The literature informs us that the instructional procedures and practices surrounding the use of technologies in schools are many and varied; that the rhetoric underpinning the pedagogy is mostly about constructivism presenting itself as engaged or transformative learning; and that in the academy there are interesting debates about the impact of the technology on teaching and learning in a psychological and cognitive sense. However for school communities the literature presents an enigma – how do you use it to make decisions about appropriate practice?

It is within this context that the design and conduct of this project occurs. What contribution does it make? It is our view that the role of educational research is to assist the teacher to reflect on what happened in setting A and determine whether it is appropriate for setting B. The role of the educator is to use research findings to make intelligent decisions about how to best organise the teaching and learning environment (Biesta 2007). The main aim of this project has been to produce narratives that help school communities make decisions based on what they can see is working for others and decide if it is appropriate practice for them. The challenge has been to present the narratives in a structure that is accessible, engaging, and an accurate representation of the appropriate use of ICT in education based on our current understanding.

Project Design

This project adopted a case study methodology and collected qualitative data for analysis. The aim of the project was to identify six schools across Australia that were exemplars in the use of innovative learning technologies (the process for identifying the schools is discussed below under *issues)*. Once identified, principals were invited to showcase their school by participation in the research project.

It was explained that the project would, through observations, interviews and discussions explore the ways that computers, the Internet and other technologies had been harnessed to support learning and teaching in the school. At prearranged times researchers visited each school over a three day period and conducted interviews with the principal, teachers, students, and parents; as well as conducting classroom observations and perusing policy documents, teaching materials and student work samples. The data set collected for analysis included video and audio recordings.

The video and audio files were used to construct "digistories" from selected teachers from each school. The three main research themes underpinning the project required the researchers to:

1. Demonstrate via a case study model, effective strategies and practices using ICT across various curriculum areas to engage students with learning for improved educational outcomes with sustainable & embedded use of learning technologies across the curriculum.
2. Use the case studies to show examples of student engagement and motivation as a result of the use of innovative learning technologies in the classroom. The study was to contain examples that would be replicable for future school implementations and involve comments from principals, teachers and students. At least one of the examples should show improved literacy or numeracy outcomes as a result of the use of learning technologies. The results of this research were to be in a form compatible with both print and online publication.
3. Develop 'digistories' of school leaders and classroom teachers, from a variety of learning areas, articulating the pedagogical strategies they use when integrating innovative learning technologies with their students. The development of digistories across a range of areas, age levels and settings was expected to assist in meeting the needs of teachers nationally.

The Exemplar Schools

For the purposes of this project the schools were chosen by the government department contracting the research in consultation with the researchers. The six sites were selected in an attempt to provide a representative sample of schools in Australia which purported to demonstrate exemplary ICT practices. Schools were representative of urban and rural settings, primary and secondary teaching contexts. The sites selected also provided a balance between private and public schools. The sites were selected from a school in each of the following states; Victoria, Queensland, Western Australia, NSW, Tasmania, and South Australia. By selecting this diverse range of sites, a broad representation of purported exemplar ICT use in Australia was sought.

Victoria: Saint Pius X

Saint Pius X is a co-educational single campus Catholic Education primary school (P-6). It is located in what is described by the Principal as one of the poorer suburbs in Melbourne with 64% of the students' families being on welfare support. In addition, the school caters for a high proportion of students (approximately 50%) who are described as having English as a second language.

Despite the hurdles facing them there is a fierce pride at Saint Pius X in their accomplishments including the use of technology to improve outcomes and celebrate success:

> *"We want the world to know our kids are really good and they have great results and great teachers and it's a great school. And if technology can in one way support that we'll continue with it." (Principal, Saint Pius X School)*

The school utilizes a wide range of hardware and software including both Macintosh and Windows platforms. Each classroom has a small number of networked computers of varying ages and has access to printing facilities, digital cameras (still and video), DVD players and projectors. The school as a whole boasts a wide range of uses of the technology including student audio and video productions, Claymation, in addition to slideshows, desktop publishing, spreadsheet and graphing, emailing, as well as use of internet based learning activities such as those provided by the Learning Federation. The school also boasts individualized intranet pages (MyClasses) created by teachers for student work as well as student networked folders for access throughout the school allowing students and teachers to work from any location.

The Principal points out that they take a holistic approach to technology integration:

> *"Technology is not just word processing. Every kid can word process. It's giving the kids the experience to use a whole range of technology. Technology is not just computers, it's DVD's, Ipods, cameras, it's the whole bit. So to live in this world you've got to have expertise in this area… that's a responsibility we take pretty seriously." (Principal, St Pius X School)*

Queensland: Cairns School of Distance Education

This government run school is one of seven schools of distance education run by Education Queensland to service the educational needs of remote and rural students from prep to year 12. The school is co-educational and provides students with an individualised curriculum through a close working relationship with teachers, students and home tutors.

The use of ICT in this school is critical to everyday communication between teachers and students and between fellow students. As one teacher commented:

> *"Whether it be on a yacht sailing in the Mediterranean Sea or whether it be in a mining town on an isolated cattle property, on a fishing boat in the gulf, they are dependent on the ICT to give them the opportunity to interact with each other." (Teacher, Cairns School of Distance Education)*

ICT is used by the Cairns School of Distance Education to mediate the face to face relationships that are taken for granted in many other schools. Students are sending emails, skyping and video conferencing from a young age as a way of communicating with their teachers and fellow students.

Western Australia: Presbyterian Ladies' College

Presbyterian Ladies' College (PLC) is an independent P-12 school for approximately 1000 students and some 140 teaching staff. It is located in an inner suburb of Perth, Western Australia. It also provides a warm and welcoming boarding house for 150 girls between Years 7 and 12. School life is enriched by the presence of students from many areas of Western Australia, Australia and overseas.

The school has been harnessing the power of ICT since the early 1990s. During this time the school had developed into a 'laptop school' which has been ably supported by a technical helpdesk that is accessible 24/7 by phone and through email. One of the most significant turning points over this period has been the establishment of a wireless environment within the school campus.

> *"Every student from Year 5 to Year 10 carries an Apple iBook linked to school resources with wireless AirPort networking". (Principal, Presbyterian Ladies' College)*

The school is the host of an innovative LearnerLink community broadband service for families within the school community. It allows participating families to *"not only provided access to the World Wide Web and email as would normally be provided by any Internet Service Provider, but it also provided seamless wireless access to the … [PLC] network as well, so that students could continue to study at*

home with access to the same resources and computer facilities that they had at school". (Principal, Presbyterian Ladies' College)

New South Wales: Brookvale Public School

Brookvale Public School is a suburban primary school located in an industrial area and featuring a broad ethnic mix including Asian and Pacific island groups. Families are generally not wealthy. Computer ownership in the community is low (50%). The students are identified as having high education needs in all curriculum areas.

The school has won several awards for IT innovation and excellence, including a Schools Improvement Award for its *Integration of Information and Communications Technologies into the K-6 Classrooms* (2005). ICT supports self-paced learning, skills development, modelling better use of technology and improved self-esteem. Student members of a research team assist in maintaining the School's Intranet and supporting other students in the use of technology.

Tasmania: Reece High School

Reece High School is a regional secondary school teaching students from years 7-10. The campus has been recently rebuilt, and has an enrolment of 800. Parents are locally employed and the community is typically financially secure but not wealthy. Computer ownership in households is estimated as low at 80%. The school is well known for innovative uses of ICTs and particularly for the broad application of technologies into learning activities. Staff from Reece are frequently asked to speak about the comprehensive school management structure which enables a vey high degree of integrated studies.

South Australia: Eastern Fleurieu School

Eastern Fleurieu School is a co-educational multi-campus government school catering for primary and secondary school students, located 50 kilometres south-east of Adelaide. The school is comprised of seven campuses and over 1200 students are currently enrolled.

Data Collection

Data were collected from the above schools according to the following schedule:

- **Phase 1** - Individual interview of the school principal.
- **Phase 2** - Focus-group discussion with up to 12 teachers of the school. Based on the input, up to three of the teachers who are particularly innovative and creative in harnessing ICT in their pedagogical practice were invited to take part in Phase 5 of the project.
- **Phase 3** - Focus-group discussion with up to 12 parents of the school.
- **Phase 4** - Focus-group discussion with up to 12 students of the school.
- **Phase 5** - Individual, semi-structured interview with the 3 teachers identified at Phase 2.
- **Phase 6** - Document analysis, involving policy documents, teaching materials and student work samples. These were to be obtained from the three particularly innovative teachers, and would constitute evidence of exemplary practice.

Researchers from the Centre for Educational Multimedia (CEMM) at Monash Education collected qualitative data at each site. These data sources were audio- and video- recordings of interviews and discussions, observation notes and relevant artefacts. The collection constituted the data set for the project. Table 1 summarises, for each site, the participants involved, the data collection strategies adopted, the framework of sample questions asked, and the thematic coding used by each researcher during the collection phase and subsequent analysis.

Table 1: Data Set Framework with Coding

Participants at each site	**Data collection strategy**	**Sample questions/documents**	**Research theme with thematic coding used during collection and analysis**
Principals	Individual semi-structured interview (Video or audio taped)	• What is the relationship between innovation and ICT why does the application of innovative ICT programs matter? • What are the key drivers to innovation in your school? • What are the key inhibitors to innovation in your school? • What impact do you think innovative ICT applications have on student learning across KLA's and on student achievement? • What evidence do you have that suggests ICT innovation has contributed to or improved student outcomes, for example in mathematics or literacy? • How important to you is it that children leave your school as confident, creative and productive users of new technologies? • How important to you is it that children understand the impact of technologies on society?	**<u>Research Theme 1</u>** Demonstrate via a case study model, effective strategies and practices using ICT across various curriculum areas to engage students with learning for improved educational outcomes with sustainable & embedded use of learning technologies across the curriculum **<u>CODING</u>** • **1a –** engagement • **1b –** sustained • **1c -** embedded **<u>Research Theme 2</u>** Use the case studies to show examples of student engagement and motivation as a result of the use of innovative learning technologies in the classroom. The
Teachers	Semi-structured focus group interview (Video or audio taped)	• What interests you about using ICT in student learning? How do you see innovative ICT use in relation to student learning across KLA's and on student achievement? • Who responsibility is it to develop, implement and maintain innovative practices within the school? • What would say operates as the main drivers and inhibitors to innovative practices in your school? • What ideas, theoretical perspectives or practical outcomes do you base your approach to innovative ICT use on? • How important to you is it that children leave your school as confident, creative and productive users of new technologies? • How important to you is it that children understand the impact of technologies on society?	

Parents	Semi-structured focus group interview (Video or audio taped)	• What is your understanding of the role of ICT in children' learning today? • How do you think ICT relates to or supports your child's learning? • Do you think your child learns most of his or her ICT skills at school or at home? • How important to you is the development of your child as a confident, creative and productive user of new technologies? • Do you think it is important for your child to understand the impact of technologies on society?	study will contain examples that are replicable for future school implementations and involve comments from principals, teachers and students. At least one of the examples will show improved literacy or numeracy outcomes as a result of the use of learning technologies. The results of this research should be in a form compatible with both print and online publication**.** **CODING** **Examples that purport** • **2a** – to improve literacy • **2b -** to improve numeracy
Learners	Semi-structured focus group interview (Video or audio taped)	• What types of learning activities/experiences have you participated in using ICT? • Do you think ICTs help children learn? • What would you ideal day at school involve and how would ICTs be used in this day? • Can you take some photographs or video record examples of ICT use in your school that you think helps children learn?	
Identified innovative teachers (Digistory)	Individual interview for development of Digistories. Docs, exemplars, photos of innovation (Video taped)	• What can you tell me about your particular innovation – what was the background to its development, where did the funding come from? • What do you see as the main teaching and learning implications of your innovative? • How does your innovative relate to the development of children as confident, creative and productive users of ICTs? • What learning outcomes have been noted as arising from your innovative and across which KLAs? • What would you say are the main issues other teachers would need to consider if they were to implement something similar?	**Research Theme 3** Develop 'digistories' of school leaders and classroom teachers, from a variety of learning areas, articulating the pedagogical strategies they use when integrating innovative learning technologies with their students. **CODING** • **3 –** articulating … strategies they use … with their students**.**

Data Analysis

Six sites were involved in the project with different researchers visiting each site (one researcher visited two sites). Each site yielded a data subset with the six subsets

making up the data set. Each researcher collected data according to the framework described above and with the thematic coding in mind. It was recognised that there were strengths and weakness in this approach. As each data subset was collated it was coded, using Nvivo, by individual researchers using the codes described in Table 1, that is:

- **1a –** engagement
- **1b –** sustained
- **1c –** embedded
- **2a –** Examples that purport to improve literacy
- **2b** - Examples that purport to improve numeracy
- **3 –** articulating … strategies they use … with their students

Table 2 provides an example of the coding process used by the researchers.

Table 2: Sample Coding from two different sites

1a – engagement	The school community has benefited from the synchronous opportunities provided from the emerging opportunities of new ICT practices. The teachers and students have found the digital based lesson more engaging that those of paper based mail out lessons. The new technological configurations engaged teachers in their profession as well as students in their learning. As the principal states: *If you write an engaging, relevant, current online unit of work, then kids are going to be attracted to it. It's going to have purpose and meaning and the experience is going to be far more enriching for them. Teachers get that feedback. They see it happening. They become more enthusiastic about generating new materials (Principal).* Teachers and students have benefited from the synchronous opportunities provided from the new ICT practices as paper based lessons are phased out across the school. One teacher highlighted the benefits to the students: *I'd say the thing that underlies ICT for us is the fact that we can have immediate response from our students in an environment where having immediate communication has never happened before (Teacher).* ++ It is worth emphasising that for this College, the introduction of these and other ICT initiatives have been guided by a learning first, technology second approach. As quoted by one of her teaching staff, *It's the approach. The executive took a really clear decision that they would look at learning first and technology second. Then everything that we do there has to be a clear educational outcome or spin-off otherwise we just don't look at the technology. (GG, 2007, lines 439-441)*
1b – sustained	ICT use was sustained by teachers aligning ICT pedagogy with their changing professional identities. One teacher outlined that his classroom pedagogy sits adjacent to his work on developing teachers' professional identities with ICT. *When I introduced myself I mentioned that apart from working …. I also do online learning coordination for the Learning Place and I'm an accredited facilitate for Smart Classrooms ICT integration course. As an online learning coordinator I facilitate courses for teachers across the state.*
1c - embedded	Bigum identifies ICT practices as a design sensibility and suggests schools with effective implementation of ICT have a focus on relationships rather than information transfer. As one of the teachers commented, *Knowing that relationships and friendships now can be developed just as powerfully through ICT as it can face-to-face, has certainly made a big difference for me in my own teaching ideas about relationship is that, you know that quote 'relationship is ninety percent of your teaching (Teacher).*

	The school has an approach to ICT that focuses on relationships and social practices of ICT use rather than artefacts and transfer of information. The embedded use of ICT is based on a design sensibility that values people not just the acquisition of the latest technologies. ++ An example of this pedagogically-centred approach to ICT use is the school's development of a digital resource package for students. This is essentially delivered on a self-contained CD featuring the entire term's work for the school subjects concerned. Text is complemented by embedded movies, audio and podcasts. Multimedia and hypermedia technologies are also usefully harnessed in the CD's pedagogical design, allowing for online support and for the availability of up-to-date information. In particular, video clips of corresponding lessons are included, to facilitate student revision but more importantly, to allow students who somehow miss particular lessons to have an opportunity to listen and watch a version of the lesson(s) missed. For mathematics, the inclusion of the video clips demonstrating the mathematical processes involved in problem-solving and other mathematical activities has been found to be especially helpful for students. Questions posed in the materials are also not just textual – very often these questions are also presented with links to audio, pictorial or movie modes. The digital resource package is not just a learning resource. It also serves as an assessment and revision tool for students of the school. The language learning discs, for example, incorporate the Provox software, which allows students to practise and self-assess their pronunciations of the respective foreign languages they were studying in the school. The package also caters to the revision and self-assessment needs of new students to the school: relevant audio-video and text materials are included in the discs for this purpose. The development of this digital resource package had been guided by the school's recognition of the need to better personalise students' learning experience through the differentiation of the curriculum. As expressed by the school's principal, *the most powerful or innovative use of the technology has been in supporting us as educators to differentiate the learning experience for our students. So the technology allows us to develop teaching and learning materials that will suit a range of abilities that you will inevitably have in any classroom environment. It gives us also the ability to capitalise on the range of learning preferences that we would also have in a learning environment …. it does mean you can deliver material in a different way to those students. (Principal, 2007, lines 14-21)*
2a – to improve literacy	The principal at was upfront about the lack of quantitative improvement in literacy results as a result of ICT use. *I can't tell you the evidence is that our numeracy or literacy performance across this school has improved yet. But I can guarantee you if you came back in three years, that would be the case. It just will be (Principal).* What the principal did not mention was that the standardised quantitative testing may not show improved literacy outcomes in relation to multimodal uses of literacy. Paper based literacies appear to be only a narrow slice of the meaning making pie that students from this school use in their everyday practice. The principal of is suggesting it takes time for the literacies of standardised testing to improve after a school focuses on multimodal ICTs. ++ Another pedagogical underpinning of the production of the digital resource package for the school's students arises from the school's recognition that the students need to learn how to manage information and how to use technology ethically. In this light, the school principal summed up the organisation's thinking thus: *We know that knowledge is increasing at such an exponential rate, that our students cannot possibly master all the knowledge or to have contemporary knowledge to be taught contemporary knowledge. But it's there at their fingertips, so what we have to do is to ensure that they know how to access it, that they are critical thinkers, that they are able to analyse and synthesise the information that is available to them. (Principal, 2007, lines 85-90)*

Researchers were also asked to code for emerging themes and themes that might be of interest. The coding of the various subsets of data was then synthesised into various "digistories" and the digistories have become the mechanism for reporting the results of the project. A digistory is a web site containing various digital artefacts, including text and video that gives a rich thick description - as well as an in-depth analysis, of the various strategies that school leaders and classroom teachers utilize in technology rich schools and classrooms.

Results

The data collection, coding and subsequent analysis resulted in the production of eleven digistories each showcasing a particular aspect of the work of these schools. The researchers believe that each digistory greatly adds to our knowledge and understanding of the use of ICT in education and the combined body of work highlights the complexity and diversity of the topic. Table 3 provides a summary of the eleven digistories which are listed under two main headings - *Integrated technologies and pedagogical strategies,* and, *Professional learning, school culture and leadership*.

Table 3: Digistories divided into two broad themes and eleven sub themes

Description of Digistory	
Category: Integrated technologies and pedagogical strategies	
1	**Student-generated digital video** The creation of video is embedded in the curriculum as a standard tool in communicating and analysing but also, and most importantly, as a tool to facilitate reflection and metacognitive thinking. Student videos are also used to improve assessment and reporting.
2	**Virtual learning environment** The use of an intranet/extranet learning environment (eg. myclass) to scaffold students' access of the web, access to tasks and supports, communication and other learning activities.
3	**Interactive white boards** The use of interactive white boards (eg. SMART boards) coupled with a focus on curriculum applications has been shown to facilitate student engagement.
4	**The digital school newsletter** Digital texts produced by the students and distributed to parents, teachers and peers. This provides an authentic audience for the texts produced by the students as well as a space to celebrate exemplary work across remote contexts.
5	**Student engagement with locally constructed WebQuests** An innovative use of WebQuests to engage students including engagement through connectedness to strong student image of their own social futures.
6	**Local and global** ICT integration was supported through exemplary school and community engagement practices that address particular community needs and engage students in rich, topical and socially responsible projects.
7	**Future perspectives** The school has adopted a futures perspective in which staff are encouraged to reflect on what the world will be like for students in the future and what learning and skills will be available for them.

Category: Professional learning, school culture and leadership	
8	**Professional learning** Schools demonstrating effective ICT integration across the school also demonstrated sustained professional learning. Several models of whole school professional learning were observed including action learning.
9	**Leadership and learning** Techniques that principals and senior admin staff can use to promote integrated/sustained use of ICT education in schools.
10	**Community engagement** By focusing on relationships and student engagement, innovative practices with ICT's have a better chance of withstanding technological change than a policy that invests heavily on the latest technological artefact. The stories above are a testament to the effectiveness of using ICT to support a diverse range of inclusive relationships that underpin pedagogical success.
11	**CD Resource** The use of digital resources covering an entire term's work distributed to students on a CD.

Digistory #1 Extract: Student Generated Digital Video

This Digistory focuses on the outstanding practice at Saint Pius X primary school in the use of student-generated digital video to facilitate meaningful learning.

At Saint Pius X the use of student-generated digital video was very much in evidence in years 2 through to 6 with the majority of innovation occurring in years 2 to 4. In these years video production was used to support learning across a variety of learning areas including literacy, scientific inquiry and numeracy.

Students used video to produce poetry recitals, television advertisements, animation sequences including Claymation, plays, narratives, scientific and factual reports, and other presentations commonly found across the curriculum. In addition, students used video recordings to observe and analyse phenomena around them for studies in mathematics, science and social studies.

Finally, and most powerfully, the students used the video to significantly improve in the quality of their work through a process of “rehearse, record, review and then reflect.” This process not only improved their communication skills but also was reported to increase student's understanding of concepts as well as generally improve the quality and depth of student work.

> *“They do what we call: rehearse, record, review and then reflect. They will record themselves when they are going to do a presentation and they then talk about how they need to improve their performance. They go away and practice it with a partner and then come back and record it again. A lot of their oral presentations are all recorded and they reflect upon them. Every*

> *presentation they do to the class is recorded as well, so that they can look at them and talk about what they've done. If we're out doing a measurement activity, they'll use video to record and report on their findings, so there's a huge amount of video evidence for assessment and also they just use it as another form of publishing". (Teachers, Saint Pius X Primary School)*

By encouraging students to rehearse, record, review (often in pairs) and then reflect and then repeat the whole cycle again "students could see their own growth".

The teachers reported a variety of reasons for using student-generated digital video in their lessons. These reasons broadly correspond with the advantages described by Schuck and Kearney (2004) in their study of five Australian schools:

- Building new literacies
- Creating authentic learning experiences
- Developing conceptual understanding
- Enhancing motivation and other affective outcomes
- Promoting expression and communication skills
- Developing collaborative learning skills
- Building technology skills
- Building generic learning skills

It is also worth noting that the development of student generated digital video involves a social constructivist learning approach which values:

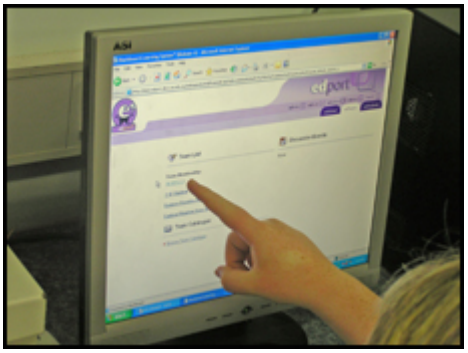
1. the role of the more capable other (Zone of Proximal Development) in scaffolding student learning
2. student independence and ownership of their own learning
3. collaborative activity
4. problem based learning
5. authentic or situated contexts

The teachers at Saint Pius X Primary School stressed that it was important to see beyond the technology to focus on the learning. For them, the most important aspect of using technology was to give students an authentic context in which to develop understanding or skills, including cognitive skills.

One teacher commented that teaching students how to do transitions in a movie is not important. Instead it is more important to understand the students, understand what kind of thinking skills are involved in creating video productions, and guiding them in their inquiry or reflection. For instance, it is less important that a student created a television advertisement with lots of transitions and edits than the fact that

"they're thinking about how to communicate with other people and sequencing a narrative not to mention making judgements about the content that you want" (Teachers, Saint Pius X Primary School).

Digistory #2 Extract: Virtual Learning Environment



This Digistory focuses on the development and use of various Virtual Learning Environments at Saint Pius X Primary School which are used to facilitate student collaboration and learning.

Virtual Learning Environments (VLE) are a group of web pages which allow users to upload content, links, resources and multimedia and often include communication and collaboration tools such as discussion forums, email, chat, blogs and wikis. Some systems are hosted on an intranet and cannot be accessed from outside of the school, however many are hosted on the internet and can be accessed, with the correct password, from anywhere and at anytime.

> *"We make classroom pages where we have links to literacy activities or maths activities and we have photos of the kids working, we also have children's work and there are forums where children can reflect and write what they've learnt." (Teacher, Saint Pius X Primary School)*

These systems are also known by many other names including Content Management Systems (CMS), Managed Learning Environments (MLE), and Learning Management Systems (LMS).

Some examples of these systems are:

* Blackboard
* MyClasses
* Moodle
* Think.com
* Sakai.

Benefits of using a VLE

The use of VLEs in traditional classrooms has been shown by the research literature to offer significant advantages to both students and teachers. These advantages include: flexibility in anytime, anywhere access; increased writing, understanding and presentation skills; improved motivation and engagement; support for self-paced study; development of different learning styles with higher order cognitive thinking; sense of authenticity of purpose by engaging with real texts and issues; greater participation, including collaboration, through communication tools such as discussion forums (BECTA, 2004).

These benefits of using a VLE were supported by Victoria School which uses a VLE called MyClasses. The teachers reported improved reading, increasing motivation through authenticity of texts, and greater independence n their students' work from years 2 through to 6. For instance one teacher pointed out that the VLE allowed her curriculum to become more student centered:

> *"I uploaded resources onto the My Classes page and the children go to that My Classes page and they access all that information and it really keeps them busy. They've been able to plan, they've been able to research using all that information." (Teacher, ,Saint Pius X Primary School)*

Blended teaching

Blended teaching is a term used to describe a situation where a traditional classroom environment integrates online teaching and learning. The research literature indicates that this kind of blending of activity is more effective and less labour intensive than trying to move all resources onto the VLE.

It was reported that through a blended learning approach, coupled with a school wide professional development strategy the teachers felt positive about the use of ICTs in the improved educational outcomes of their students. This perception is supported by an independent study by Dr Jean Russell in 2005.

> *The study found that trial teachers, with their experience of professional development and practice in the use of the MyClasses learning management system (LMS), have made significantly greater gains than control teachers in their use of constructivist pedagogy and in aspects of teacher collaboration. Trial teachers also showed significantly stronger development in their attitudes and beliefs about learning. Trial students, relative to control students, demonstrated significant positive change in their approaches to learning during the project. Their levels of engagement and motivation, compared with those of control students, also increased significantly. (Russell, 2005, p. 56)*

Digistory #3 Extract: Interactive White Boards

This Digistory focuses on the innovative use of interactive whiteboards to facilitate student engagement at Eastern Fleurieu School.

The use of interactive whiteboards was a consistent theme that arose in data collection from the principal, teachers, students and parents. Evidence presented indicated that the use of interactive whiteboards was seen as being very worthwhile by the commuity.

Literature indicates that interactive whiteboards can enable longer attention span with students, and can assist with student motivation and engagement (Kennewell and Beauchamp 2007). Interactive whiteboards have been introduced in all primary schools in the U.K. (Gillan, Staarman, Littleton, Mercer and Twiner 2007).

There has been a recognition at Eastern Fleurieu School that teacher expertise with technologies such as the interactive whiteboards is very important.

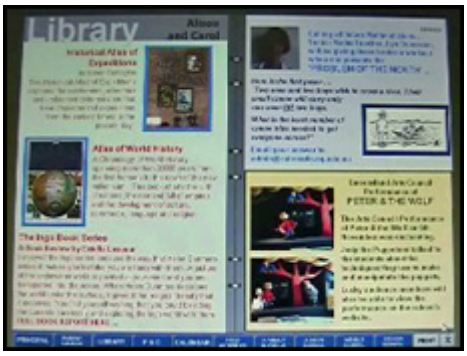
This approach is supported by the research review on interactive whiteboards by Higgins, Beauchamp and Miller (2007), who found that while the technology of Interactive Whiteboards was important, teacher skill and knowledge in using it was critical. The photos to the right show students at Eastern Fleurieu School using interactive whiteboards in their classrooms.

Delivering Rich and Diverse Experiences

Several teachers at Eastern Fleurieu School provided evidence that they accepted responsibility for the use of technology such as the interactive whiteboard in order to provide rich and diverse experiences to their students.

> *"I've got a 1/2 class …I have an electronic whiteboard in my classroom…I see my role is really to integrate it into all areas of the curriculum. …I also see my role as exposing them [students], at my age level, to different programs and different technologies, …whether that be maths or literacy or PowerPoint's or Click 5 or things like that. So just expanding their horizons with the technologies as well." (Teacher, Eastern Fleurieu School)*

Digistory #4 Extract: The Digital School Newsletter



This Digistory focuses on the development and distribution of a digital newsletter at the Cairns School of Distance Education. The digital newsletter plays an important part in building community relationships.

While many school newsletters are paper based, Cairns School of Distance Education has developed a digital school newsletter. The digitisation of this newsletter is part of a wider shift in this school community in moving from print to digitally mediated communication between students and teachers. Most schools have newsletters as a way of communicating important school events to the wider school community.

An important context of this school is the remote audience of this newsletter. The school newsletter is sent to parents all over far North Queensland in remote rural and urban home environments. The digitisation of the newsletter is a way of facilitating the flow of information while developing new relationships in the school community.

To understand the practices behind the production of this newsletter, it is worth exploring some ideas of multimodality. Kress & Van Leeuwen (2001) suggest multimodal texts have elements of discourse, design, production and distribution. Each of these elements will be introduced and explored using evidence from CSDE in this digistory.

The Discourse

When the unpacking the Discourse of this digital newsletter, (Gee, 1996) notions of ‘discourse’ and ‘Discourse’ are worth exploring. Gee (1996) suggests there is a ‘discourse’ which involves the ‘connected stretches of language that make sense’ (p.127). There is a ‘Discourse’ that is ‘ways of displaying membership in a particular social group’ (Gee, 1996, p.128).

The ‘discourse’ of the digital school newsletter involves integrating multimedia and print elements which should not be much of a problem for schools which host good quality web pages. The identities or memberships that underpin this particular newsletter, the ‘Discourse’, are worth exploring as these could be critical to the success of the digital product. Underpinning the innovation is a belief by the principal that technologies are changing and teachers and parents should be embracing that change to support the social futures of the students.

The digitisation of the school newsletter can be seen as a tangible move to support students’ future literacies. In promoting a multimodal newsletter, the principal is also promoting a community membership with future technological literacies. As mentioned above this digitisation of newsletter was part of a broader move by the school community to integrate new technologies into everyday teaching and learning.

When reading the school newsletter there is also a strong sense that the membership of this text includes a space for reinhabiting a student voice. Many

paper based newsletters are colonised by principal's messages and used to inform parents of upcoming events. While there is a comment by the principal and a calendar in this newsletter, there are also other elements that provide a strong student voice in the newsletter.

The Design

This section explores the design of this digital newsletter. (Kress, 2000) defines design as employing the 'available resources in a complex ensemble' (p.157). The important idea to take from this is that there is no one design for a digital school newsletter. At Cairns School of Distance Education, they use a program called "Desktop Editor" to construct the newsletter.

School communities considering the shift to a digital newsletter should first embark on constructing a design that can accommodate elements of multimodality. The design from this school newsletter included sections that provided the readers with a strong sense of community and place rather than school and pedagogy.

The Production

The administrative staff are responsible for producing the digital newsletter at Cairns School of Distance Education. The newsletter is produced once a month and relies on teachers identifying excellent student work and passing this onto the office staff to integrate into the next edition.

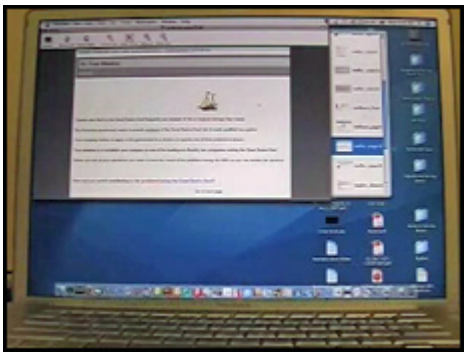
This means the production of the newsletter comes from authentic texts constructed by students as part of their everyday classroom practice. Asking teachers to select these texts and making them available to members of the administrative staff to appears to work well in this school.

The Distribution

The distribution of digital media in terms of computers and hard drives is rather simple. The distribution of this school newsletter in terms of the social practices associated with technology is rather complex. The issue of privacy of students' names and images and texts they produced was encountered at this school.

The teachers at this school repeatedly discussed how the move from print based artefacts to digital mediums supported improved relationships amongst the school community. Bigum (2002) suggests that efforts should be spent on designs that promote relationships rather than simply the exchange of information.

Digistory #5 Extract: WebQuests



This Digistory focuses on the innovative use of WebQuests to engage students attending the Cairns School of Distance Education.

After many years of engaging students through WebQuests, Tom March has offered the following description:

> *"A WebQuest is a scaffolded learning structure that uses links to essential resources on the World Wide Web and an authentic task to motivate students' investigation of a central, open-ended question, development of individual expertise and participation in a final group process that attempts to transform newly acquired information into a more sophisticated understanding. The best WebQuests do this in a way that inspires students to see richer thematic relationships, facilitate a contribution to the real world of learning and reflect on their own metacognitive processes."* (March, 2003)

Intellectual Quality

Teachers use WebQuests to support higher order thinking through explanation, critical framing and transformed practice. An effective WebQuest requires students to engage in tasks that are interesting and achievable and to develop higher order thinking.

The technology behind the WebQuest is a connected computer that supplies students and teachers with information in order to answer a real life problem. Students use their understandings of critical analysis to develop a position on the solution they are defending.

Connectedness

Teachers outline several aspects of connectedness through the use of WebQuests at Cairns School of Distance Education. Education Queensland identifies a high level of connectedness when the students' linguistic, cultural and world knowledge is linked to the abstract outcomes of the lesson. The link between the children's everyday experiences and the abstract critique of their practices was exemplified in the WebQuests from Cairns School of Distance Education.

One measure of student connectedness is the extent to which they engage in the curriculum during the school holidays. The important pedagogical element in this example is how WebQuests are used by the teacher as a way of liberating the time-space students historically associated with school. Many readers of this digistory will know first hand of similar experiences where students have become engaged in a connectedness to learning that exemplifies the possibilities of effective teaching practice.

Supportive Classroom Environment

Zyngier suggests the supportive classroom environment should be reimaged to include supportive learning environments. The learning behind the webquests strongly supports this broad view of just the classroom environment. As already mentioned the learning through these WebQuests challenges the time and place of learning in the classroom, connects to learning about place and provides teachers with understandings about student engagement. A feature of the WebQuests in this school is the use of Blackboard to mediate student learning.

> *"Even though they've never met they become very familiar and feel quite confident at discussing things and even disagreeing with each other while doing these courses."* (Teacher, Cairns School of Distance Education)

An important element in the supportive learning environment in this school is an ethical approach to the use of ICT which mediates these learning spaces beyond the classroom. The process of developing students who are confident in disagreeing in a respectful way with other students in their class is a powerful discourse to impart on students. Unpacking the ethical frameworks that support the learning environments that surround these WebQuests would provide students with an explicit charter of ICT use in the broader society.

Recognition of difference

The opportunities to negotiate student difference in relation to technological practices would provide a useful starting point to identifying individual strengths in the classroom. Such practices could turn around pedagogies supporting an ICT medium. Aligned with this practice, teachers would be promoting multimodal textual spaces, which provide real choices to the students. In response students would bring their capacities with ICT to the classroom using the medium of their choice to position their message.

At this school, teachers use of WebQuests mediated in a large part by ICT's, upholds the rights of children with their home tutors (who are mostly parents). Re-aligning teaching so it is based on a respectful relationship with children is a fundamental right of their learning space. The engagement exemplified by the above stories highlights the importance WebQuests can play in re-positioning children's learning spaces so they are more ethically sound for children's learning.

Digistory #6 Extract: Local and Global

This Digistory focuses on exemplary school and community engagement practices that address particular community needs and engage students in rich, topical and socially responsible projects.

Connecting local community

Technology creates a focus for engagement in all aspects at Brookvale School. There has been a concerted attempt to gather, maintain, enhance and employ technology in the widest variety of ways at this school despite limited funds and specific challenges.

> *"When we started here, we didn't have any parents with computers. We did some research a few years ago, but I would say now that only about 50 percent of our families actually have a computer at home. So obviously the importance of technology and what we try to do in a number of other programs in schools, is to give kids access and opportunities that they wouldn't otherwise have."* (Principal, Brookvale School)

This school uses its student authored website to communicate school activities to the community, to celebrate the work of students at all levels and as a vehicle for purposeful language study.

Educating global citizens

Reece High School leaders consider that the collaborative effort of teachers creates a model learning community that inflects the school philosophy into all teaching and learning activities. At both Reece High School and Brookvale Public School considerable efforts are made to place all learning into a global context with a problem solving approach to student activities.

Three strategies were identified at this school:

- Specific work to enhance students' understandings of school life, the role of school, and its enjoyment.
- Initiatives to better involve the community of parents in the workings of the school.
- Projects that relate students to the environment, local community and to their place in a global setting

  "Well when I first came here we used to do pen pals, teachers used to write to classes overseas, and now we use key pals, email, most of the time the classes now are in contact with a group of similar aged children from overseas – not all the time, because obviously the curriculum is so crowded now, it's hard to fit it all in, but most of the classes are emailing overseas as some point during the year with a class overseas. So that has great benefit because it helps with the kids' writing, it's personalised use of technology and it helps them to understand other cultures". (Principal, Brookvale High School)

Student engagement

Building upon the imperative to seek points of contact with students, the following examples illustrate technology uses that expand student horizons into local and global relevance. In all cases the teachers have located technology with a problem solving context. Theoretical models of problem based learning (evident also in WebQuests see other Digistories) and situated learning are helpful references to this approach (Boss & Krauss, 2007 and Barell, 2006).

Tongan Dictionary

One of the ongoing projects that seeks to enhance the connections between home and school at Brookvale Public School is the web-based Tongan Dictionary. This is a simple website, authored by the students and maintained by them with some assistance. It features common words and their translations to and from English.

Figure 1 Tongan Dictionary

The Tongan Dictionary at the Brookvale website is well known and highly regarded.

Digistory #7 Extract: Futures Perspective

This Digistory focuses on the development and implementation of a school wide futures perspective at the Eastern Fleurieu School

The school has adopted a futures perspective in which staff are encouraged to reflect on what the world will be like for students in the future and what learning and skills will be available for them.

Following this process through logically, the implications of the vision of the future were explored in terms of relevance to issues such as text book acquisition.

The use of scenarios for the education of teachers has been previously described by Williams (2005), who has also explored the importance of ICT knowledge and skills in such scenarios.

A number of teachers were aware of the importance of considering the future in determining what ought to be taught and changing notions of the purposes of school education.

Ideas such as this are consistent with research on scenarios on futures of school education (Halse 2004; OECD 2001). The following teacher quotes reflect the teachers' understandings of these changes.

> *"…we're very aware of the fact that we are actually preparing these students for living in the future, and I guess that's a huge motivation for us. We know that if we don't prepare them for living in the future, they are going to be exposed to technologies that we haven't even dreamt of yet, and we are doing them a great disservice."* (Teacher, Eastern Fleurieu School)

> *"The schools aren't supposed to be a place for empty minds and we fill them up – they're supposed to be places where we try to get the kids to learn how to fill themselves up. And the future is one of technology, so the more comfortable and skilful they are at using it, the better their chance is for learning for life."* (Teacher, Eastern Fleurieu)

> *"I was talking to some parents the other day … I said to the parents, they can't cope in the modern world without exposure to as wide a range of learning technologies as possible. I suppose with what we've all been saying is we try and build that into our teaching practices and then the learning for the kids."* (Teacher, Eastern Fleurieu School)

Digistory #8 Extract: Professional Learning

This Digistory focuses on the professional development of teachers and draws upon case studies from Victoria, NSW and Tasmania

Introduction

Teacher professional development was found to be a common theme across the schools in the effective integration of ICTs across the curriculum. This pattern is reflected in the wider research literature which confirms that a significant factor in technology adoption and integration is professional development (for example see: Commonwealth Department of Education Science and Training, 2001; Department of Education Science and Training, 2002; Downes et al., 2001; Lloyd & Cochrane, 2005; McRae, Ainsworth, Groves, Rowland, & Zbar, 2001).

Saint Pius X Primary School: Research, reflection and peer support

At Saint Pius X Primary School the majority of the staff meet fortnightly to share, reflect and learn about their use of technologies to address specific learning goals. This professional learning community is called the e-Learning team and arose from the e-Learning initiative of the Catholic Education office. The success of this professional learning community appears to have been built on several factors, including:

- ongoing and regular meetings,
- an emphasis on professional learning through self and peer reflection,
- a research oriented focus on improving specific learning outcomes,
- relevant and timely technical training,
- funding for teacher release and professional development, and
- strong positive leadership from both the teacher who coordinated the professional learning as well as the principal.

Brookvale Public School: Just in time and ongoing support

The success of professional learning at Brookvale Public School is founded on a mutually supportive model of technology integration. Key factors in its success are:

- Situated learning with team teaching and teacher relief
- Just in time support
- Ongoing support
- Reliable technology through adequate staffing
- Using the right person to support the peers

The commitment of the senior management in the ongoing support of the teachers is clearly evident. One of the Assistant Principals is released from his own teaching for one day per week to work in classrooms with teachers. The second

Assistant Principal has a similar approach to supporting staff with IT in their own classrooms, and has a strong background as computer coordinator at a larger school.

Suggestions for improved management

Reliable technology is important if teachers are to take risks. The Principal of NSW School felt that the key to reliable technology was having sufficient staff time allocated to managing the resources. In addition the Principal pointed out that time release for staff should include team teaching.

Ongoing support

Continuous support for teachers is an important element in successful professional learning (for example see: Hawley & Valli, 1999; Lloyd & Cochrane, 2005). However, a teacher at Brookvale Public School argued that it is important to carefully select who is to give that support:

> *"You actually need somebody who is perhaps more a good teacher and knows how to do some integration, than somebody who perhaps is brilliant at the technology"* (Teacher, Brookvale Public School)

Professional learning circles

At Reece High School, the flexible "trans-disciplinary" structure of the school coupled with an intensive focus on team collaboration has facilitated innovation, dissemination and sustaining of professional learning.

> *"Everything is done in teams. There is no silo. We don't have silos, we don't have individual teachers. If teachers go off and start becoming isolated then it's highly likely that the team leader or myself or someone will ask them: are you unhappy? What's happening? Why aren't you working with this team member? Is there a problem that we can deal with?* (Principal, Reece High School *)*

The school is organised into several layers of teams including junior/senior schooling, year level, and others including an information literacy working party. All staff are members of teams and take on special responsibility within those teams. While someone on a year level team may be an expert in literacy they necessarily engage with the ICT expert when the team comes together to plan their curriculum. Moreover the ICT expert would be a member of the information literacy team and would be expected to act as a conduit for issues and learning between the teams.

Digistory #9 Extract: Leadership and Learning

This Digistory focuses on the exemplary teaching and learning community at Reece High School.

> *"…the critical thing is that in the first place you have to build a learning relationship between yourself and the learner and that means that you actually have to understand their learning needs.* (Principal, Reece High School)

A major renovation took place at this school 2000-2003. Part of the brief that was developed through community consultations was to have a state of the art school and a significant consideration was the teaching and learning approach, integration of information technologies, and building up the relationships with the community.

Information and communication technologies are pervasive in all aspects of the school. While there are implementations of technology in all curriculum areas in terms of learning activities, music technology, media production, simulations and Global Positioning Systems to name several, this digistory concentrates on the school organization, planning systems and focus on a "complete" educational model.

The principal refers to the process of researching into equipment, programs, IT and pedagogy as a "hunting and gathering" phase.

> *"For some of us it was just research, just reading up on articles, getting products, trialling them, trialling them with students, trialling them with teachers, looking at how they linked into pedagogy. For others it was participation in IT conferences, experimenting with online forums, talking to people who have been influential in the area.* (Principal, Reece High School)

Technology, teaching and learning

The research conducted by Reece High School into ICTs had two foci:

- Selection of hardware and software platforms, including the role of laptops and computer laboratories.
- Bringing about a teaching and learning focus for the effective uses of ICTs across the entire school.

A strong motivational and comprehensive approach to student learning can be achieved through problem-solving projects facilitated by Virtual Learning Environments. Reece High School's organisational structure provides the planning context, and the school intranet is used to provide this complete picture of the students' work.

This typically includes:

- The task - presented as a problem
- The context - local or global but far-reaching in terms of curricula
- The resources needed as documents or citations
- A workspace for each student to place drafts

- Feedback through a discussion forum
- Places for shared work
- Assessment rubric

Notably, these intranet spaces are also considered to be an effective conduit between school and home, enabling parent observation and assistance as well as easy access to work in progress.

Interface with the community

Australian schools routinely involve parent and local business or service agencies into curriculum as well as to source relevant and highly contextualised student tasks. These efforts are largely conducted as peripheral, or at least in addition to core teaching activities. Research indicates (Sanders 2008; Heppell 2007) the critical nature of being organised in this way and the subsequent need to systematize these relationships.

At Reece High School, restructuring the curriculum and organization of the school was partly driven by a desire to better engage the school and local community activities. This was reflected in the "team teaching" design and the implicit use of ICTs across the curriculum

> *"It's a smaller community and if you get people along to our presentation assemblies, end of year assemblies, which many of the public come and see, and then if they think, 'Gee, Reece students can do a reasonable job', they'll go back and talk at their Rotary or Lions Club or whatever and then they'll approach us. So if you're showcasing what the students can do then people will come. And we get people hiring our facilities here and saying, 'Can we have the students to do the sound, do the lighting, do the videoing?'. The school - I'd say that in our wider community the school's got a good name of what - the quality of work and the reality of our students as well."* (Teacher, Reece High School)

Digistory #10 Extract: Community Engagement

This Digistory focuses on improving relationships through innovative use of ICT that will serve to engage the community while providing quality pedagogical opportunities for the students.

Promoting a social approach to technology is not a new concept (see (Feenberg, 1991; Franklin, 1992; Pacey, 1983). The digistory demonstrates the possibilities of community engagement when school communities are focused on improving relationships rather than acquiring the latest technological artefact.

As such the following stories highlight the advantages in adopting an approach to technology based on relationships rather than the flow of information (Bigum, 2002). The relationships promoted by schools through the use of ICT provide different elements of this digistory.

Underpinning this digistory is an optimistic view of the future pedagogies in these schools. The teachers are engaging in developing their professional practice (see Professional learning community digistory).

At the same time these teachers are also decentring the learning spaces they have inherited to construct learning bubbles through the broader engagement with the community (Ferguson & Seddon, 2007). The stories below highlight the role a practice approach to technology can play in a school in transforming the places of learning for teachers, parents and students.

Relationships between parents and teacher

Cairns School of Distance Education students engage in lessons in a variety of remote locations in Far North Queensland. The home tutors, who are usually parents or caregivers, support the students in their learning which is increasingly mediated by ICT.

The principal and teachers at the school have identified the key role these home tutors play in providing role models to the students. They also realise that by developing the technological practices of these home tutors, they are supporting the development of a parent network mediated through ICT across Far North Queensland.

An important element of the ‘Technology on the Road' program is how it is based on a respectful relationship between the parents and teachers. Teachers visit parents at home and travel long distances to provide this support. If this could be done in remote and rural homes across a jurisdiction greater than the combined size of Tasmania and Victoria, teachers in urban contexts need to take stock of how easily a similar program could operate in their schools.

Relationships between teachers and students

A range of technological artefacts were used at Cairns School of Distance Education to support innovative learning spaces. When asked about the innovation in

the middle school with ICT, the teacher listed the artefacts but highlighted the relationships that are supported through this new use of ICT.

The possibilities for connecting students to a range of experts in an ICT mediated environment, is a practice promoted by this school. ICTs support student-teacher relationships by decentring the teacher as the expert and drawing on members of the community to actively contribute to the students' learning. As a consequence of this engagement with the community, the students are using digital mediated spaces such as *wikis* and *blogs* to document and unpack their learning.

Much of the success in this school with innovative pedagogy in ICT rests on the belief that the artefacts are there to serve the relationships between people. The school is well positioned to integrate a range of community engagement initiatives as many of teachers are motivated to improve relationships rather than acquiring technological artefacts. There appears to be a pragmatic approach to technological artefacts in the development of these community relationships.

Relationships between students and community

The teachers supported students in their transformation through a critical examination of their practice: much of this revolved around the student's interests and locating this interest in the community. This transformative approach to pedagogy is liberating for the students as they are in a better position to make informed choices about their everyday practices. ICT played a role in connecting students to a sense of citizenship and supported their emerging identities.

Relationships between students

One of the interesting things about ICT use at Cairns School of Distance Education is the important role computers play in developing a connectedness amongst the student community. Most relationships amongst students are mediated through ICT. Many face to face relationships that students take for granted in an urban city school are mediated through a computer at Cairns School of Distance Education due to the remote locations of the children's homes. ICT plays an important role in developing these relationships between students from an early age at school.

The stories above demonstrate that community engagement in a school is best supported by a social approach to technology rather than a desire to acquire technological artefacts in school buildings. By focusing on relationships and student engagement, innovative practices with ICTs have a better chance of withstanding technological change than a policy that invests heavily on the latest technological artefact. The stories above are a testament to the effectiveness of using ICT to support a diverse range of inclusive relationships that underpin pedagogical success.

Digistory #11 Extract: CD Resource

This Digistory focuses on the use of digital resources covering an entire term's work distributed to students on a CD.

A feature of a student's academic learning in the Presbyterian Ladies' College is the distribution to students of a self-contained CD resource package featuring the entire term's work for the school subjects concerned. Multimedia and hypermedia technologies are usefully harnessed in the CD's pedagogical design.

Student learning from the lesson notes are supported through embedded movies, audio and podcasts. The variety of multimedia resources is felt to provide students with greater differentiation.

> *"So what I really like is that it offers me multiple ways of engaging them and stretching them, and I think that that's a really important part of the use of the technology at the school."* (Teacher, Presbyterian Ladies' College)

Pedagogical underpinnings: Differentiation of the curriculum

Members of the school community at different levels (from the principal to the student) are explicitly clear about the pedagogical underpinnings of the CD resource package. All expressed their understanding that the main reason driving the production of the CDs was to better personalise students' learning experience through the differentiation of the curriculum. The principal made the following point:

> *"I think the most powerful or innovative use of the technology has been in supporting us as educators to differentiate the learning experience for our students. So the technology allows us to develop teaching and learning materials that will suit a range of abilities that you will inevitably have in any classroom environment. It gives us also the ability to capitalise on the range of learning preferences.... it does mean you can deliver material in a different way to those students."* (Principal, Presbyterian Ladies' College)

The school's valuing of differentiation through the CD resource package was portrayed via the following features of the package:

- learning materials developed at three different levels to cater to the different learning needs of students
- video recording of the classroom lessons (caters especially to students who were absent or those who benefit from listening to the lecturer's speech again and again)
- video recordings of the processes involved in solving mathematical questions
- questions posed may be hyperlinked to other modes of communicating the questions, such as audio, picture or movie
- hyperlinks to related websites
- the integration of the Provox software in the package allows students to practise and self-assess their LOTE pronunciations

- Audio-video and text materials facilitating self-revision of expected known content knowledge for new Year 7 students and new boarders

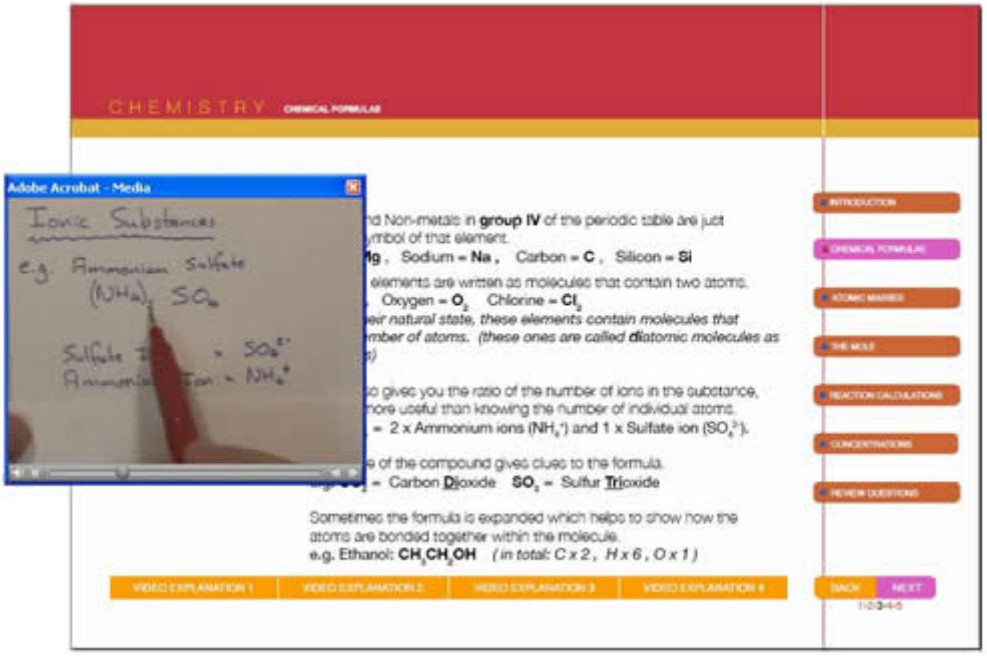


Figure 2 CD Resource Screenshot

Responses to Research Themes

The three main research themes underpinning this project were to:

1. Demonstrate via a case study model, effective strategies and practices using ICT across various curriculum areas to engage students with learning for improved educational outcomes with sustainable & embedded use of learning technologies across the curriculum.
2. Use the case studies to show examples of student engagement and motivation as a result of the use of innovative learning technologies in the classroom. The study was to contain examples that would be replicable for future school implementations and involve comments from principals, teachers and students. At least one of the examples should show improved literacy or numeracy outcomes as a result of the use of learning technologies. The results of this research were to be in a form compatible with both print and online publication.
3. Develop 'digistories' of school leaders and classroom teachers, from a variety of learning areas, articulating the pedagogical strategies they use when integrating innovative learning technologies with their students. The development of digistories across a range of areas, age levels and settings was expected to assist in meeting the needs of teachers nationally.

The first two of these research themes is addressed in this section. The third theme is addressed by the online digistories and the associated digistory summaries [Results Section].

Effective strategies and practices

Changes in teaching philosophy

At Saint Pius X primary the teachers felt that being able to effectively use technology across the curriculum required a change to their teaching philosophy which included adopting a different role with their students.

In this quote teachers are described as motivational guides.

> *"It's had a big change in my philosophy of teaching in that I no longer take the view that the teacher is on top and everyone else is down below and that you are the source of all knowledge in the classroom, that just can't happen these days and I really think that in some regard you're just a guide to those students, you're a motivator for them and you're a guide. You can't just give them the technology and think they can run with it because you've always got to take a step back and have a look if they're using it effectively. If it's not being used effectively then you need to polish what's happening and refocus it. It's not about the technology it's about effective learning and the most important thing is that you are the guide and keep directing the curriculum in the appropriate direction rather than thinking there's ten students on computers, they're using technology. They may be doing nothing more than just reading. If they're going to be using technology it's got to be a natural part of their learning."* (Teacher, Saint Pius X Primary School)

Teachers need the confidence to let students explore the technology but at the same time teachers need to have a firm understanding of what learning skills or curriculum outcome they are trying to achieve.

> ***"Using the technology I think it involves a fundamental change in how you approach teaching.*** *You can no longer be standing up the front giving the students work and being the sole person in charge of what their needs are and what they need to improve. 23 students in a class giving out work for the whole class just cannot focus on the needs of every student at where they're at. With the technology you have to stand back a bit and you have to accept that some of these students know more than you and for some people that's really difficult whereas for me and my background in technology I just naturally felt comfortable with that and we've got to reflect back and think these students know how to find every little crack on a Playstation 2 game so that's their world,* ***they know how to learn, they know how to discover things in the technology ... so once you understand that some of these students will know more than you then you have to have that confidence to let them go with it but you've always got to keep in mind that it is just a tool in education. It is not about the technology. It is about advancing the students' learning and using the most effective form that you can find that will deliver those goals for you."*** (Teacher, Saint Pius X Primary School)

Students have more direction over their learning which can be frightening for some teachers.

> *"One of the challenges in our school has been to have this technology used across the curriculum. In my role with ICT and also using it in my classroom the other teachers have seen how it is used in my classroom and they would like to adopt some of those approaches. I think some of them are a little bit hesitant about it and* ***some of them are a bit hesitant about having the students having more control over the direction of their learning.*** *It may seem a little bit foreign to them but the most important thing is that if you can understand where you're going or what you want the students to achieve the technology is just a means to achieving that. There's no point being scared about the computers or the use of the technology. You need to focus back on what you wish to have the students improve and then worry about the tools later on." (Teacher, Saint Pius X Primary School)*

It is interesting to note that most of the teachers at Saint Pius X Primary School felt that they were not particularly skilled in using ICTs. Nevertheless, all of the teachers were able to describe complex ICT skills in the pursuit of curriculum goals.

> *"Well I don't – I don't understand all the things that we do on the computer, we've done clay animation movies, inserting pictures, making slideshows, doing whatever we can with the computer, and I'm not afraid to ask the children how do you do that? And they get it great through and say oh, this is how you do this, do you remember now? And I'll do it in front of them, yes, I know all that now, thank you very much. I also find it good that you are able to say to the children, I can't do that, you show me how to do it. We email – we email other schools, we type stories, we do everything on the computer, we do so much."* (Teacher, Saint Pius X Primary School)

A longitudinal perspective is adopted by the school with regard to teacher capacity and ICT integration. The school recognises that by placing considerable emphasis on younger year levels those students will bring their expertise and confidence into older year levels. This is seen as a significant strategy in the long term embedding of ICTs across the curriculum and across years.

> *"One of the key things that we're focusing on in our levels is that the students are so skilled with using the technology and also not just mastering the technology, it's the whole process of using it as a tool to improve their learning that they will carry that up as they move up the school but it will be second nature to them that they wish to use this technology and even the teachers further up are not familiar with the technology or someone daunted by it they will have our support in us saying just let the students go, you'll learn from them and in that regard hopefully we can move them along so that they can start adopting some of the practices that we have in the classroom."* (Teacher, Saint Pius X Primary School)

A teacher of years 3 and 4 agreed that her role was more of a facilitator, encouraging students to share their knowledge.

> *"We have experts in the classroom, so they always mix around and say oh, I know how to do it, and they'll show the other children how to do it and eventually that spreads throughout the whole class and I've found that's worked really well. So it's a matter of just working as a team and getting things done. I find I'm more a facilitator than a teacher in those sort of IT things 'cause the kids just know so much now."* (Teacher, Saint Pius X Primary School)

Integrating technology requires considerable planning but a teacher of years 3/4 points out that it also results in "richer" teaching.

> *"The main teaching and learning implication of using technology has been it takes a lot of planning, you have to be able to use the program because sometimes there are going to be things when the kids can't do it and they need you, it's always good to have a tech next door as a teacher so you can ask them for help. I also find that I need to search out resources; I can't just use the same resources all the time because the kids are going to recognise that that's happening. I think my teaching is richer, I'm finding more things I want to go out and use, find a video or find something on the web that I can show the kids that links into our enquiry unit or links into our literacy focus for that week.... but I think the main thing is you have to be organised, you have to be willing to go out and search for resources and search for things that are different, if you don't, you're going to not be able to keep up with things that are happening"*. (Teacher, Saint Pius X Primary School)

The idea of a change in teaching philosophy was also observed in other schools around the country.

> *"We see ourselves as a community of learners and we see ourselves as a 21st century place of education and so you need to have… the technology's a natural part of that and learning from each other's a natural part of that and working in teams and being collaborative and all of that's based around what's best for our kids and what's going to best prepare them for the world that they move into."* (Vice Principal, Reece High School)

> *"…learning and education doesn't have to stay in one physical location anymore…it always fascinates me when …I'm driving to work and someone else is driving to work in the opposite direction and sometimes it strikes me that a lot of us are driving to work to do things which we could just [as]*

easily do from home using technology, and I think … if you've got a group of students who are studying, …then they could be anywhere. They don't have to be even in your region. They could be just a group of students who are interested in that thing, and the teacher can be doing it from anywhere. Yes, people say 'well, we still have to have the social aspect' and I agree, so you still need to have a hub where people come to socialise, but not necessarily to do that formal sort of learning…I think the whole nature of what we've got now, in physical buildings and computers, is outmoded. It needs to change." (Principal, Eastern Fleurier School)

Changes in school organisation

In addition to changes in teaching philosophies, the researchers discovered changes taking place in the ways in which schools are organised.

Reece High School demonstrates a team approach to teaching. This is supported by the staff intranet which is used extensively. The Intranet serves a teacher planning role in terms of documenting policy and practices, providing a collaborative workspace for teachers' teams to plan and to connect curriculum and school ICT agendas with learning and teaching activities.

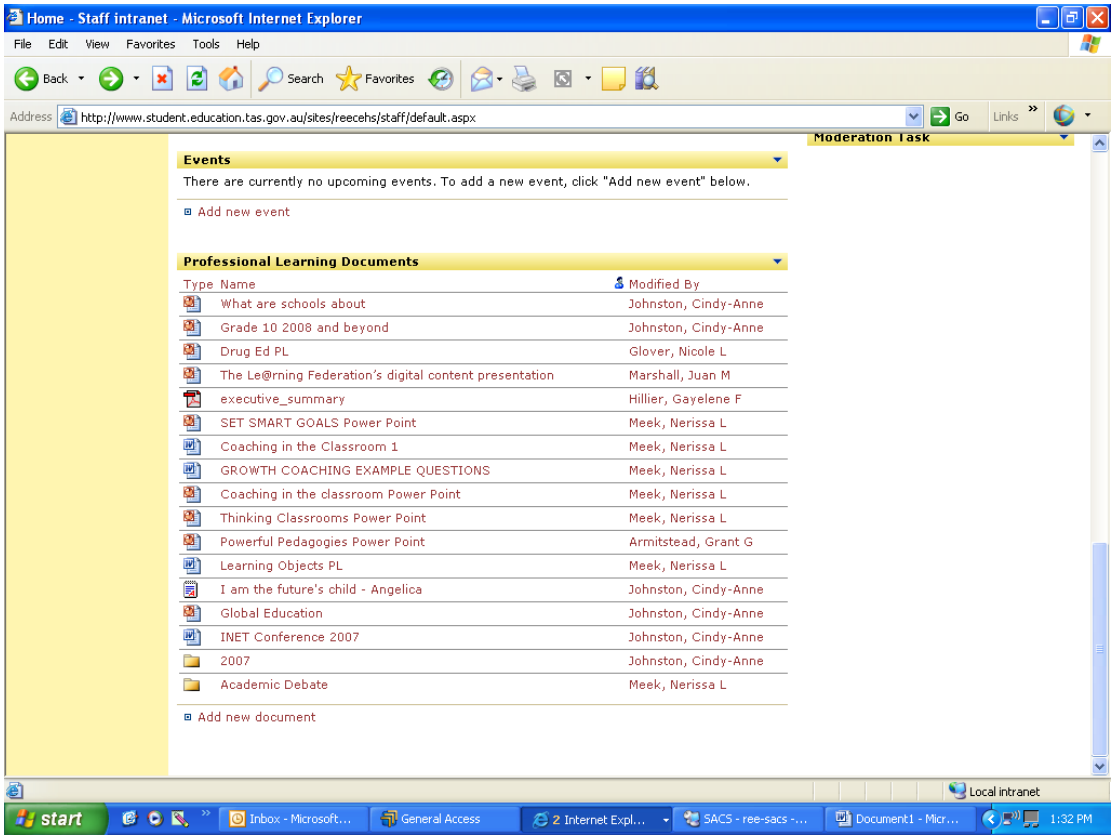


Figure 3 Reece High - Staff Intranet

"… there are at least seven teachers on a grade team and they all have different learning area backgrounds, and so different people on those teams I suppose take really responsibility for pushing the band wagon of their learning area in some degree or sharing information or directions with them in those areas. So there would be a person on each grade team that was part of that information literacy working party and then they feed back that

> *information. So at different times through planning units, because they all plan together they get an opportunity for us to reinforce this idea. So their research and information so we can teach these research skills and those ethical issues can come in too at that time in the unit."* (Vice Principal,Reece High School)

Professional development is also organised in teams and information sharing is implemented as a continuous process rather than as a series of disconnected events.

> *"We have what we call "Professional Learning Circles" but we use a learning centre model like in primary schools so every so often we have a work-back, which is a longer time, not huge things, because I don't believe in working when you're brain dead. But at those learning centres we would then say: okay, there are these five people who have been doing this research or been part of this professional learning experience, they would then become a learning centre and people would cycle through the ones that they wanted to see.*
>
> *There might have been someone who'd been to a literacy [professional development event] and so there might be five of them [in the learning centre] and then they'd go round. And then one of the lenses that we put over it, because we are about IT, is, okay, is there any IT that we need in order to make this program work better? How will we enhance the learning through IT? If there isn't, then we don't worry about it. But if there is we do.…"*
>
> *"There are 50-odd teachers and they would select into which group that they want to go, including me, and the leadership team, so each one of us is in a different group. Then every so often we have a reporting back session on the work that you've done. The information about the learning circles is also on our share points so we run a share point here for staff and for students and these sorts of things are all posted on there. Then the team planning is - well, you're in it depending on what your team is. But you will notice there in those team planning things, they are very teaching and learning focused. We don't do managerial things in team planning."* (Principal, Reece High School)

Modelling Appropriate Practice

An effective strategy for harnessing exemplary learning technologies was the concept of modelling appropriate practice. This was well demonstrated by the leadership team at Eastern Fleurieu School where an early initiative was an interstate visit to schools in Victoria:

> *"… quite a large group… went to Melbourne … to look at ICT uses in schools there, in particular at Bendigo Secondary College and the Methodist Ladies' College there, which had a very strong emphasis on the use of laptops. .. we came back very enthused about what we saw and what the possibilities were for Eastern Fleurieu School. I think it's worth saying from that trip interstate,… the group that came back actually drew up a plan which was the called The Way Forward, and that really plotted the next period in the school in terms of ICT. It talked about the need for strong leadership in ICT. It talked about the need to put computers on teachers' desks if we were serious about skilling our teachers so that they could better work with the students and with the equipment. It talked about a large*

> *financial commitment, which the school has made. And it also talked about the importance of having a committee that was going to monitor and continue to put into place plans for learning the technologies in the school."* (Principal, Eastern Fleurieu School)

The researchers noted that the process of 'modelling appropriate practice' was somewhat different to the popular concept of 'adopting best practice'. It was clear from discussions with principals and teachers that each school was a unique community and that it was therefore not possible to develop a single ICT policy that would meet the needs of every school.

Therefore, the most effective strategy for a school looking to harness technology was to explore the ways in which ICT was being used in other schools and then use this information to develop a plan that met the needs of their local educational community.

Adopting a future perspective

An additional method of focussing teacher attention on the importance of ICT and in gaining staff support for leadership initiatives in this area was to ask staff to reflect on students' needs in the future. At Eastern Fleurieu School this included discussion of an article by Hedley Beare, entitled *Angelica's Story*, (Beare 2000) which provided a scenario of education in a future digital age. Related scenarios can also be found in Warner (2006). This procedure was followed by a discussion on the skills that students would need in order to be successful in their lives in the future, and the steps that the school could take to enable them to achieve this.

> *"… [Angelica's Story] was really something that we used to get people thinking about what the future was and to get them to realise that the world as we know it now is not going to be the world in five years time. …we talked about the children who are currently in our school in Reception and what their world might look like by the time they got to Year 12. So that was a tool and an article that we used to stimulate some talk and thinking around what the future might look like and then what the skills were that the students needed in order to be successful in their lives. …that was further supported by the Learning to Learn project. …that's a South Australian initiative, looking at how students learn best and different learning styles. … that actually facilitated the whole process more."* (Principal and Head of School, Eastern Fleurieu School)

A South Australian project entitled *Learning to Learn* (2008) was used in conjunction with this step:

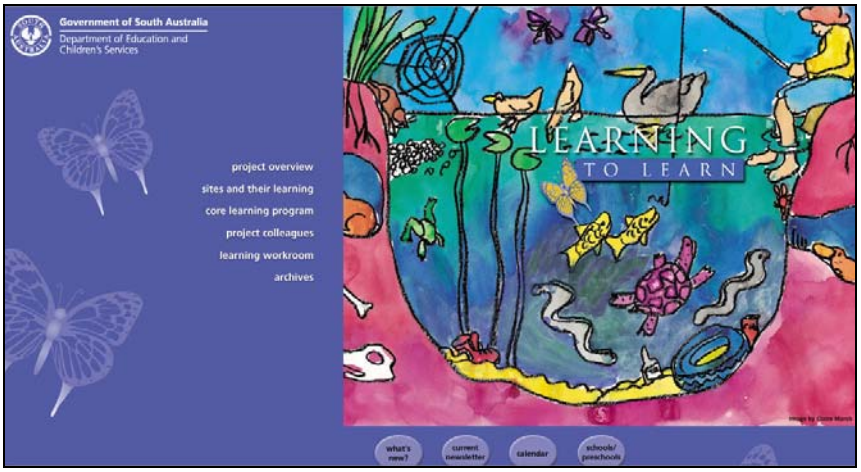


Figure 4 Learning to Learn website (DECS 2008a).

The importance of adopting a focus on the future was also mentioned by a number of school leaders and teachers from across the Exemplar Schools.

> *"There aren't too many other professions where you have to basically work in an environment up to an entire generation ahead of you. But that's what you have to do as a teacher. It's not sufficient for us to get hung up on whether or not every child's going to need a laptop. We know that it's going to be the case…. It's just as important for our children as anyone's children that using ICTs is second nature, just as important. So the logic is all about preparing kids for their future, that's all."* (Principal, Cairns School of Distance Education)

> *"…we're very aware of the fact that we are actually preparing these students for living in the future, and I guess that's a huge motivation for us. We know that if we don't prepare them for living in the future, they are going to be exposed to technologies that we haven't even dreamt of yet, and we are doing them a great disservice"*. (Teacher, Eastern Fleurieu School)

A process oriented approach to ICT

While teachers at the Cairns School of Distance Education celebrated the digital texts produced by the students, there was also a strong process approach to the use of ICT across the curriculum. Teachers and students were sending drafts of texts backward and forwards adding text boxes, audio files and movies about the draft as a way of developing the student learning. One teacher found these drafts much more valuable that the final product as the developing text became the dialogue through which she could track the student learning.

> *"Now when children are doing their drafts, they email it in to us, and we email it back with the text boxes and then they overlay it with their text boxes about things that will happen, and then we put little recordings attached to words about 'do you think you could add this?' So it becomes a real working document, and as a teacher, we get far more from that working document than we do from a draft or a finished product."* (Teacher, Cairns School of Distance Education)

Interestingly, this process approach to the text appears to lie at the heart of what Kress, and Van Leeuwen (2001) identify as communication. '*We define*

communication as only having taken place when there has been both articulation and interpretation' (p.8).

The process approach to text development as a result of student and teacher dialogue provides the student with repeated opportunities to articulate a text and then interpret the teacher's response to their text. This provides the students with a sense of audience as they are developing and exchanging the texts with their teacher.

Perhaps the teachers are beginning to identify that the report cards that focus on a product are a becoming redundant in this learning context. As one teacher suggested:

> *"At times, I think their report cards become fairly redundant at the end of the year, because it's a delayed time feedback, whereas we've experimented and engaged in so many other different forms of feedback and working together collaboratively, that report cards sort of seem a waste.* (Teacher, Cairns School of Distance Education)

Supporting risks

An important strategy identified at the Cairns School of Distance Education was that teachers were supported by the principal to take risks with ICT. At a systemic level this promoted the use of ICT across the curriculum and positioned teachers as professionals.

> *"So if a teacher comes to me and says, "There's this new software program and I want to give it a burl," I almost certainly will say yes, because I know that inherent in that person is an awareness of whether this is going to jeopardise that child's education to be going and experimenting with something or not. So I really actively persuade teachers to look for what's out there, whether it be in terms of hardware or software or new ways of doing things, and then if it's really working out well, then adopting it across the school".* (Principal, Cairns School of Distance Education)

Embedded in the Principal's approach is a critical consumption of ICTs for pedagogical purposes by teachers. An example of how this plays out in a teaching context is exemplified by the following comments of a teacher who was discussing the use of technology in the year two curriculum.

> *"There was too much technology in there, so we revamped it and took bits out and modified it like you should do and trialled it again and it was just right this year. So a lot of it is trial and error because we didn't know what in the past what Year 2's are capable of doing."* (Teacher, Cairns School of Distance Education)

The opportunity for teachers to make mistakes with ICT can be seen to be an important strategy employed by the principal as a way of promoting ICT use across the curriculum.

Engaging students

Supporting a diverse range of activities

Across the Exemplar Schools, ICT was found to support a diverse range of activities which teachers used to construct engaging learning experiences for their students. These activities were found to be necessary in order to engage students who are growing up in an increasingly technologically oriented society.

> *"I think that we are actually competing with some pretty whizz-bang things that they do at home… That's probably what has driven us to explore things more, because if we just stick with the old chalk and talk and books, we've lost them. Society has changed. I think also, the way in which kids learn has changed* (Teacher, Eastern Fleurieu School)

> *they're going onto websites and they're reading things from the web… they play a game on their Playstation II or their PSPs then they go off and they're blogging and they're hearing voices on the internet, and then they're coming to the classroom and we're just showing them traditional things such as books or big books and we're not implementing [ICTs] into our classroom, the kids are going to be bored."* (Teacher Years 3/4, Saint Pius X Primary School)

The following extracts describe a variety of innovative uses of technology in years 2, 3 and 4 at Saint Pius X Primary.

> *"…so in my class we made ads last term in our unit of work about healthy foods. They had to make an ad of their own choice. Some people did magazine ads, so they used the internet and saved photos and filed them and inserted them into Word to use that. They used GarageBand which is sound and voice and iMovie. So they've taken photos and they take their own video and they insert it and do transitions and titles and all that sort of stuff. We've done [...] which is like Inspiration but it's on the net. It's free, so we do a lot of mind mapping on that and concept mapping, and we have Inspiration in the classroom too, so they use that. They use PowerPoint a lot, but what they've learnt with PowerPoint is to use it as a support. Initially they were just writing heaps of information in there, but now they use it they've put pictures, and instead of having boxes they'll use arrows and label the picture, and just talk off it, and they also ... they'll record themselves with iMovie, make a Quicktime movie from it, and then insert it into PowerPoint, which is quite interesting. With my top kids they could do that independently…At the moment they're making animations. They're taking photos and they'll put that up – they'll all upload that on to the computers and then put that together to make their story." (Teacher Years 3/4, Saint Pius X Primary School)*

> *"We've got our own little forum set up. They've got their own chat room and that can be a reading task, and they can go on there and have a bit of a chat. It's quite humorous. They're talking to each other ... but I just want them to get used to being reading on the screen. The other one that we forgot to mention, is last year the students did a unit on endangered animals, and they made their own documentary, using iMovie and they did the voiceovers and the clips."* (Teacher Years 2/3, Saint Pius X Primary School)

> *"Oh, we did puppet plays and we filmed them. We made a DVD of it. We also did – I don't know if this was you too. Five shot sequences, where they take five photos and have to tell stories and they put it into iMovie and make movies. They can do it in PowerPoint as well."* (Teacher Years 3/4, Saint Pius X Primary School)

The following provides a student's perspective of a multi-modal ICT based activity conducted at Brookvale Public School.

"On the 2nd of May 2005, Steve from Digdi Ed came to teach us how to make animated movies on the computers. Firstly he told us we needed to get into a group. When we were in our group we made a storyline and then made the figures for our movie.

Solly, Tim and I made a movie called The Bank Robbery. It was very hard work we took over 200 photos with our computer but all our hard work would soon pay off.

After recces we conutided our movie and then we started to edit which took a very long time. We had to delete a bit of our movie that we didn't want then we went to lunch.

We all came back at half bell because it gave us extra time to finish. When we finished our editing we had to burn our DVD it took quite a long time.

At the end of the my group was so exhausted and anxious to get our DVD's but beside that we all had a great day."

(Year 6 Computer animation project, Brookvale Public School)

Additional examples of the diverse range of ICT based activities were obtained from a focus group of year 5 and 6 students.

> *"We did it for Integrated Studies, we had to do our video hits about – we had to make up a song about music and drugs or about living healthy. Drugs and living healthy – Yeah."* (Year 5/6 student, Saint Pius X Primary School)

"…and we also do other things like we had to do a news report on global warming ... some people did a claymation about it." (Student, Year 5/6, Saint Pius X Primary School)

"We had to make up a dance and we had to a news report or claymation about global warming. We had to record our voices... We had to like sing really like loud because we had the iMac and the iMac was far away." (Student, Year 5/6, Saint Pius X Primary School)

"…when we were in Grade 3/4 the Grade 5/6s would put up clues about space. Like we had to guess the planet and we – they'd put up clues on the [virtual learning environment] page and we'd have to go and read the clues and think of the planet. And then... in assembly we'd have to stand up and say the planet we thought and they'd tell us. And each week they'd do a new planet but they'd only give us some clues... They like typed it up. We have a thing where you – it's like a journal, a class journal, where you can type up things and ask questions and people answer them and they did it on that. And they'd type up words and then we could type back. If we thought it was Jupiter we'd type back, 'Do they have a lot of moons?' or something and they'd answer yes or no. Yeah." (Student, Year 5/6, Saint Pius X Primary School)

At each of the Exemplar schools, teachers and parents identified a range of additional activities that were used to engage students.

YouTube research

"I've done a topic with a lady … she was in a car accident and her face and her hands have been severely burnt while she was trapped in a car, and through using the web you can go through lots of different things until you get to an open interview, which is about 13 minutes on YouTube. I found a lot of information about her, and her talking about what happened, but you can't find a lot of information about they guy who did it. And then you get further into YouTube and you can have a look at his reaction and his mother's reaction, and all the kind of things that kind of fill in the story a lot more. But when the kids came to write a recount or actually reflect on it, write a reflection down, there's a lot more detail that they can put in and have a look at." (Teacher, Reece High School)

Ipods as data devices

"I think a couple of things, the fact that I've the access to mediums, like we mentioned we use MySpace etcetera etcetera, the access to the mediums is so much more, and makes it a lot easier too. So the kids often have their own iPod and will bring something they've downloaded from somewhere, so maybe that's one thing that's successful again in terms of being real." (Teacher, Reece High School)

"My kids will do their work and then they'll put it on their MP3 player, bring it home and finish it off at home, you know, English or whatever they're doing. So I suppose that's sort of using technology to do that." (Parent, Reece High School)

Integrated imaginative uses of technology

> *"So they actually incorporated live interviews into a presentation that they were doing on stage, so that the interview was then on the screen and the whole assembly hall could hear it – that surprised me, I thought wow."* (Teacher, Reece High School)

Interactive whiteboards

> *"The kids are really excited about using the interactive whiteboard just because it is interactive. If you're already writing on one like that, probably not so much, but because it's interactive, they've come home and talked about it and been really excited to read what was on that board because of what it is, because of the technology. …The ability for students to be able to work together on a project. The ability of the teacher to be able to use that resource or that technology with the whole class and access internet, access anything that they like that they can access on a normal computer, is amazing. So that technology's straight away at your fingertips, and also to be able to use it as just a normal whiteboard as well. So the functionality of a bit of technology like that is just amazing to have in the classroom."* (Parent, Reece High School)

Phones for data

> *"I do, in the library, because I work here as well. And I have so many kids come in and they've taken photos for school projects on their phones, but we don't have any way for them to download them. They're coming in constantly asking if we've got a cord that can attach their camera to the computer, so they can download their work. So I have a camera, he does, yeah. Takes them home and puts stuff of his phone."* (Parent, Reece High School)

Phones and school work

> *"Ben last year was doing something and he couldn't find it on the internet. I don't know what words to use to search these mum. And I said 'okay then, well we can have a look'. And he said 'oh no, it's alright. I just sent a text message and such and such will get back to me in a minute and they'll tell me what they put in"* (Parent, Reece High School)

GPS

> *"Well of course the GPS devices, when you hook them up to a geography lesson that you're talking about, they can suddenly have another whole dimension that we couldn't possibly have imagined."* (Parent, Reece High School)

Filming performance for discussion and workshops

> *"…the other thing that we use heavily is actually footage of filming their performance, and it gives it a very much a formalisation to their performance. So we have the video camera there filming, and it seems to up the anti of the significance, and also increase I suppose the amount of nerves or performance anxiety that they suffer with the video camera."* (Teacher, Reece High School)

Creating comics

> *"Another thing we did, just last term, was looking at chemical explosions, and we looked at all of the things that made explosions in our own homes, and we used Comic Life, which was a free download. It was in beta form, so not reliable, but the kids used Comic Life to show different explosions, and it was a day in the life of the student's name, and chemical explosions. So that was a great use of not only looking at explosions and the scientific principles behind it, but looking at the kids' humour that was built over the top of it, and we had lots of fun with that."* (Teacher, Cairns School of Distance Education)

Music development and distribution

> *"I was asked by a couple … to .. watch them while they digital recorded a DVD, and they were just, not only did they have all the equipment, put it all together, feed it in, record it all, and I had absolutely no idea what they were doing. They then sampled it, took it onto a flashdrive, went home and put it on MySpace that night – and they are very technologically aware, and I was really impressed at how quickly they could get that song out to their friends. And then when I came in on the weekday, I heard kids talking about their song and their band, and I think that was really impressive that they had the facilities to be able to do that so quickly – like literally they put it on the day they recorded it, and this is probably about six or seven hours of actual hard work on a weekend, and then took it home that night and put it on the website so they could listen to it. So I though that was a really good way to use that technology, because I think they were really impressed with the fact that they could actually go out and put their music out on the internet so other people could listen to it. That was the actual ownership I think for them."* (Teacher, Reece High School)

School website managed and authored by the students.

> *"The combined issues of ownership, responsibility, management of information and communication technology feature in the whole-website project of NSWSchool. While many of the writing tasks, editing, conferencing drafts, and obtaining material from other students and teachers are often completed on paper, the outcome is digital and expected to communicate woith an online audience. This school was thus able to demonstrate significant interest from visitors to their online 'guest book'.*
>
> *You can actually differentiate the curriculum by using technology, and we actually have a group of kids now that pretty well do the whole of our website, under direction from Chris of course, but all the taking of the photos and the text and the editing and the cropping of the pictures and put them and dumping them on the website, it's all done by the kids."* (Principal, Brookvale Public School)

Final product, process and assessment

> *"I suppose the biggest thing in teaching that you look at is the motivation and the product as well, and I know that I had kids who were going to do environmentally friendly houses at the end of last year, and I had the old get the cardboard and we'll cut it out and do this. One of the kids said 'oh are we going to use Google Sketcher to do that?' And I said well if we're going*

> *to use Google Sketcher, you're going to have to teach me how to do it. And you should have seen some of the houses they've achieved, and they weren't environmentally friendly, [overtalk] [laughs] pools, and grottos. Like I mean the motivation of them to actually pick it up, and then to go on and on and on with it, and it was to the point where I said 'right, okay, today's the last day we're going to be doing Google Sketcher.' But it's the product at the end of the term, and with that assembly, the product it was like watching that footy show whatever it was, and it was just a seamless product that had been put together, obviously quite well, and it hadn't been just patched up on the spot. And it's that product that you look at, so that's telling you whether or not they've engaged with it or whether they've done a good job."* (Teacher, Reece High School)

Combining technologies in innovative ways was also seen as engaging. One example that was referred to by teachers, students and parents at Eastern Fleurieu School was the use of a microscope with an interactive whiteboard:

> *"One of the other things that [teacher name] did…was to use a microscope attached to the computer attached to the smart board and each of the kids chose something really tiny to do a project on and included the picture from the microscope in it and so that sort of was a trigger for them exploring all sorts of interest[ing] things and then using technology in their project."* (Parent, Eastern Fleurieu School)

Similarly, the same teacher had also used the interactive whiteboard in combination with photos from a digital camera showing the stages in a tree's growth over time:

> *"They're much more engaged and excited…building in that little bit of technology is much more exciting for a kid to walk outside and to photograph the tree that they're doing their research on and then photograph again at the end of the year and make the comparisons, than just go out and measure it and draw it…. the use of photographs alone can really enhance what they're doing and it helps them explain, especially if they've got photographs of their trip, they put [it] up on the screen and share. You've got a kid who's much more engaged with their learning than someone who just passes a couple of photos around and doesn't know what to say. So, yes, I think the kids' approach is much positive and you're dealing with a positive group of children."* (Teacher, Eastern Fleurieu School)

The researchers also found that the technology was used to provide personally relevant feedback and to engage students in deeper reflection on own learning. An example: a teacher of years 2/3 explains that he got students to video record their own presentations and then reflect and improve upon their performance. The students then repeated the cycle. This model was used for all presentations and the teacher was able to give personalised comments to the students (see Student generated video digistory for more details).

> *"I couldn't have made the class sit through 23 presentations and then two weeks later in the old traditional form we'd sit through another 23 presentations and then we'd tell them how to improve it and in two weeks time we'd do the whole thing again. It just doesn't work. This way it's happening all the time. There is always someone there doing it and it just*

> *flowed through the year ... it just flowed and it was natural."* (Teacher, Saint Pius X Primary School)

Collectively, these ICT based activities provide compelling evidence to suggest that the Exemplar Schools are utilising technology ways that increase student engagement on an ongoing basis.

Recognising student expertise

In addition to providing students with a diverse range of activities, the researchers also found that recognising student expertise was an effective way to increase student engagement and participation.

> *"I think it does change the relationship with my students, I think that they're more excited to come into the classroom and see what's going to happen. They know that it's just not me who's the expert, they're the experts as well. They know that they can – if they have an idea on what they want to do or how they want to present something, that they can go onto the computer and they can do it. If they need to search something on the web, they can go and do it, and just with the way they speak about technology, it's just integrated in everything. Can I go on the computer and go and search for this? Can I go on and do an IMovie for our presentation or they've come up with – we were doing Power Point presentations and they said oh, can we go onto IMovie and record ourselves? And then put that into Power Point? So they're thinking of the ways the programs link, and they learn how to make it into QuickTime movies and insert it. So I think that the students see me as oh, I can show them initially, but then they'll go away and do it themselves, and then I'll be like oh, wow, show me how to do that. So they see me as learning as well, it's just not that I'm removed, I'm just showing them then doing nothing, they see me as a learner as well and we work together to get things done."* (Teacher, Saint Pius X Primary School)

This sentiment was echoed by the Principal of Eastern Fleurieu School.

> *"… the other day for example I wanted to know myself something about a problem I had with my MP3 player. And they've all got their iPods. The easiest and quickest way to get information, how to fix a problem is to go out into the yard and ask the students. And that's what I did. That's where I got the information on software and what I needed to do to fix my problem…. What's the most exciting thing is that they know more than we do. And I think we need to keep encouraging that. .. it's also really exciting that .. we can't be the experts because there's no question that the students ..come with a digital headset. And they bring to school the most amazing things on USBs that they've done at home that they want to share at school."* (Principal, Eastern Fleurieu School)

Connecting with the community

Another approach to increasing student engagement was to use ICT to establish connections between schools and the wider community.

> *One of the non-negotiables, for example, was that every class needed to get out into our local community and do something with them. Every single teaching class.* (Teacher, Reece High School)

A particular example of this strategy was the development of a website for a local community group.

> *"Well what I do is like here during ICT my teacher said that the Rotary Club was looking for someone to do a web page and they used to have close ties to the school, she set me up and so I had a meeting and again designed. So then we started sharing the files, see how she liked it over the emails and arranging meetings through email. Yeah it's all come together and soon to be uploaded."* (Student, Reece High School)

On their own time

An interesting insight that emerged from this research is that students are at times so engaged by ICT based activities that they elect to pursue them in their own time.

During a focus group interview with years 5 and 6, all of the students in the focus group indicated that they had, at one time or another, written stories at home for their own pleasure. Students also indicated that they enjoyed communicating with others using MSN Messenger, creating their own online presence through Piczo, MySpace and Beebo, and sharing movies through YouTube.

The following interview extracts are from year 5 and 6 students who indicated that they enjoyed creating slideshows and stories at home.

S1 *If don't have anything to do, I just do a PowerPoint, and that's it.*

Q *Not just for school? You do PowerPoint for fun?*

S1 *Yeah.*

Q *Okay. Can you tell me one thing that you did on fun? If you don't mind?*

S1 *I did it on my home country.*

S2 *I did one on my phones.*

Q *So you did one for fun as well?*

S2 *Yeah.*

S3 *You get bored and then it's just 'Do something on the computer or else you have to do chores'.*

Q *Have you done one for fun?*

S3 *Yes.*

Q *Okay. This is a whole thing going on here I didn't know about. Do you make movies for fun?*

S3 *Movies? No. I type stories for fun.*

S1 *Oh yeah.*

S2 *Me too.*

S4 *When my cousin comes over I make up a wrestling movie.*

Q *You record a movie?*

S4 *A movie. Like I've got the camera.*

...

Q *Do you do anything else at home?*

S1 *I make a website.*

This high level of student engagement was also observed in the use of WebQuests at the Cairns School of Distance Education.

> *"…the students who were involved in it became so engaged with the unit that they actually worked through their Christmas holidays which kept me quite busy as well because I had to respond to their emails and their discussion forum topics as well."* (Teacher, Cairns School of Distance Education)

The commitment of this teacher is combined with engagement of his students to develop a highly supportive learning environment. An important aspect of this engagement is the students are not bound by the time or space of the classroom for their learning. The fact that students chose to engage in school based learning on their holidays highlights the student engagement that is possible with supportive ICT practices outside of the school environment.

Engagement and improved student outcomes

While there are no quantifiable measures of engagement provided in this research, there were some qualitative indicators that student engagement was underpinning effective pedagogical practices. Below are some indicators of this engagement and the qualitative links to improved student outcomes.

As ICT has been used at the Cairns School of Distance Education, the turnaround time for student work has been reduced. The principal noted that teachers have:

> *"…become people who are at the front end of curriculum development and not simply delivering products that other teachers or other people in the organisation have manufactured. Now that makes the teaching experience infinitely more satisfying."* (Principal, Cairns School of Distance Education)

While this may have been satisfying for the teachers, ICT practices also provided opportunities for student engagement.

> *"I'd say the thing that underlies ICT for us is the fact that we can have immediate response from our students in an environment where having immediate communication has never happened before."* (Teacher, Cairns School of Distance Education)

The Cairns School of Distance Education has benefited from the synchronous opportunities provided from the new ICT practices that replaced the paper based lessons that were mailed between schools and home learning contexts. The new technological configurations engaged teachers in their profession as well as students in their learning. As the principal states:

> *"If you write an engaging, relevant, current online unit of work, then kids are going to be attracted to it. It's going to have purpose and meaning and the experience is going to be far more enriching for them. Teachers get that feedback. They see it happening. They become more enthusiastic about generating new materials." (Principal, Cairns School of Distance Education)*

One point that was highlighted by this research was that the engagement and motivation was inclusive of teachers as well as students. Teachers were learning about pedagogy and practice while their students were engaged and motivated with their learning. The innovations with ICT in the Exemplar Schools appeared to be a result of the intersection of this community of practice between students and teachers.

Technology in itself does not engage students

Although ICT has been shown to be a valuable tool for developing engaging activities, it is important to clarify that technology in itself does not engage students. As discussed in the introduction of this study, technology is only as effective as the learning theory it supports. When ICT is used for repetitive drill and practice it is not seen to be particularly engaging. However, when ICT is used to develop structured, interactive lessons that are based on the tenets of social constructivism, students engagement levels are found to increase.

> *"I think a lot of it comes down to the teacher and what you're going to use and what you're using, because if you're just going to do Word type – like we write stories on Word as well. So if you're going to do that all the time, you're not giving them a big scope. It does – it engages them if I feel if you're using it in a way that they're going to use it so it's real, then it will be engaging. If you're just showing things and off they go, I don't see IT as that engaging. I think they need to – there needs to be something that they can access. We're focusing in our E-learning research on multi literacies, and we're looking a lot at what the kids are interested in, and so therefore we're doing films for our shared reading and different types of texts and if they see that, what we find is our big dimension – the big dimension, our creative dimension you want to improve it, is that they go away and use it themselves, and go beyond what you have taught, and that's when I think it becomes engaging."* (Teacher, Saint Pius X Primary School)

At Brookvale Public School several teachers indicated that they used ICT to provide a scaffold for student's research projects through a combination of structured questions and modelling.

> *"I have an outline of the project and then I give them a few different web sites so that basically helps and then I would have the questions... We may have done sort of a blue whale and then okay, what animal would you like. … So start with a modelled example first and then they can add to that modelled example and then they have an idea of what they're looking for when they go searching on the web."* (Teacher, Brookvale Public School)

> *"I said okay I want you to have a graph, I want you to a map, I'd like you to have a photograph, I'd like you to have .... and I would make a list of things in their production of their work after the research, this is at the end of the year, and that they could go and find all of those things on the web, work out whether they are allowed to use them or not and put them in the final production."* (Teacher, Brookvale Public School)

Another way to provide scaffolding for students is through the use of learning objects such as those available from the *Digital Learning Bank* (2008), a south Australian initiative, and other sources such as *Edna* (2008)

> *"I think a lot of us, if I can speak for everybody, we're often alert and tuned into the technologies that are out there, but also what the technologies offer us and what the Department, education system offers. One in particular is a*

> *Digital Learning Bank…it is available to all the teachers and it's just a huge resource of lots and lots of game-type activities that can motivate students to get them engaged in the learning. So more and more I think teachers are discovering that and discovering the power that they can hold, and use those and build them into their learning programs."* (Teacher focus group, Eastern Fleurieu School)

Although the options available to teachers utilising ICT are increasing at a rapid pace, it is important to realise that ICT is not a panacea for Australia's educational problems. iPods, interactive whiteboards and other emerging technologies are simply tools which professional educators must understand and use in order to develop engaging learning activities that meet the unique needs of their student community.

Sustainable use of technologies

Funding issues:

It is not surprising that all of the teachers indicated that their use of technology was dependent on having access to reliable equipment.

> *"Certain programs on certain computers don't work so I get really, really frustrated with it because you've planned this and you can't do it. So because that's happened quite a few times I have a little bit of negativity towards the computers because I think 'will they work or won't they work?"* (Teacher, Saint Pius X Primary School)

Moreover all of the teachers pointed out that students are discerning in their choice of technology and vie for the latest computers, cameras and other devices because they are faster and have the most sophisticated features. The principal of Saint Pius X Primary School pointed out that while they had computers in each classroom the reality was that only a few of the computers were what the students wanted to use:

> *"We went out last year and borrowed another $20,000, for our size that's a huge amount of money, to put in the iMacs so each room has at least one new iMac and the teacher an iBook. So okay in each classroom now, people come through and say it looks fantastic, we've got seven computers in each classroom, there's 21 kids, that's one computer between three. We've got one computer per two children in the school. That looks great on paper. Of the seven computers in the classroom the kids only want to use two. The quick ones. So we'll always be chasing our tail with technology because of the funding and affordability."* (Principal, Saint Pius X Primary School)

Reece High School has addressed the issue of fund sustainability by utilising collections of laptops located strategically between clusters of classrooms. These are moved into class as a whole for activities or students might be asked to get one or two for particular work. As access to computing from homes is a concern for the staff, laptops are frequently loaned overnight to students.

Learning Community

At Saint Pius X Primary School the majority of the staff meet fortnightly to share, reflect and learn about their use of technologies to address specific learning goals. This professional learning community is called the e-Learning team and arose from the e-Learning initiative of the Catholic Education office. The success of this

professional learning community appears to have been built on several factors, including:

- ongoing and regular meetings,
- an emphasis on professional learning through self and peer reflection,
- a research oriented focus on improving specific learning outcomes,
- relevant and timely technical training,
- funding for teacher release and professional development, and
- strong positive leadership from both the teacher who coordinated the professional learning as well as the principal.

These factors also appear to have resulted in or enhanced a high level of staff commitment in using technology to improve student learning.

The issue of building capacity of teachers in integrating ICTs is seen as an ongoing and never ending process at Saint Pius X Primary School. While teachers are engaged in professional learning it is recognised that they cannot learn everything or change everything immediately. Consequently, each teacher tackles their own learning as a long term professional commitment supported by the e-Learning team.

The importance of establishing a sustainable learning community was also observed at the Cairns School of Distance Education. The following relationships were identified as being central to the ongoing success of the school's ICT program.

(1) Relationships between teachers

> *"So we'll always have, just like any organisation has, a wave of people at the front who want to have higher levels of knowledge and learning, and in this case it's around ICTs. More so in this school though we want that size of that group to continue to grow until it becomes the entire population and then the whole benchmark has sort of subtly gone up a notch and the bar has been raised just a notch."* (Principal, Cairns School of Distance Education)

> *"In our sub-school meetings, and we have a sub-school meeting every week, we go through all the normal business and the things that we need to be talking about, but we also know that it's one of those times when we can really get down to those ticky-tacks of ICT that we need to unpack for our junior school."* (Teacher, Cairns School of Distance Education)

> *"The things that we do are fuelled by those collaborative practices, by sitting down with each other and talking about it, and also by the different experiences each one of us brings. All of us are along a continuum of all different levels and abilities in our own ICT use."* (Teacher, Cairns School of Distance Education)

(2) Relationships between teaches and students

> *"In fact a lot of our students, and my students, show me things every day that are new, and so for me it's a joint learning process and it's an exciting one."* (Teacher, Cairns School of Distance Education)

> *"…what it does is create like a community feel, you know? A learning community. And the kids really respond very well."* (Teacher focus group, Cairns School of Distance Education)

(3) Relationships between teachers and home tutors

> *"So for us, it's an entirely new environment, where home tutor and student are both within our realm of being students as well as ourselves."* (Teacher, Cairns School of Distance Education)

> *"…so just like the students have their telephone lessons I have technology telephone lessons with the home tutors and I break that up into – because we have so many different home tutors, different levels we have a beginners one and a experienced on."* (Teacher, Cairns School of Distance Education)

(4) Relationships between the students

> *"A lot of the activities we have are like putting in your own comments about something you've researched and people can piggy back off you and change it and compare ideas."* (Student focus group, Cairns School of Distance Education)

(5) Relationships between the whole school community

> *"We've got a monthly newsletter that's on our school website and our school website is set up so that the whole world can view it but if you're a member of our school community you can log on and you can access other things within it but just through these Blackboard discussion forums or blogs the teachers can actually attach things for the students. We encourage our home tutors to actually go into the student's Blackboard courses to see what the students are doing and we usually put galleries in there as well, if students are doing artwork or a really good piece of writing or something great in science we'll put that up in the gallery which is like a gallery of examples of student's work and so the home tutors can see what their student has done, they can also see what other students have done and they can compare how they're going with each other as well which you don't always see in mainstream school"*. (Teacher, Cairns School of Distance Education)

Teachers at Eastern Fleurieu School also discussed why ICT could be considered to be sustainable at their school. There were suggestions that teachers' ideas were in synch with school policies and that there had been a tradition of integrating ICT into learning, and a focus on students' learning processes. One teacher explained this approach:

> *"I think it's because ICT has always been a part of our way of integrating. We are looking at things like learning to learn, how the brain works. It's all part of what we do, and we focus quite heavily I think on students' learning – not "We're going to improve our maths." It's just all about students learning. And this ICT and eLearning is all just part of it. It's just one big part of that. And that's reflected, I think, in our policies and when we look at directions. We're just reviewing things now and it's still a big part of it. It's not like, "We've done that. Let's move on to the next one." It's been part of it for a long time. Part of the culture."* (Teacher, Eastern Fleurieu School)

Staff change

The Principal pointed out that staff change has been the greatest challenge for continued integration of ICTs across the school. The eLearning team has been a valued asset in maintaining staff expertise despite staff turn-over while at the same time the eLearning team has also been identified as a reason for staff change due to their advanced skills being highly desirable by other schools. When asked what the greatest problems the principal faces he answered:

> *"Staff changes. If you lose expertise. But our staff basically get poached. People love teachers that worked here because they know they're just so far ahead of anyone else, technology wise. They're not poaching as such but they make it pretty attractive to them. All our teachers who have left here have gone onto leading teacher roles in other schools."* (Principal, Saint Pius X Primary School)

The principal of the Cairns School of Distance Education also identified staffing issues as having a major impact on the sustainability of their ICT program. He was adamant that the staff he employed had to have the potential to adapt to changing ICT practices.

> *"So in terms of shoring it up so that there is sustainability of change, then it's about choosing the right people and making sure that the teachers we recruit into our school have the energy, the desire and the commitment for using ICTs to improve children's learning. Now that doesn't necessarily mean that they have to be high end ICTs users. It means that they have the right attitude."* (Principal, Cairns School of Distance Education)

At the same time the principal was clear that change was only sustainable if the culture was not dependent on one person

> *"Sustainability and succession planning are around embedding a culture and not relying on the principal as the person who holds the culture."* (Principal, Cairns School of Distance Education)

Student Peer Mentoring

Students helped to sustain the use of ICTs in the classroom through not only bringing their own expertise to class as described above but also through peer mentorship.

> *"As soon as I showed them once how to use it that was it. I taught four or five students, I didn't teach any of the other students in the class. That's one thing that we've got to not forget that these students at home they're using this technology all the time. We're no longer the top person in the classroom in regards to some of this technology. We've got to take a step back and let the students use it because for them it's second nature and it's just natural for them to use it."* (Teacher, Saint Pius X Primary School)

> *"…we have experts in the classroom, so they always mix around and say oh, I know how to do it, and they'll show the other children how to do it and eventually that spreads throughout the whole class and I've found that's worked really well. So it's a matter of just working as a team and getting things done. I find I'm more a facilitator than a teacher in those sort of IT things 'cause the kids just know so much now, yeah."* (Teacher, Saint Pius X Primary School)

> *"…we do use mentoring because we've got some kids that are really, really good on the computer so they will show other people what to do, so their confidence is growing all the time."* (Teacher, Saint Pius X Primary School)

The teachers also recognised the value of sharing around the responsibility of being the peer mentor.

> *"With learning the software I found it very easy to teach some of the students, I call them my SEED students, and once four or five of them had learnt the other students in the class just quickly caught onto that and* ***I deliberately didn't choose the highest performing students in the classroom because I thought the other students would think oh that's too hard, only the high performers can do it.*** *I chose some of the middle and lower performing students in the classroom and once other students could see that they could use the technology effectively then everyone in the classroom was very comfortable with using it and it just became natural to them to jump on the computer to video or to grab the camera and go out and rehearse in the corridor and that has been a very easy process for the students to adopt.*" (Teacher, Saint Pius X Primary School)

> *"Well what I've done this term, when I came in there seemed to be two or three children that were almost like the computer children so whenever you had an issue you'd call these particular children. And it got to the stage where I'm thinking 'well hang on like this just doesn't work for me' so it was sort of like 'okay you three you go down the line and then you teach these three and okay your job's done for the term now'. So I've actually only had to call one of them once to go in and help someone else, so then because these other kids at that next level they need to learn and then they can go down the next ones. So that was sort of my aim this term was to flow through and not use those children that were really with the computers all the time and it's almost like their job in life is to help…"* (Teacher, Saint Pius X Primary School)

An advantage of having a middle school approach to integrating ICTs was that the students could share the skills they learned as they moved into the older year levels. A teacher of Years 2/3 said:

> *"One of the key things that we're focusing on in our levels is that the students are so skilled with using the technology and also not just mastering the technology, it's the whole process of using it as a tool to improve their learning that they will carry that up as they move up the school but it will be second nature to them that they wish to use this technology and even the teachers further up are not familiar with the technology or someone daunted by it they will have our support in us saying just let the students go, you'll learn from them and in that regard hopefully we can move them along so that they can start adopting some of the practices that we have in the classroom."* (Teacher, Saint Pius X Primary School)

This is confirmed by a teacher of 5/6 who looked forward to the current year 4 students moving into the combined year 5 and 6 classes. She felt that it would allow her to draw on the skills of the students but would also mean that the new year 5 students could *"mentor my grade sixes"* (Teacher, Saint Pius X Primary School).

Another teacher of Years 5/6 commented on the eLearning Coordinator and teacher of 3/4:

> *"she's tried a lot of the new stuff... I've worked in her room one day a week this year up until this term and she actually does see what else happens and how the technology's used and she brings it back but it takes time for it to filter through to all of us. But what they do in her room is fantastic and then that will flow through again next term... they'll come into grade five and six."* (Teacher, Saint Pius X Primary School)

Student Ownership

The researchers found that another way to sustain student's interest in ICT was to give them a sense of owning their own virtual space in the form of a student portfolio. The fact that this tool remains essentially under the control of the individual student over several years creates a powerful model for self awareness in the digital age.

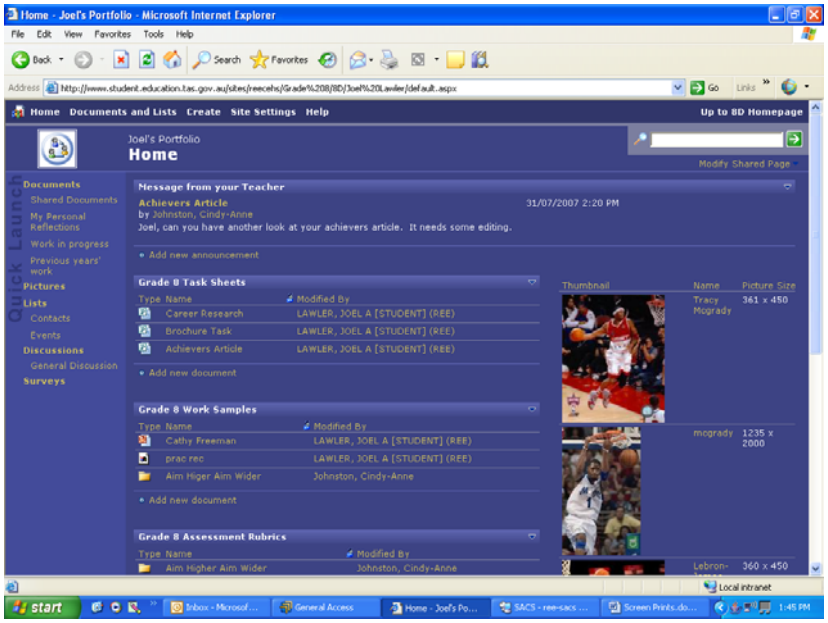


Figure 5 Student Portfolio screen, Reece High School

Teachers at Eastern Fleurieu also commented on the importance of student self-sufficiency and ownership in the use of technology and related it to the philosophy and policies of the school:

> *"The schools aren't supposed to be a place for empty minds and we fill them up – they're supposed to be places where we try to get the kids to learn how to fill themselves up. And the future is one of technology, so the more comfortable and skilful they are at using it, the better their chance is for learning for life."* (Teacher, Eastern Fleurieu School)

An example of sustainable use of technology was demonstrated with the use of robotics. In this case, a teacher, parent and students were enthusiastic about the success of the project, which had involved collaborative hands-on work in class and peer teaching:

> *"We've been involved in robotics at different times – not with me as a leader, but with a student …at the senior school who did it as part of a project. That*

> *was really successful. The kids became quite involved. And then some of the more experienced kids in my class were then able to conduct robotics lessons with some of the others. So it was sort of a train-the-trainer situation."* (Teacher, Eastern Fleurieu School)
>
> *"[One project was interesting] because it was a combination of building the robot and writing the programme and testing it to make sure the programme worked and when it didn't work they could go back and they could work through the programme and figure it out. It was group work as well and I think that sort of helped as well."* (Parent, Eastern Fleurieu School)
>
> *"Last year a couple of people did something called Robo Lab and we programmed Lego robots to follow paths around the room. That was good. …it was heaps cool."* (Student, Eastern Fleurieu School)

Parents also remembered several examples of their child having come home from school motivated to carry out further work at home, or having been interested in something outside school and having the opportunity to follow it up in the classroom. They strongly supported this process and believed that it should be encouraged. The responses from parents suggests that reinforcing the partnership between home and school can be an important factor in the sustainable use of ICT

> *"I think [name's] confidence definitely grew, the more she was doing and finding out. Like you said, [referring to a similar example from another parent] coming home and searching on the net and doing deeper research and then coming to school confident with what she'd learnt and what she knew. So I think it helped her in that sense"*. (Parent, Eastern Fleurieu School)
>
> *"I went to the movies with my daughter. We saw the movie "Hairspray" - we talked very briefly about civil rights in America. She'd listened to a CD or a song on the radio and she made the link between Martin Luther King and she hopped on the internet and off she went researching Martin Luther King and ended up doing a PowerPoint presentation about that which really surprised her teacher*." (Parent, Eastern Fleurieu School)
>
> *"…in the most recent class that my daughter was in, it was very much integrated because there was the smart board in the classroom and they were using computers really regularly during the week and my daughter was doing quite a bit at home as well that related to it, just spontaneously because she wanted to…"* (Parent, Eastern Fleurieu School)

Promoting a professional identity

Teachers at Cairns School of Distance Education identified the important role their professional identity played in the everyday practices with ICT in this school. After one teacher described his role in the school, he then went on to outline his role as a co-ordinator of an on-line course.

> *"When I introduced myself I mentioned that apart from working at Cairns SDE I also do online learning coordination for the Learning Place and I'm an accredited facilitate for Smart Classrooms ICT integration course. As an online learning coordinator I facilitate courses for teachers across the state. Notably ones such as building hot web quest and uncontained in the web and*

> *weaving into the classroom. Both of these courses help teachers in creating online units and activities. The teachers then use these in the classrooms with their students. In facilitating these courses I always give access to participants to the courses that I myself have developed so they can get ideas in how to develop their courses further." (Teacher, Cairns School of Distance Education)*

The role of this teacher's external engagement with improving pedagogical practices of teachers should be celebrated as a way of sustaining the exemplar ICT practices in this school and across the state. On a local level other teachers were using metacognitive strategies to identify their own strengths they bring to teaching and how this impacts on ICT pedagogy.

> *"So I suppose that on a different level, rather than ICT just being a separate component, we've begun to look at our own personalities and learning styles and our own strengths in our profiles, and as a junior school we've looked at those people who are process-orientated and love the tools, and those people who are ideas-orientated and love the drive, the passion, the big picture, and have worked to develop a structure, so that all of those things are incorporated, because without the other, ICT falls in a heap."* (Teacher, Cairns School of Distance Education)

It is clear then that the long term sustainability of an effective ICT program is dependent on a number of factors which extend beyond a simple lack of funds or resources. This study has shown that sustainability is based on developing a cohesive learning community and giving individuals a sense of their roles and responsibilities within that community.

Embedded use of technologies

While previous sections of this report have identified many applications of ICT within the classroom, this section will examine the concept of embedded technologies.

Embedded technologies are those which have become part of the learning infrastructure of a school and help deliver improved educational outcomes across the curriculum.

Virtual Learning Environments

A significant strategy at Saint Pius X Primary School in embedding ICTs in learning is through the use of the virtual learning environment called 'MyClasses'. The principal pointed out that each class and each integrated unit has their own MyClasses page. These pages support student independent learning through links, resources including video and learning place objects, as well as discussion forums.

> *"We use MyClasses very heavily... we can make our own pages up.... I make up a page at the start of the term, and... we can actually put video on there, so we watch it through there. They have links to sites they want and they need. They can put PowerPoints on there, so everything's stored on the one page. So when we're doing our inquiry work they go straight there and do it, and we have one for each unit of work. We also have a page – a class page, and what happens there is, all the maths links and the literacy links are there, and we have photos of our class and all that sort of stuff up there. So the kids go straight on there, and they email as well. So they're doing emails recently,*

but in Myclasses case we have forums, so the kids can write up reflections, and we can write to them as well." (Teacher and eLearning Coordinator, Saint Pius X Primary School)

At Eastern Fleurieu School, the principal has particularly encouraged teachers to explore the capabilities of tools that will enable students to participate in online environments, including those that will allow access either outside school hours or at home. One site, provided by the government of South Australia, is the Edu-Connect system (DECS 2008b) which enables schools to set up online learning teams. It includes a digital drop-box capability that enables teachers to access students' work from home or for students to submit work outside school

"[Edu-Connect is] our whole of government for South Australia; it's more than a learner management or a content management system, although that's basically what it is. It allows every school to have a presence, and within that each school can have learning teams, that's where sometimes where the email all comes through and everything as well. But what I was able to do was to set up teams for each of my classes, and there's a range of technologies that are in that…one in particular that I thought was really, really good was the digital drop-box function, where students can complete tasks digitally, and instead of printing them out or handing them up ..all they need to do is use that digital drop-box, and then I can then access their work from that. Which was fantastic, because I'm dealing with quite large files in the multimedia area, and it was a way of me not having to worry about, how can I take their work home, or how can I access their work for marking after hours." (Teacher, Eastern Fleurieu School)

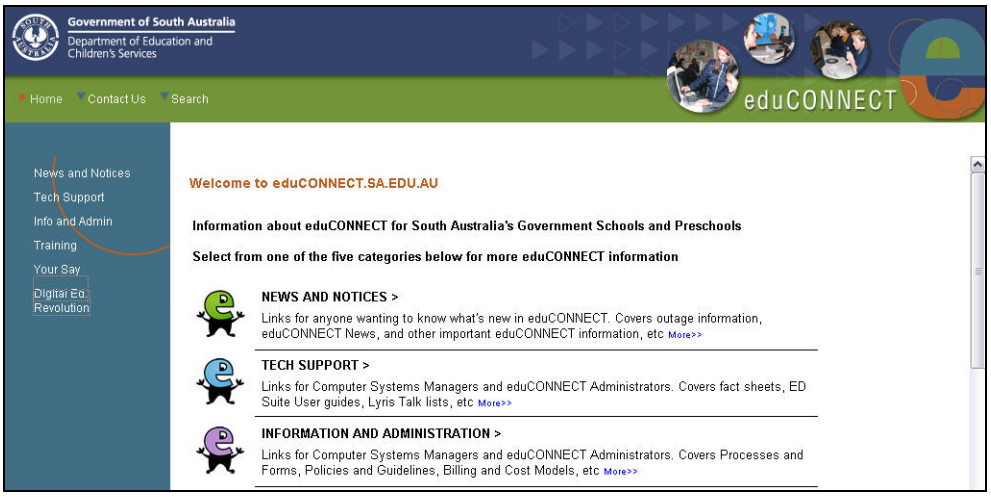


Figure 6 Edu-Connect (2008)

An additional example of a virtual learning environment is the use of Centra technology (Decs 2008c) to enable online learning between students who wanted to participate in classes from home, and between the host school and another schools. Again, the principal explains one example of this use:

"About 3 years ago… we were looking at ways that students could access education in a more remote way without having to come to school…What we've gone to now is use of Centra technology…. we have a chemistry

teacher who is really enthused about the use of the technology and willing to overcome any hurdles. So he started with a group of Year 11s and 12s who were using Centra. So they were in various parts around the school or at home. The teacher…was at his home and he would deliver chemistry using the Centra technology in that way. And he's found it to be really, really successful. … he's actually said that he has monitored the results and he feels the results of the students over the years has actually gone up using that technology, probably because it so suits the learning styles of students. …he's also linking up with another school which is on the other side of the range. So …we're now able to assist schools that can't run their own chemistry courses using the Centra technology that we enlist here. And that is working fantastically…it's something that you couldn't have done without a) without someone who wants to do it and b) without the Centra technology." (Principal, Eastern Fleurieu School)

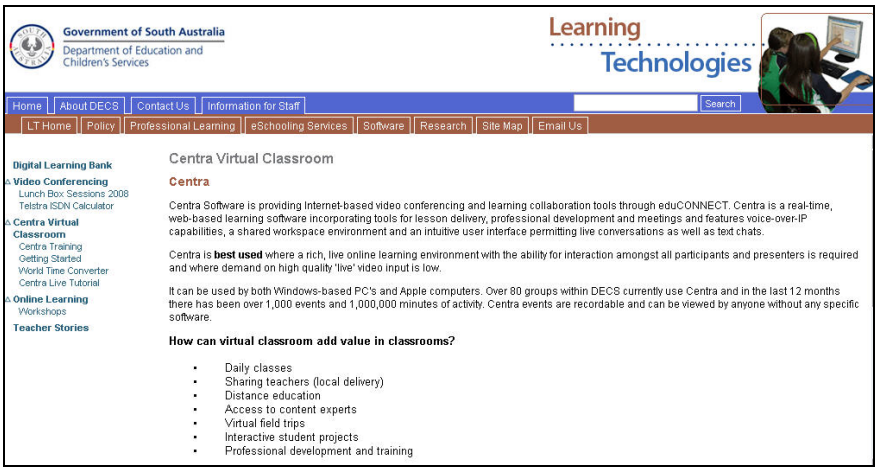


Figure 7 Centra (DECS 2008c)

In addition to making use of government established virtual learning environments, some schools have developed their own 'in-house' Intranets which act as an archive and central repository of problems, scaffolds, resources, and assessment rubrics.

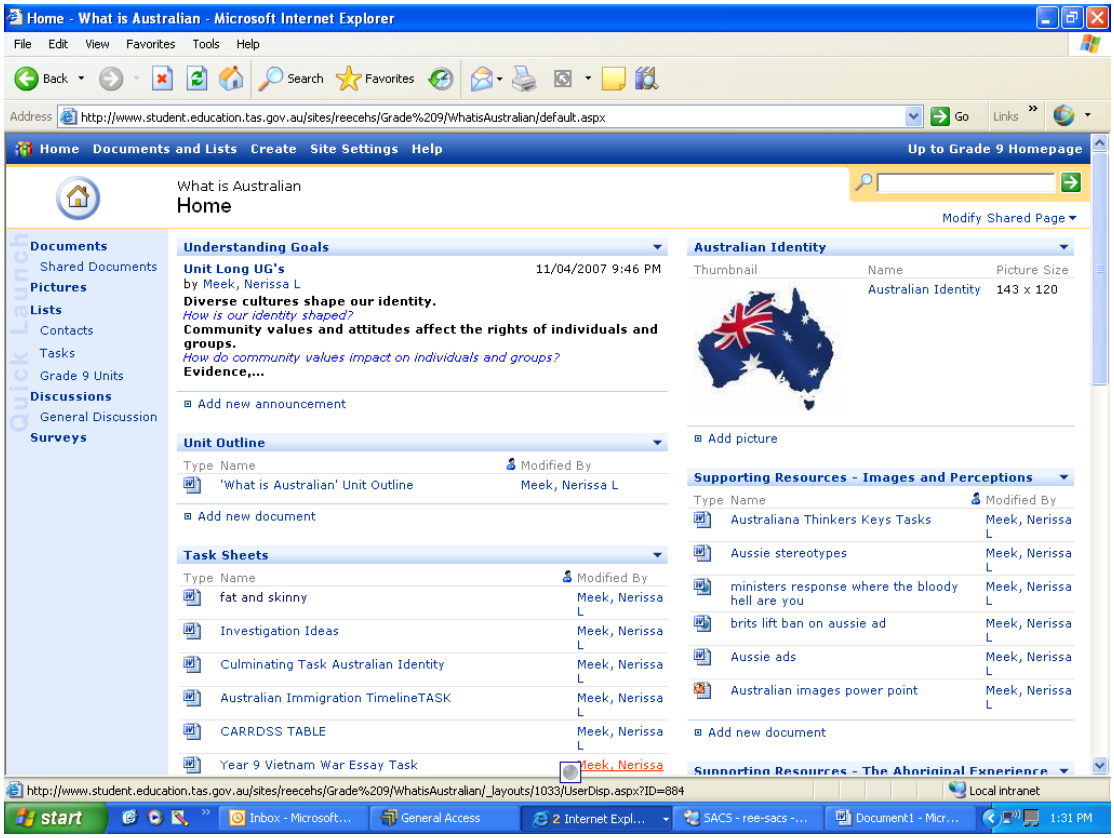


Figure 8 Reece High School Intranet

In the above example, the unit of work is completely visible, its aims, procedures, learner scaffolding, assessment requirements and the students drafts and completed work. Online discussion is also available for students to communicate with others in their group and with the teachers.

> *"…having archives is the best idea of it that it's working – if the student comes up and they are learning a new thing, they're not really aware of their progression, but when you can actually physically show from Grade 7 to Grade 10, that's when I know that it's worked, and it sort of gives you some reassurance that yes… I mean a couple of people in the last two years have gone from the ultimate beginner to the; so that's when I know that technology…"* (Teacher, Reece High School)

Like Government hosted VLEs, school intranets also allow students to make a conection between their home and school environments.

> *"Yeah, Mitchell was in Grade 10 last year and he brought home a disk from the school and loaded them onto our computer and was doing maths from home, and then would follow it up with the teacher the next day. And it was a SharePoint, so he'd being doing work at home and putting it onto SharePoint, saving it to SharePoint, so that the teacher could look at it at home, to mark his work."* (Parent Reece High School)

> *"Particularly with homework, there's more of a… in our case, my daughter's friends come around or kids in her class that are doing the same project, and*

> *they do that at home as well. So the home is an extension of the school."* (Parent, Reece High School)

Spontaneous use of internet to support classroom learning

In addition to the virtual learning environments and school Intranets, the teachers of Years 5 and 6 pointed out that having access to the Internet is now seen as an important aspect of supporting general classroom lessons.

> *"You know... we read the newspaper every day [as part of] multi literacy, we look at the newspaper, The Sun and The Age... And we might want to ask a question so straight away the beautiful computer's right near where I'm talking to the children so we just get on it and find out information. Now I just think that's wonderful, one day it was someone said how many Popes, so straight away here we are, they're the Popes. And it was something about the King and the Queen too, straight away we're onto the Kings and Queens."* (Teacher, Saint Pius X Primary School)

> *"Or like you have the… oh in my other class, in grade three and four we were doing newspaper headlines and stuff and we only had The Sun because that's more appropriate for that level and headlines, but we spin onto the computer, get up The Age, get up The Australian 'what headlines do we like here? Any of them related?' and you're doing that… and you can't sit the class there for that long with just the one computer screen…"* (Teacher, Saint Pius X Primary School)

> *"Why I think we use computers now, because the information is at our hand. I read the newspapers to the children, we have a look at the newspapers every day, The Sun and The Age, so we know to differentiate, and we often go straight onto the computer to find out the latest information about what's happening in the world today. We go onto The Age website or The Herald Sun website as well, and just find out the latest information, if something really interests the children."* (Teacher, Saint Pius X Primary School)

In each of these examples, the Internet can be seen to be an embedded technology that has become a ubiquitous component of the school's learning infrastructure.

Interactive Whiteboards

An interesting example of the ways in which ICT has become embedded in a school's approach to learning is the electronic whiteboard, or Smart Board. At Eastern Fleurieu School in addition to placing electronic whiteboards in classrooms, a smart board was also placed in the school staffroom where its use could be modelled and staff could experiment with it.

> *"…having it [the electronic whiteboard] in the staffroom and using it for the daily routines, daily notices and calendar functions allow people to play with it in their own environment so that they feel a bit more comfortable, then going back into the classroom and working with the kids because of course the kids pick it up so much faster. So that's something that's worked really well."* (Principal, Eastern Fleurieu School)

> *"…the key has been in looking at the teaching methodology linked to the whiteboard. So it's just not putting the whiteboards into classrooms and having a giant computer in the classroom, but it's about working with teachers to change the methodology. And getting teachers to use the whiteboard to bring the global situation into the classroom or to bring the world into the classroom so that the students are working with real life resources, talking to real people, working with other schools in other places so that they're actually accessing real resources live in the classroom."* (Principal, Eastern Fleurieu School)

Figure 9 Smart Board in use

Several teachers at Eastern Fleurieu School agreed that that it was important to use embedded technologies with students.

> *"I've got a 1/2 class …I have an electronic whiteboard in my classroom…I see my role is really to integrate it into all areas of the curriculum. …I also see my role as exposing them [students], at my age level, to different programs and different technologies, …whether that be maths or literacy or PowerPoints or Click 5 or things like that. So just expanding their horizons with the technologies as well."* (Teacher, Eastern Fleurieu School)

> *"I was talking to some parents the other day … I said to the parents, ".. they can't cope in the modern world without exposure to as wide a range of learning technologies as possible." I suppose with what we've all been saying is we try and build that into our teaching practices and then the learning for the kids."* (Teacher, Eastern Fleurieu School)

Parents at Eastern Fleurieu School suggested that as computers and electronic whiteboards became widespread in classrooms their use was becoming common place for students.

> *"I think because they have a computer, or computers, in every classroom there's an opportunity for the children to use that technology at other times other than just computer lessons. The smart boards are used. I know my child talks a lot about those and the use of those in various lessons."* (Parent, Eastern Fleurieu School)

> *"I don't think they are [innovative] so much to the children now - I think they're quite a common place thing now. Even the junior primary children know how the smart boards work and get an opportunity to use them."* (Parent, Eastern Fleurieu School)

> *"… in the most recent class that my daughter was in, it was very much integrated because there was the smart board in the classroom and they were using computers really regularly during the week and my daughter was doing quite a bit at home as well that related to it, just spontaneously because she wanted to…"* (Parent, Eastern Fleurieu School)

ICTs support the curriculum – they are not the curriculum

Technology is only a tool and as a result should be used to support the curriculum rather than be the focus of the curriculum.

> *"It should just be that's a part of my curriculum, that's a part of my activities in my classroom and in the planning it's usually a reading activity and maybe a writing activity as well. It always jumps into ICT and it always jumps into Maths but it's just an activity, it's not using the computer, it is learning using a different form."* (Teacher, Saint Pius X Primary School)

The principal pointed out that the school has a successful history of trialling new technologies but that the focus in recent years has been to concentrate on learning outcomes and purposely use technology to support those outcomes:

> *"We've actually stepped away a little bit from the technology side to the more using the holistic teaching approach, incorporating technology". An example of this is to use video recording to support student reflection specifically to enhance multiliteracy learning: "we use lots of camera work to reflect on what they've actually learnt. The staff do the same"* (Principal, Saint Pius X Primary School*).*

The principal argues that computers should be in the classrooms and not in labs. In addition he argues that computers should be placed in the centre of the room and given prominence as a learning tool.

> *"Other schools are terrific at teaching computers as a subject... **we incorporate it as the holistic approach, it's just another tool, part of the***

> ***curriculum.*** *So we actually disbanded our, we used to have a computer lab, we disbanded that and put them in the classrooms. And* ***we placed them in the classrooms in the middle, not around the walls so they were part of the teaching centre.*** *Not something you go off to when you've finished your work and do a game on the computer."* (Principal, Saint Pius X Primary School)
>
> *"One of the teachers commented that having the computers on desks in the middle of the classroom meant that "they can just sort of go up and it's right there. It's part of their learning. It's not separate around the room. They don't have to go far for it"* (Teacher, Saint Pius X Primary School).

This approach to technology as a ubiquitous tool and not an end in itself has provided students with the confidence to choose appropriate technologies to achieve their goals. One example can be seen in the way in which the following Year 5 and 6 students discuss how they would begin researching a topic. It is interesting to note that the students in this discussion appear to have a research strategy in which the internet is considered to be only one resource with its own peculiar problems.

> Student 1 - *You ask the teacher first, then you go to the computer, then you go to the library. Because they know everything and if they know something then you can probably get an idea for it to go on the website. They're teachers, they know everything.*
>
> Student 2 - *I would go to the library because I would search up a book and books have lots of information. Sometimes the computers don't have a lot of information.*
>
> Student 3 - *I was going to say there is a problem with the internet and books because sometimes you don't understand what they're saying.*

A teacher reports that an appropriate focus on outcomes in a technology rich classroom can result in students as young as Years 2 and 3 being selective about how they use the technology to achieve their goals.

> *"I'll look around at some stage, and there'll be students leaning in front of a computer recording away, and I won't know exactly what they're doing, but they'll be able to tell me 'oh I'm just doing this.' So it's just natural for them.* ***It's not like it's a novelty. It's just every day.*** *It's just how things are. They want access to the computer and they know they can get it, and if someone's on it they'll wait, and that person, once they're done they'll just swap. It's not I need – it's not what it used to be, where they all wanted to be on at once.* ***They make choices and when it's free, they'll go up and if they want information they'll search for it, especially when we do research.*** *We do a lot of research in my grade, and they present. Oh, and so they research on the computer. They research in books and organise it that way. So it's just a natural thing for them.*" (Teacher, Saint Pius X Primary School)

These comments from students and teachers provide further evidence to support the notion that technologies such as virtual learning environments, intranets and interactive white boards are steadily becoming a part of the embedded infrastructure of a school's learning environment.

Examples of improved literacy as a result of the use of learning technologies

At Saint Pius X Primary School, using digital video recordings has provided students with another way to express themselves, to demonstrate comprehension and to engage with deeper learning.

> *"How **this has affected their traditional reading and writing in the classroom** is that it provides another medium for them to report without for some of them the very laborious task of having to sit down and write three or four paragraphs. It allows them to talk about what they can see in the imagery, what inferences they have gained from the text and to record it in a way for them that is easy and it also allows them to be more creative in what they're talking about and they converse with each other. It's not always just one student in front of the camera, it can be two or three and sometimes you actually capture a complex conversation where they're offering feedback to each other."* (Teacher, Saint Pius X Primary School)

In one example year 2/3 students took a series of still photos to produce an animated movie. This process is sometimes called claymation.

> *"We also use the technology for a way of **presenting their stories** as well. The students draw a background and make small little characters for their presentations of a story and what they'll do they'll use the digital cameras and they'll take a whole sequence of photos of their whole story and once they've done that they download them to the computer and then import them into a movie creation program. Once they've got them in there they record their narration of the story and **they've just developed their skills so much this year they can now adjust each image to match the narration for it and it is a form where they're presenting their story in a short animation.** Once they've finished that they know how to create them into a DVD and they take them home. It's almost an automatic process for them now where they will go "[Sir] my story is finished" and we will sit down in front of the computer and watch their short animation. That for me, **the goal of that was not that they were going to make a lovely little film but the goal of that was to assist them in being able to sequence their stories correctly, that was my goal and the technology was just a form of completing that.** Some of the students couldn't sequence a narrative correctly. They would have events out of order, they would have characters come in and out at the wrong time. I needed to address that and I think the most appropriate way would be for them to animate their story. **I've seen real improvement in students that had that difficulty and one student in particular I was overwhelmed with just how much they had improved and it also allowed them once they had the story in order they started including adjectives and adverbs into their story which was something that I hadn't even thought would be a goal for this year. The work that they completed I was really proud of and it came down to them using the technology to put their events in order and it was just the perfect form for them to understand how the story flowed."*** (Teacher, Saint Pius X Primary School)

In this example the teacher points out that creating videos, claymation and other presentations which were watched by the class and in some cases by parents motivated the year 2/3 students to consider issues of audience and purpose.

> *"Yes there's a lot of thinking skills involved in it. I think one of them also as well there's been an improvement in their vocabulary. The students even in grade two and three they will use the thesaurus to improve their vocabulary and some of them will try and clarify terms that they've read. If they're doing a report some of them were doing reports on fruit bats that they'd picked up from the internet and if there were words in there they didn't understand or they didn't think other students would understand they were going about the process of going "[sir] we need a better word than this, they won't understand it" and they would use the thesaurus or they'd use an on line dictionary so they were rephrasing it to suit their audience so there was that aspect to it as well that they weren't just parroting what they were presenting, they were consciously thinking about their audience and also the content of what they were going to present.*" (Teacher, Saint Pius X Primary School)

This quote describes some of the literacy related activities in which year 3/4 students used technology.

> *"Okay. One thing I've got in my classroom that I've found has been really effective and has impacted on the students has been when we did our go for your life unit which was about healthy food and the influences on choosing food. What we wanted out of that unit was the children to look at ads and see how that – how they've done little tricks in the ads and techniques to influence them. So we looked at a variety of ads such as radios, print, TV and what they had to do was they had to pick them apart, so when we did our visual literacy in literacy, we looked at photos, so what are the specific things in photos? Are they close up, are they distance? How has the photographer put the people in there? What does it mean when it all fits together and the use of colour and things. Then we went on to film and ads and we looked at what have they done in that ad? So how does the music make you remember the product? How does the character work and what slogan do they have and they had to do all that sort of stuff. Then from there, they had to research a food and they had to storyboard an ad, so before we leave and got to the computer, there's a lot of working behind the scenes because they need plans before they go on. After they did their storyboards, they went onto the different programs which was GarageBand, iMovie, Microsoft Word or Microsoft Power Point and they created their ads from their storyboards using things such as digital cameras, video cameras and inserting them into those programs."* (Teacher, Saint Pius X Primary School)

The same teacher of year 3/4 students stated that she has seen an improvement across the middle school.

> *"Yeah. I find that e-learning has improved student outcomes across the school.* ***I'm in the middle school team so I find that I see a lot of outcomes improved there.*** *For example... we chose multi-literacies as our e-learning goal was because we wanted it to improve comprehension, especially in three to six...there's different texts that the students have to read, different formats, some of the – they're just not printed on a page and it might be timetables,*

> *there might be weather charts, there's all different things and they have to learn how to read them... So what we did in our e-learning is we looked at different types of text: what do we need to teach them? It's linked into our literacy team as well, so we go back to our classrooms and we use that type of work.* ***I found with the three/fours that they have improved with their comprehension, when we do the [written] test at the end of the year, and that shows me that even though we have been doing multi-literacy such as print, such as videos, posters, all those things that it has impacted on that.*** *They can go to a text and they can draw things out of it. So they know until they – the label's on a picture, they know that the information links in the text, so we've done all that sort of stuff through literacy mainly."* (Teacher, Saint Pius X Primary School)

Teachers at Eastern Fleurieu School have also used computer applications to support student learning and engagement in a range of literacy modes. In the extract below, a teacher explains the advantages of using the Microsoft program *Photo Story* (2008) to create multimedia stories related to poetry:

> *"I think things like their digital story, Photo Story assignment that my students did last year, would provide the evidence of how creative the students were. The students were asked to use a poem that they were given, find their pictures from the internet to actually put together the images that the poem created for them, so that shows the creativity that they've developed. They also had to record the poem over the top of it, so that helps to show that they're enthusiastic about their task and how they went about it."* (Teacher, Eastern Fleurieu School).

Figure 10 Photo Story (2008)

The multi-literacy approach was also in evidence at Brookvale Public School.

> *"Last year we dressed up in olden day clothes, for want of a better word, and wrote diaries home from the goldfields and the input was first we got dressed up and took our photographs and imagined that we were writing home, and I think that was quite successful." (Teacher, Brookvale Public School)*

For this activity a range of ICTs were employed. Internet research over a limited range of websites exposed the students to genealogical data and diaries which were used to model in-class writing activities.

> *"We went into some sites and looked at diary entries that had been written and letters home that had been written from that era, the actual letters, and then we used those as models for them to role play their own letter home."* (Teacher, Brookvale Public School)

Measuring Improvement

The following discussion with the principal of Saint Pius X Primary School describes the measurable improvement in literacy from the use of technologies.

> *"...we wanted to improve as a school our comprehension levels in year 3 to 6. From our data we see them do exceptionally well in prep to 2 and their comprehension plateaus in 3 to 6 to a certain extent so we want to improve that. The way we wanted to improve that this year was through multi literacies because our student population, half of them are ESL, so they come with very limited English background. We are socio economically a very depressed area so the children don't have many experiences outside the suburb and they don't have a range of vocab to express different things... [when you read] the state-wide data they'll talk about the AIM testing, they might have a piece of comprehension on a day at the beach. Well the majority of our kids haven't been to the beach so it's not relevant to them. The AIM test is basically designed for middle class white Anglo-Saxon kids. That's the middle of your curve. Our kids, 50% ESL, 64% on welfare, socioeconomically this is one of the poorest suburbs in Melbourne so they don't have the breadth of experience... Multiliteracy is a way we can actually incorporate that. So we use the multi literacy's to broaden the experiences. And we've found, we've got a year 3/4 project with Melbourne uni at the moment... and it's on comprehension so we are getting results on improving comprehension with explicit teaching and you can use the technology with that as well because the kids can reflect on what they've done so we use the technology that way so the kids can record themselves, record their responses. So that's how we use technology a lot."* (Principal, Saint Pius X Primary School)

Q How do you know that there's an improvement?

> ***"Testing results. We use a comprehension probe and torch testing*** *and they have shown improvement. Probe and torch, they're two comprehension testing methods... And the Melbourne Uni project [we are involved in] map our results, they've shown improvement. Still a long way to go but there's a general improvement."* (Principal, Saint Pius X Primary School)

A teacher of year 3/4 also felt that using technology to focus on multi-literacy also resulted in an improvement in the end of year written test.

> *"Because we're doing multi literacy, we've been looking at different text types, and I do a lot of visual literacy with my kids, and we've done, looking at pictures, photos, all that. Taking photos and different shots and how that influences what you think, and we watch videos and the body, the postures and all that sort of thing with the people. The music; how is that influencing – but what was interesting was,* ***even though we're doing different text and the test that we do at the end of the year is a written test, they've improved. So in some way, what we've been doing in all those different modes has impacted on their end of year results.*** *So even though it's all different text*

types; there's visual and the different modes, it does impact. Which I initially thought 'oh we're not going to see any difference' but we have, which is really good, because I think they're perhaps summarising - they're paraphrasing from using the different modes, so you are seeing that in the end of the year results. Do you find that?" (Teacher, Saint Pius X Primary School)

The provision of literacy support at Eastern Fleurieu School is one area where there has been attention to measurable improvements in learning associated with the use of ICT. This approach has included the use of the computer program *Phonics Alive* (Figure 11). An example of the records maintained is shown in figure 10. The following extracts from interviews include observations from a teacher and a School Support Officer (SSO).

"In our area in special needs, we actually have a graph of when they first start a program, and then say six months down the track we may test them again with their literacy and maths skills, and that's how we measure the progress that our students have in our area.… it's allowing those students that would normally not be able to participate in mainstream, to be able to do that." (Teacher, Eastern Fleurieu School)

"…the children who are doing the spelling program are improving their reading age by as much as up to three years and six months…. it was extraordinary in that I might have had a child who was twelve months behind in their reading, all of a sudden I realised that that child was now two to three years up in their reading within four to five months of being on this particular program….we would literally measure improvements and so it has been very easy to see, … by the end of the year we actually do a graph .. [for example if their] chronological age would have been 10.3 and they happen to be reading at 9.3, which is obviously 12 months down, by the end of the year hopefully they're reading is showing at 11.8 or something fabulous…we keep records and graphs of that for all of the students over the last X years and it's just fabulous to watch the extra improvement." (Student Support Officer, Eastern Fleurieu School)

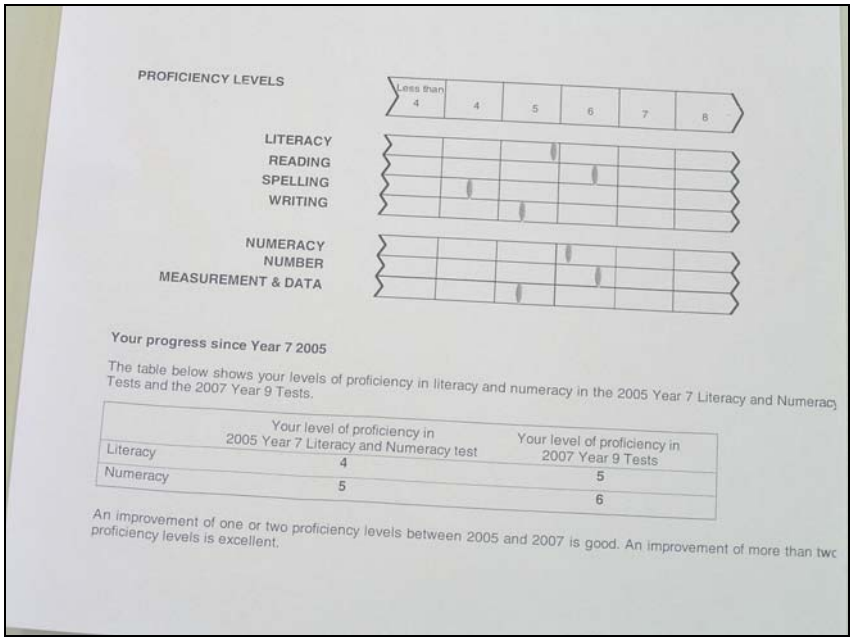


Figure 11 Record keeping for literacy and numeracy

Figure 12 Phonics Alive (Commercial program)

The School Support Officer involved in the use of ICT with students in literacy classes noted that the program had been particularly successful and that she had been able to demonstrate improvements in students' literacy through careful record-keeping. It was likely that not only would this program be maintained, but consideration was being given to more widespread use in the school:

> *"…some of the class teachers are now saying to me 'I reckon we should be running this in our classes because why shouldn't mainstream children have access to the same spelling program that we're giving children who are behind?'… the school is now so supportive it's absolutely fabulous, they're using the same CD programs in [the] special ED room and some of the other teachers are asking me if we can try and get some copies and they can run it in their room as well, and the heads of campus are absolutely rapt in it and they are just so surprised I think at how much of an improvement we've made with some of the children."* (Student Support Officer, Eastern Fleurieu School)

The School Support Officer was later asked to expand on her initial discussion of the place of the *Phonics Alive* program

> *"I wanted to find something really, really innovative and I actually have, so for myself I'm really, really, really happy and obviously the school is as well because this particular program has got levels that go from A for apple, B for ball, C for cat sort of thing right up to extensions of every single spelling rule that there is, it records results and all the way through the program the kids love it because it's fun and that's probably the best part of the whole thing, is that as you can see by that book,[points to book] …it's got witches and people chasing each other on motorbikes and all sorts of fun things and the kids thinks it's absolutely fabulous,… I actually think [we need to]…..come up with something that's almost slightly outside the square to be able to encourage the children who are being a bit bored by some mainstream information perhaps, to try and find something else that might interest them and excite them…"* (Student Support Officer, Eastern Fleurieu School).

Problems associated with measuring improvement

At the Cairns School of Distance Education when asked about improvements in literacy or numeracy, the principal was upfront about the lack of current evidence.

> *"I can't tell you the evidence is that our numeracy or literacy performance across this school has improved yet. But I can guarantee you if you came back in three years, that would be the case. It just will be."* (Principal, Cairns School of Distance Education)

Although he was open about the current lack of evidence, it was clear that there were a number of underlying reasons for his views.

(1) The lead time for improvement in literacy and numeracy after ICT roll out. The principal acknowledged the lead time required for the impact of ICT to improve literacy and numeracy performance. The principal also acknowledged he had been provided with a space to develop best pedagogical practices with ICT independent of the students' literacy and numeracy results.

(2) The skills and practices the students develop with multimodal literacies through ICT use might not translate to immediate improved literacy results. Another important aspect of the ICT use in the school is that the students are developing skills and practices that might not necessarily be used to measure improved literacy and numeracy. While the students are developing multimodal literacies in this school through their everyday use of ICT, the tests that measure improved literacy and numeracy generally are paper based. The students may be developing improvements in literacy and numeracy that are not measured by the paper based tests.

(3) There was a strong focus on improving relationships through the use of ICT rather than immediate improved literacy outcomes.

There is a strong argument for taking up the challenge set by the principal and following up this school in three years time. If the timeframes for improved literacy and numeracy outcomes are longer than it takes a school to develop exemplar ICT practices, there needs to be some alternative evidence based practices used by managers to gauge ICT practices in the school.

The researchers encountered a similar response from the principal of Brookvale Public School who also spoke of the difficulties in measuring gains in literacy through formal and informal means.

> *"It's very difficult to say that technology has led to an increase in improving our results in basic skills tests, particularly for boys, but I'm pretty sure it has …So we do keep a lot of information about the kids and their progress, because you can't really make decisions on what programs are working unless you've got information. Originally we use it to target the kids that needed additional help, but we find that it also gives us interesting information about the kids progress as well."* (Principal, Brookvale Public School)

In addition to the tracking of student progress and documentation of their literacy achievements, the principal was able to provide evidence that was particularly helpful in the light of specific issues in the school.

> *"A lot of them come from non-English speaking backgrounds, many of them haven't been to pre-school, a lot of them come from working class families where both parents are working, a lot of single parent families, and they haven't got any idea. It takes our kids years sometimes to work out what school is about. By the time they get to year 3, our basic skills tests results are about the state average, and by the time they get to year 5, our basic skills tests are well above grade average. We have the strongest growth rate between year 3 and year 5 of any school in the northern city region."* (Principal, Brookvale Public School)

Using technology to help structure student ideas.

The year 2/3 teacher agreed that he could also see an improvement in literacy through the purposeful integration of technology. In particular the use of technology to support student expression and reflection. In this example the teacher also describes a student who has difficulty in writing sentences and uses audio recordings to help her put the words in the correct order.

> *"Yeah I found that with my students as well, but we were focusing on like, we're at a lower level and we were looking at just their – you know how the detail was coming in with the imagery, and you know they were recording their own as well. Like the photo and they'd do a reflection on it, but with mine as well, with the literacy, we use it for the younger students. They would - or one was going to today just* ***read out what they want to type, because they have trouble when they write it down****. The words are written the wrong way, or all over the place. She's just going to talk the story with one of the teacher aides, and then they will just play a small segment. You know maybe 10 words, and then she will copy them down, and she'll be able to repeat it and repeat it. So for her it's a way to get her thoughts down on paper in a practical means, rather than you know, standing there beside her and trying to get her to write them. She gets frustrated and with the higher students, they too – they will tell their stories as well. They'll sit out in the corridor and video.* ***They'll interview each other about – we're doing non-fiction as one of our reading classes. We're going to be doing research and they'll sit out in the corridor and they'll interview each other, and that's entertaining because they're much more relaxed. There's no classroom and you know, there's one girl in here, who very rarely speaks, but when she comes back in you see a whole different side of her."*** (Teacher, Saint Pius X Primary School)

The students are more aware of their audience because the work they are producing is more often for the consumption of peers rather than just the teacher.

> *"I find their language has improved as well – their oral language, because they're thinking of their audience. If they're doing on the computer a video or something or recording their voices, they have to speak clearly. They have to – and project their voice so everyone can hear them, so I find that's impacted on when they're speaking in front of the class also, and the language that they use when they're explaining things, they know to speak in sentences and not just use do one word, because they've seen themselves, and when we do our visual literacy or mixed modes, they're using the language of oh, demand, offers and that's coming in. Oh look they're using a close up shot or that's a different shot. That comes through across the board now. It's not just*

in one thing and then they apply that into their ICT photos and all that sort of stuff, so it's going across the board." (Teacher, Saint Pius X Primary School)

"…we do a lot of research where they have to do a data chart and write questions and then research, and they wouldn't write a lot, or they'd just go to one website and that's it, and as the year's gone on I'm seeing that they're writing – that they can collect a lot more information from the computer. They choose how to organise it. So they just have to do – if they don't do a data chart they can do a concept map or something else, and I'm getting - the content is more specific to their topic. Whereas before they'd just write broad things, they're actually finding the answers to the questions, organising it the way they want and then finding more information and then they go away and rewrite it. So they're not writing sentences. Most of them write little short phrases or key words and paraphrase it. So that's the change I've seen in them. I'm also seeing that with searching, they'll just go on and do their own turns, and they're finding out what they want. They couldn't – at the start of the year, they're writing in these massive strips and just with what they're doing on the computers now, they just go up by themselves. Whereas before it was like 'can I do this?' 'Can I do that?' Now they just know to go on. I think it's more natural for them. Yeah." (Teacher, Saint Pius X Primary School)

Student examples

The following extracts are from year 5/6 students in response to questions about how technology helps them to read, write, present, search and understand.

Word processing improving through easy drafting and spell checking function.

"Well, you get it done quicker and if you make a mistake you don't have to like scribble it if it's on your good copy, you just delete it. And if you've spelt something wrong you'll know because a little line comes up underneath it. Then we go to spell check and we look at the words and if they're not the words we're looking for we go to a dictionary and re-write it." (Student, Year 5/6 Saint Pius X Primary School)

"Well, because sometimes if you just write it out the teachers might not find a spelling mistake. But if you type it out on the computer it'll find your mistake and you can think about it but if you can't remember the word or spell it right, you can just go to spell check and that'll spell it right. And with the punctuation, if it's wrong you also go to spell check and fix it. And teachers might not pick that up. Yeah." (Student, Year 5/6, Saint Pius X Primary School)

"And it's wrong, like that underlines it. And then you can check it. And most of the time when I check my spelling and then it has a red line under it I go to spell check and it has all these words and I look for the correct one." (Student, Year 5/6, Saint Pius X Primary School)

Specialist software called "Zip Tales"

"You read a story and then you have to answer questions at the end about the story. They have all sorts of stories, like all fantasy, scary, true stories and all that. And you have to read them. And then – you read it and then you've got to remember certain parts of it and in other – and in the next bit of it you have to answer the questions and it will give you a score at the end if you got

50 per cent of the set or like 30 and it'll give you how many you got right or wrong." (Student, Year 5/6, Saint Pius X Primary School)

Using mind mapping software to develop stories. The maps may or may not be converted into traditional narrative text. (Software used: Inspiration and a website called http://bubbl.us/). The following extract is from a Focus Group interview with Year 5/6 students.

S	*We've got a site that we go on called bubbl.us and we go on there for English and we type up like in bubbles and all that.*
S	*It's like mind maps.*
Q	*Okay. So how does that help you with English?*
S	*For typing stories.*
S	*Because you're writing out information in the bubble that you've learnt.*
Q	*What do you do after you've done it in the bubble? You've made a mind map.*
S	*You print it.*
S	*And present it.*
S	*We edit it and then we present it and then we print it.*
Q	*Okay. Do you turn it into a longer story or anything or an essay or something like that?*
S	*Yes.*
Q	*Sometimes?*
S	*Sometimes.*
S	*Sometimes.*

Class books

At Brookvale Public School, a focal point of the library is the collection of "class books" authored by individuals and groups of children at all levels and over several years. The class books are word processed in senior years and group-conferenced according to a method that is displayed on wall charts. These served a range of purposes:

- Celebrate the written work
- Motivate student writing
- Develop conferencing skills
- Develop writing skills in a systematic and publicly recognised way.

"…we've had a policy over the years of publishing class books and you can see the huge leap the children make particularly from Year 3 to by the time they get to Year 6 because they've been able to use word processing. You just can't get kids to go back and change things once they've written it down but with a word processor you can." (Teacher, Brookvale Public School)

The use of interactive whiteboards to improve literacy outcomes

As previously mentioned, a number of teachers attested to the value of interactive whiteboards at Eastern Fleurieu School. In the extract below, a teacher explains the process by which a sample of student's writing was improved through the collaborative use of an interactive whiteboard:

> **"***…we scanned a student's work and had it up on the screen, with his permission, and the software enables us to look at it and highlight and pick out bits and basically pull it apart and re-put it back together again. Now when you work with a student with a book… you've only got you, the pencil, the paper and the student and you['ve] got 30 odd students' work to get through. Well this is a small piece of work where he had …to use certain words so we understood the meaning of it, and this is the piece that he started with.*

A pharos who had great potential as pharos. Sorry, there was a pharos who had great potential as a pharos and everyone called him King Tut. Well one day a catastrophe and a miraculous thing happened. The Nile flooded, meaning that all the young pharos had called and prayed upon the Gods for the flood. When the flood subsided all the people raised the amateur King for good harvest, sorry praised the amateur King for good harvest. When the sun came out, all the crops started growing and all the people started synthetic farming tools and all the people were optimistic with the future of the King. (Fact) - many people were noxious towards the King.

> *…his understand[ing] of many of those words was very low and …we captured each paragraph of that, highlighted the key words and then for each of that small section he re-wrote the same text but in a much more powerful way. So the end product was…*

A pharaoh called King Tut had great potential. Suddenly a catastrophic and miraculous thing happened. The young pharaoh had called and prayed to the Gods for rain. The great rains came, the Nile flooded, all the people had a good harvest. When the flood subsided and the sun came out, the crops started growing. All the people were optimistic for their own future and the future of the King. The crops were very green, so the plants had been well tended by the farmers, using good farming tools. Unfortunately for the people, the King was murdered.

> *So we had a bit of humour in the end. But the quality of it, I have never seen such quality from a Year 6 student from something that started out as really just a mix mash and I think that says a lot."* (Teacher, Eastern Fleurieu School)

Support students with special needs

Eastern Fleurieu School has made provision for remedial students in the area of literacy through the provision of a technology that allows the student to communicate with others:

> **"***We've got a cerebral palsy student here that's got some equipment called the Vanguard, which allows him to speak to you, because he can't actually speak to people, so he communicates through this Vanguard device. This also can be used for him to navigate the internet. So he's got a lot of*

different software programs where he can use and type it in himself. He's been able to do nearly everything that a normal student can do in the classroom, he can do PowerPoints with the equipment that he has got, and things like that." (Student Support Officer, Eastern Fleurieu School)

Figure 13 Vanguard system used for disabled students

Parents in a focus group at Eastern Fleurieu School were enthusiastic about the ways in which ICT had been used to promote oral forms of literacy and students' self-confidence:

"Another example for English, …I think in the oral language stuff, my daughter really enjoyed, if she had a talk on something. Like if she had to just do a morning talk, she'd say, can I put some pictures to it? So she'd come home and make a PowerPoint …if it was talking about a holiday for example, she'd go through all my photos on the computer and make a PowerPoint display that she'd take and put up on the Smart Board to do her morning talk and she just loved doing it that way. And I think it gave her something to talk about that wasn't sort of all the focus on her as well. So she enjoyed [it], but I suppose it's building towards doing PowerPoint presentations in public." (Parent, Eastern Fleurieu School)

Examples of numeracy outcomes as a result of the use of learning technologies.

Although Saint Pius X Primary School has had observable success in improving student literacy through the integration of technology the school also admits that their results in numeracy are not as positive. The principal points out that while a push for literacy has been funded by the Catholic education office there has not been similar support for numeracy.

"*Across the board there is a state-wide resignation to the effect that numeracy hasn't improved as much as literacy. They've pumped all the money into literacy and haven't put any money in numeracy.... we're not struggling but we're not as far as where we should be. And that's not just us, that's the whole results across the state that has pointed that out... For literacy I've got a literacy coordinator who's fully funded and all schools do... Numeracy you've got to do yourself so it's a funding issue with numeracy more than anything else*." (Principal, Saint Pius X Primary School)

Year 5/6 teachers agree that numeracy has not been given a priority in the past and needs to be given a greater focus. However the teachers also pointed out that they were not aware of ways in which to use technology to support numeracy other than using some Learning Federation resources and excel for graphing.

A2 *Numeracy probably has to be…*

A1 *Yeah we need…*

A2 *…pushed, a lift…*

A1 *We were talking about that last week, yeah.*

A2 *Yeah a lift with numeracy.*

A1 *...But then I can honestly say I'm not aware of… I know there's stuff on the computers with the maths but I'm not…*

The Year 5/6 students agree that they have not used technology to support their study of mathematics. The few uses included drawing multi-sides shapes, creating graphs and playing math games from the learning federation.

Q *Do you use computers for Maths at all, apart from shapes?*

S1 *Very rarely.*

S2 *Most of the time we don't. We haven't used it this year.*

S3 *For maths you might be using Microsoft Excel to do graphs.*

S4 *On my class's page we have this maths folder kind of thing and they've got math games and stuff in there that we use... they're website games.*

One innovative use of technology to support numeracy was reported by the teacher of years 2/3. In this example he describes how students could use digital cameras (still and video) to record their findings.

> *"It has been fantastic in Mathematics where the students can record their findings in regards to measurement or other activities where the actual writing of their findings would take longer than concluding the activity so for the students who are very challenged at completing their writing it is a perfect medium for them to present what they really know rather than what they can write."* (Teacher, Saint Pius X Primary School)

The teacher of Years 3/4 points out that while she has used some websites, including the Learning Federation, to support student numeracy she still needs to work harder.

> *"I find with maths, we've used – I don't think I've used enough for maths. We use websites and stuff and they're able to go on it, and I think what with the maths it's improved their mental – because some of them are timed, so their mental computations have got to be faster and they've been able to do graphs and things. So I think that's come out better, but I identified it myself, that I do need it more in maths. Yeah... Because I don't think – I think more for a variety of activities in maths. That's why I think I need to use it. They're comfortable in going on and doing it, but I know with the Le@rning Federation – have you seen that stuff? They've got great stuff and I've used that, and I'd say with decimals especially. I think we've got a lot better using Wishball and talking about tenths and hundredths that way, instead of just doing them physically. So that mixed mode of activities for them would help them I think, seeing it in different ways. I do think they're going okay in maths, but just trying a variety of activities."* (Teacher, Saint Pius X Primary School)

However the teachers of years 2/3 and 3/4 feel that there is an urgency in using technology to support numeracy because it is integrated in the rest of the curriculum.

> *"It would seem unnatural if we didn't use IT in mathematics, because in literacy they would use it for their reading, their writing, perhaps doing research, and then it would come to an hour of mathematics where it's pen and paper, and then it would come back to ICT or integrated studies." (*Teacher, Saint Pius X Primary School)

> *"And you know they're using it as a tool again. So I don't know if I use it in the same manner where they're really thinking and reflecting about you know, their audience and their work, and how they're learning, but I try and do an activity that may be a problem solving activity. I'll often go to PBS Kids Cyber chase. To go there because I think a problem solving activity where they're interacting is much better than you know, there were seven sheep and four cows in a paddock. How many legs? And I think if they're solving them online that's the natural world to these students, so you've got to put it you know, in that regard because we're competing against PS2's as well."* (Teacher, Saint Pius X Primary School)

> *"That's the big thing. What we're competing – we have to keep them engaged because what they do at home, and it's a visual world now. It's a different world to when we were at school."* (Teacher, Saint Pius X Primary School)

The Learning Federation learning objects were reported to be particularly valuable in supporting numeracy.

> *"It's really difficult because I cover two levels. I cover level 2 and level 3, to place activities with – to suit both completely, but most weeks it would be one maths activity that would be reliant on the Le@rning Federation, or some other suitable website. I did find some links where they had interactive clocks, and that was the best way for them to learn how to tell the time. They could drag the hand around and they were seeing the digital time underneath, or they were seeing the analogue time, and we could have sat and played with the old real clocks down here until the cows come home, but then sitting on the website they just picked it up so quickly. It was – it was just a natural thing for them."* (Teacher, Saint Pius X Primary School)

> *"Yeah, the fractions TLS is like that too. They can drag the one up and down, and so they're actually seeing it in front of them, because we need models they'll do themselves, and after they did their own paper they went on the computer and used the fraction one. So they were applying it in two situations."* (Teacher, Saint Pius X Primary School)

Another example of the use of web-based resources is that of the commercial mathematics program *Mathletics* (2008). Several teachers, students and parents at Eastern Fleurieu School nominated this program as being particularly valuable. This is an online program that students subscribe to, which enables them to compete in maths against other students around the world. It is possible to access it from home as well as at school. One parent noted that with her son, that "he also does some work on the internet, there's a maths package over the internet that they use, he really loves that as well". For one teacher who had implemented it, the choice to adopt it was consistent with the school philosophy and approach to the use of ICT:

> *"I think you have to look at education in a different way. There's no walls. We've got technology now where students can learn anywhere, anytime. For example, one program that we have engaged and spent money on is a program called Mathletics which is web based. Now I can set work and give assignments to students that they can either choose to do in lesson time that I can give them time for, in their spare, when they're finished or they can do it at home"* (Teacher, Eastern Fleurieu School)

Figure 14 Mathletics

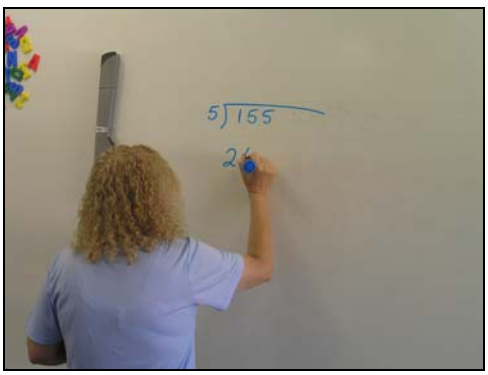
This program was also mentioned by one of the teachers at Brookvale Public School.

> *"So the kids have logged on to a practice site and be able to do maths calculations and they're competing against, in some cases, children in their own classroom, but children all the way around the world. And they were quite excited. Some of them have gone home with their passwords and used them at home which it's quite unusual for our guys. When we talk to them they use their computers at home for games and a couple of them might use it for internet, but they don't word process, they don't use educational games at home really."* (Teacher, Brookvale Public School)

Eastern Fleurieu School has made provision for the use of computer technology with disabled students. It is used for both literacy and numeracy. In the interview extract below, the Student Ssupport Officer explains the use of this system. Examples of its use in maths are shown in the accompanying pictures

> *"[with] a vision impaired child …we use equipment called the mimio; it is very similar to a Smart Board. It allows the teacher to write on the white board and it goes directly to his laptop, where the screen can be blown up so he can actually see what is written on there. You can save the work that the teacher writes on the board, and does a lot of different functions. Also on his laptop he's got equipment that actually speaks, it's a project called Jaws, and we can use that as another tool for him so he can actually hear and navigate through the internet through this program. He also knows a lot of shortcuts*

which are very similar to what you can use on a normal Windows, but this has got extra functions." (Student Support Officer, Eastern Fleurieu School)



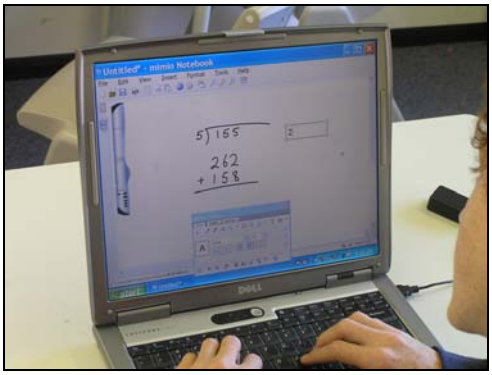


Figure 15 electronic capture of work on the board

In the photos above, maths material is written on a board with a special pen and the image appears on the student's computer screen

Teachers in a focus group at Eastern Fleurieu School emphasised the importance of looking for solutions that would suit the learning styles of their students. In some cases, replicable approaches could be identified by looking at common computer applications as well as what they referred to as the "whiz-bang" solutions promoted by software vendors:

> *"One thing that I did last year was we were looking at tessellating as a maths concept, and I decided to do it using the computer instead of using blocks. So we used the drawing toolbar at the bottom and we actually tessellated using that, and that really got the kids in"* (Teacher, Eastern Fleurieu School)

Another example of the use of ICT to improve numeracy outcomes was taken from Presbyterian Ladies College in Perth.

> *"In numeracy we have been able to build a library of iMovies for our students that enables them to have their teachers with them 24 hours a day, seven days a week. So for example a student may be sitting in a maths class and hear the explanation for a new aspect of mathematics, they may not understand it, they may be hesitant to put up their hands and ask for a third time for yet another explanation. But they have the capacity to download an iMovie onto their laptop to take it home, to replay it, to maybe listen to it as many times as they may wish to learn at their own time and at their own pace. The other advantage that offers is that for many of our parents, the way we teach mathematics at school today is very different from the way they've learned, so they can engage their parents in that process by viewing an iMovie. The parents know what methods we are teaching and can perhaps reinforce with their daughter under the maths and provide that support at home."* (Teacher, Presbyterian Ladies College*)*

The final example of using ICT to improve numeracy relates to the use of interactive white boards in a maths class.

> *"So we found interactive whiteboard was much more effective than the other methods in that all the kids could see the screen. So around a laptop one*

person tended to dominate and three people tended to watch, with the concrete materials some people spent time drawing while other people solved the problem. And the pen and paper tended to be kids worked in isolation by themselves and solved the problem in isolation where the interactive whiteboard all groups that we had on that worked collaboratively, they'd discuss things, they'd step back and look at stuff and someone would get up and move something around the board. So we found that was really effective in that maths scene." (Teacher, Reece High School)

Discussion

There already exists considerable literature on the effective use of ICT in education. Freebody (Cox, Preston et al. 1999) states that there is now a reasonably well-established body of empirical work on the nature and efficacy of ICT in education pointing to improved outcomes for learners in a range of educational contexts, and it represents a prima facie case for concluding that the introduction of ICTs into education can improve learning. So how does this project add to the corpus of knowledge on the use of technology in the classroom?

After nearly five decades of computers in education there is still confusion about the use of technology in classrooms and widespread reluctance to move beyond tokenistic use. There is not a universal, shared vision regarding the use of technology in the classroom and teachers are confronted with many theories and instructional designs and bombarded with confusing, even romantic, views of what the technology is capable of delivering. It is not possible to definitively establish a direct link between learning with technology and improved outcomes. Effective design of learning environments and the effective use of technology will depend on a number of factors especially the quality of leadership at all levels; and, of course, the quality of the teacher/teaching. Teachers remain central to the learning process - a shift in the role of a teacher to that of a facilitator does not preclude the need for teachers to teach, introducing technology alone will not change the teaching and learning process (1998).

This project builds on the notion that there is need to know more about how good teachers teach in technology rich environments. There is a need to know more about how existing and emerging technologies are impacting on classrooms and a need to know more about why it works in some educational setting and not in others.

It is suggested that there is also a need for more “scientific” evidence of “what works” in classrooms rather than more qualitative studies. Educational research is a complex and contested discipline characterized by robust debate about the very nature of science and scientific evidence, and different epistemological, ontological and methodological perspectives. As a consequence there is much criticism of educational research including that it lacks rigor, fails to produce cumulative findings, is theoretically incoherent, ideologically biased, irrelevant to schools, lacks the involvement of teachers and, is poorly communicated and expensive (see Tooley and Darby (1998), Hillage, Pearson et al. (2006) and Whitty (Underwood 2004)). Similarly, educational research into the use of ICT has been criticized for relying too heavily on small case studies using informal interviews and surveys (2007).

This criticism, and our failure as educational researchers to effectively communicate the nature and purposes of educational research, has led to a call for more scientifically based or evidence based research that uses randomized controlled trials to focus mainly on *what works* in the classroom; that is, “scientific proof” that ICT used in certain ways will improve learning – usually judged by an increase in attainment (see for example Biesta (StClair 2005)). Under this scenario much of the current ICT education research would not be highly valued. So why yet another “case study” when it is seemingly not valued?

The extent to which research constitutes evidence for the introduction of ICTs into the classrooms depends on your point of view. Our point of view is that educational research does not supply rules for action but hypotheses for intelligent problem solving. It can help us understand what worked in a particular situation but not what will work in future situations. The role of the educator is to use research findings to make one's problem solving more intelligent. Educational research assists the teacher to reflect on what happened in setting A and determine whether it is appropriate for setting B and in such a process there is greater recognition of the value of the educator's judgement (Biesta 2007). The "evidence based" model of professional action may be appropriate for medicine but is not so for education. Being a student is not the same as being a patient; education is not a causal process and professional judgment is central to educational practice. Education is a complex and contested discipline so there are those who disagree with this position however, it is a position which gives value to qualitative research even small scale, limited projects such as this one.

There are tens of thousands classrooms in Australia and in many you will find exemplary use of technology to enhance learning. How do you select just six schools as exemplars and what criteria do you use to make the selection? The researchers recognise that this is an issue and that there are many valid arguments to suggest that other schools, rather than the ones selected, might have been chosen. However, all researchers must work within the boundaries that are set and with the resources that are available. They must also be diligent in making clear major limitations and threats to the trustworthiness of the research - tagging the sites chosen for this project as "exemplars" is contentious. It may well be that for some sites it is erroneous and that our process for selection is flawed; this is noted and identified as a limitation.

In this case the schools were chosen by the government department contracting the research in consultation with the researchers. The six sites were selected in an attempt to provide a representative sample of schools in Australia which purported to demonstrate exemplary ICT practices. Schools were representative of urban and rural settings, primary and secondary teaching contexts. The sites selected also provided a balance between private and public schools. As mentioned above the sites were selected from a school in each of the following states; Tasmania, NSW, South Australia, Victoria, Western Australia and Queensland. By selecting this diverse range of sites, a broad representation of purported exemplar ICT use in Australia was sought.

One of the obvious limitations of our approach was that we were selecting **schools** that demonstrated exemplary ICT practices. In reality there are few schools that exhibit exemplary ICT practices due to the complex management and organisational strategies needed to support diverse teaching practices with ICT. More often than not, with pedagogy in general, there are exemplar **teachers** working in schools that fail to exhibit exemplary status. Our methodology of selecting schools did not explore how exemplary teachers working with ICT in an 'ordinary' school manage to instigate sustained pedagogical change beyond their classroom context. The majority of exemplar ICT teachers may find themselves in a position where his/her principal does not have a sufficient theoretical or methodological approach to supporting exemplary ICT practices in the classroom. The contested struggle of this group of teachers was not exposed in our research.

The current generation of students is growing up in a technologically-rich environment, so much so, that being technologically savvy is an assumed characteristic of students in the current-day school environment. As a consequence, the need for ICT to be emphasised in schools is often questioned. It is our argument in this paper that on the contrary, it is precisely the two factors of - a technologically-savvy student body, and a funding-strapped education system that necessitate research, administrative and practitioner attention on how ICT can be even better utilised and integrated into the school curriculum both to reflect the ways in which knowledge and skills are learnt, as well as to deliver education in pedagogically effective and financially efficient ways.

This study provides further evidence to support the view that each school is a unique learning community made up of school leaders, teachers, students and parents. Each of these learning communities is influenced by a large number of factors including, but not limited to, the socio-economic background of the students and parents, the geographic location of the students, the quality of the school leaders and teachers, and levels of school funding.

Given that the characteristics of each learning community are unique, it is our view that educational research should not focus on trying to identify a ‘one size fits all’ or ‘best practice’ approach to using ICT in schools. Instead, we advocate an approach based on adopting ‘appropriate practice’ as determined by the needs of the learning community.

Schools must make their own decisions about what is appropriate practice based on an understanding of the needs of their community and an appreciation of the ICT practices available to them. It is our view that the role of educational research is to assist schools in making these decisions.

One way to assist educators to develop an understanding of the ICT practices available to them is to construct digistory narratives featuring exemplary practice that is working in other educational communities. This format allows school leaders and teachers to readily assess the highlighted practices and decide which practices are appropriate for their own learning communities.

Recommendations

Based on the findings of this project, we present the following recommendations.

1. Appropriate practice rather than best practice

It is important to recognise that each Australian school is a unique learning community made up of school leaders, teachers, students and parents. Each of these communities is influenced by a large number of factors including, the socio-economic background of the students and parents, the geographic location of the school, levels of government funding and of course the quality of teachers and staff.

Considering the many differences between learning communities, we suggest that efforts to identify a 'one size fits all' approach to ICT are likely to be unsuccessful.

Rather than adopting an approach based on identifying and distributing educational 'best practice', we advocate a more flexible alternative based on the concept of 'appropriate practice'. This involves assisting schools to identify the unique needs of their community and educating school leaders about the ICT options currently available to help them address these needs.

2. Understanding the unique needs of a school community

It is our view that further research is necessary to develop ways to assist schools with the process of identifying the needs of their learning community. A focus of this research should be to find ways to incorporate the views of school leaders, teachers, students and parents.

By developing a comprehensive understanding of the needs of the entire school community, school leaders will be well positioned to make decisions relating to hardware and software requirements, professional learning, curriculum development, and school leadership.

3. Disseminating examples of exemplary ICT practice

This study has demonstrated that online digistories are an engaging and easily accessible way to highlight exemplary ICT practice in schools across Australia. We believe that there is value in expanding this collection to develop a library of exemplary ICT practice.

One way to do this would be to develop a community driven website that allows individual teachers to develop and upload their own digistories. This is already occurring to some extent with sites such as www.teachertube.com.

4. Plan, implement and evaluate

Once school leaders have clarified the needs of their learning community and identified appropriate ICT practices from a library of exemplary options, it is our view that they will require further assistance to plan, implement and evaluate the practices in their own communities.

Further research is required to identify ways in which to support schools with the process of integrating exemplary practice into their own learning communities.

Conclusion

This project has identified exemplary ICT practices in Australian schools. Using a case study methodology eleven online digistories were developed. These digistories provide educators with an engaging and accessible way to build new knowledge about teaching, learning and emerging technologies. In the course of conducting this project it became apparent that the ICT requirements of each school are unique and that no single ICT model can meet the needs of Australia's diverse schools. It is anticipated that the digistories developed for this study will assist educators in identifying and implementing ICT practices that are appropriate for their local learning community.

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