

# Teaching, Learning and Technology: Research, Reform, Realise the Potential

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## **Introduction**

I would like to start by thanking the Australian Council for Computers in Education and the Australian Computer Society for the award that I have received at this conference and to thank the ICTEV state council, for nominating me. The plaque and the recognition have been nice and gratefully accepted, but I think the most rewarding part is the opportunity to present this keynote address. It gives me the chance to share my ideas with a national audience and to receive some feedback on those ideas. It is also an opportunity to reflect on what the research is telling us, to reflect on what I think needs reforming, and to reflect on how the potential of technology in education is being realised.

My personal *computers in education* story is a simple one and it probably started with a vile character by the name of Carmen Sandiego. I suspect that my story, and Carmen's part in, will sound familiar for many in this room today. I first became fascinated with computers and how they might be used in the classroom over 20 years ago. At that time I was a primary teacher in Victoria. The technology was new; we were young and enthusiastic, and utterly besotted with Carmen and her Villainous International League of Evil. We were also smitten with an Apple IIe with twin floppy disk drives mounted on table. The table had trolley wheels inserted into the legs so it could be wheeled away to a secure location each evening and a seatbelt secured the hardware so it would not slip off as the children rolled it along the corridor.

There were no networks, no internet and for a long time no hard drives, but I found it an absolutely exhilarating environment to work in as I explored ideas about teaching and learning with technology. I loved the turtle, interacted with the scoundrels of the First Fleet, discovered dinosaurs, bushranged, explored, printshopped, appleworked and continued my affair with Carmen.

It was also an incredibly prolific time for Australian software and ideas about how technology should be used in the classroom. The message was, and still is, simple, students should use computers:

*... for inquiry, analysis, information processing, written expression, problem solving, creativity and recreation; in ways which stimulate meaningful learning experiences through thinking talking, listening, reading, writing, reflection; and in ways which encourage social learning and cooperative problem solving as well as fostering individual learning and development ... (National Advisory Committee on Computers in Schools (Australia) and Tannock 1983),*

I think the heady days of the 1980s profoundly influenced the way many of us think about computers and what we should be doing with them in the classroom. And, in turn, the work of Australian educators and researchers in this area has influenced the rest of the world. As I travel to conferences and seminars around the world, read of the research that is taking place in other countries, and learn more about what Australian teachers do with computers, I think we can be justifiably proud of what we have achieved. I think we can be especially proud of

the fact that *computers in education* in Australia is, and always has been, more about teaching and learning, rather than technology.

However what of the future? Does the next generation of educators understand the rhetoric of *computers in education*? In the networked world of online learning, learning objects and virtual tutors, does what we now know about good teaching and learning really matter? In a global economy where competition is good and learning and earning are inextricably linked can the focus remain on the learner?

I want to suggest that maybe we are at a bit of a crossroad and that our message about teaching, learning and technology needs to be restated and revitalised. As the technology becomes more sophisticated and more expensive, as we get more and more teachers who don't see the point, and as we get more pressure to justify the expense, the message, along with over two decades of hard work, could well be lost. I think the first step in restating and revitalising the message is to reflect on what it is we now think we know about how people learn, the design of effective learning environments, and the impact that technology can have on these environments.

### ***Research: How People Learn***

In the last three decades much new information about learning has been generated. There is currently an extraordinary outpouring of scientific work on the mind and the brain, on the processes of thinking and learning, and on the development of competence. We now have a much clearer picture how people learn. Research on memory and the structure of knowledge, the analysis of problem solving and reasoning, the significance of early foundations, the importance of metacognitive processes and self-regulatory capabilities, and the value of cultural experience and community participation, has focussed attention on learning with understanding, the role of pre-existing knowledge, and the importance of active learning.

#### **Some key findings and conclusions regarding how people learn.**

Developing expertise is not simply about memory, general ability, or generic strategies. Experts notice features and meaningful patterns that others do not, they organise their vast store of content knowledge to reflect a deep understanding, they are able to select knowledge that is relevant to a particular problem, they retrieve important aspects of their knowledge with little effort, they know their topic thoroughly and they are flexible in applying their expertise to new situations. This is not to suggest that all students should become experts; the point is that the study of expertise demonstrates what effective learning looks like and suggests that learning environments should be designed to assist learners to develop meaningful patterns of information, to organise and contextualise their knowledge, and to fluently retrieve and adapt that knowledge.

Understanding how learners transfer what has been learned in one situation to new situations is important for educators. The school system is predicated on this transfer being carried out successfully from year to year and from one course to the next. There are several factors that influence successful transfer including; the extent of mastery of the initial subject matter; the degree to which learners learn with understanding, the amount of time learners are apportioned to learn complex subject matter, the quality of the feedback learners receive, and the learner's level of motivation. When considering motivation, educators need to take into account the power of intrinsic reward and the need to design appropriate challenges.

Learners of all ages have many things in common but in many ways children differ from adult learners. There is a massive body of research, which has dramatically increased in the last three decades, on how children learn. Many of the theorists are familiar - Bruner, Dewey,

Gagne, Gardner, Piaget, Rogoff, Skinner, Vygotsky. Much of the research done in the last 30 years can be classified into four major domains. First, children have a strong predisposition to learn rapidly and readily by actively making sense of their world. However, there is evidence that young children have an early predisposition to learn about some things and not others. These *privileged* domains include physical and biological concepts, causality, number and language. Second, contrary to earlier thinking, young children do have strategic and metacognitive competence; they do have knowledge about their own learning and can learn to learn intentionally. It is therefore important for teachers to assist children to develop strategies for learning. Third, young children lack knowledge and experience but they can reason effectively with the knowledge they have. As they mature they develop theories of what it means to learn and understand. The theories they develop influence their learning and their lack of knowledge and experience can lead to misconceptions and misinformation. Finally children are problem solvers and problem generators who are self motivated and self directed in their learning. Others, including teachers, parents, coaches, and other children, play a major role as guides in cultivating their learning, assisting them to make connections, and supporting their curiosity and persistence by structuring and supporting learning attempts. Crucial to that support is ensuring children have appropriately challenging and novel problems to solve and opportunities to pose their own problems. Books, television, videos, and technology can also serve as guides and support for learning, and technology can be especially useful in assisting teachers to present interesting and novel problems.

Learning actually changes the physical structure of the brain and reorganises it, and different parts of the brain may be ready to learn at different times. These findings are significant for educators because they indicate that the development of the brain is an active process that feeds on vital information gained from experience, and that the brain depends on and benefits positively from learning. (Brown, Bransford et al. 1999).

### ***Reform: Designing for Effective Learning***

Designing an effective learning environment that considers what we now think we know about learning, requires a rethink about what is taught, how it is taught and how it is assessed. However the theory does not always provide a simple recipe for practice, at most, it offers some basic principles that should be taken in to account when teaching for effective learning. These basic principles can be scaffolded around four interrelated and interconnected perspectives – *learner-centred, knowledge centred, assessment centred* and *community centred* environments (Brown, Bransford et al. 1999).

**Learner-centred environments** pay careful attention to the knowledge, skills, attitudes, and beliefs that learners bring to the educational setting. In learner centred environments learners use their current knowledge to construct new knowledge and teachers recognise the importance of building on the concepts and the pre-existing knowledge that they bring with them. Learners are encouraged to take charge of their own learning and provided with opportunities for reflection and self-regulation. There is a balance between the processes involved in and the content of learning, self esteem, motivation and commitment to learning are nurtured. Activities are designed to stimulate learners intellectually and creatively, and the learners are viewed as explorers, cognitive apprentices and producers of knowledge rather than consumers. The aim is to excite students about learning and develop a passion for life long learning. The role of the teacher in the learner centred environment is as facilitator, guide, co-learner and co-investigator.

**Knowledge-centred environments** help students acquire the knowledge and skills necessary to function effectively in society. In knowledge centred-environments learners are assisted in developing meaningful patterns of information, making connections, organising and contextualising their knowledge, and fluently retrieving and adapting knowledge. This is

achieved by adopting a variety of instructional models - including multidisciplinary and integration approaches to curriculum organisation, presentations and materials aimed at cultivating high level thinking skills and, learning and problem solving strategies.

**Assessment-centred environments** provide opportunities for feedback and revision, and assessment activities that reflect the learning goals. They promote summative, relevant, and authentic assessment, encourage risk taking, learning from errors, cooperative learning, self evaluation and taking responsibility for one's learning.

**Community centred environments** encourage learning from one another, foster a sense of community within the classroom and the school, and *connect students, teachers, and administrators to the larger community of homes, businesses, states, the nation, and even the world*. Community-centred environments encourage shared ownership of learning and recognise that students learn a lot from each other, from other adults and from cultural artefacts. They develop a sense of a collaborative learning community that uses the strength of its members to build knowledge. This is achieved by promoting the use of heterogeneous, flexible and equitable groupings to facilitate learning and by catering for a variety of learning styles and individual differences, including cultural differences. The premise is that all students should have the opportunity to learn and develop to their full potential.

**Effective teachers** in *learner-centred, knowledge centred, assessment centred* and *community centred* environments, are able to weave the concepts and enquiry methods of their disciplines into clever instructional designs that make it easy for learners to understand complex ideas. Expert teachers have knowledge of their discipline/s and knowledge of pedagogy. The ability of the teacher to use her understanding of teaching and learning, and her knowledge of the structure of her discipline to generate effective learning environments is what distinguishes the novice from the expert (Brown, Bransford et al. 1999).

### ***Potential: Information and Communication Technologies in Education***

The potential of technology in education 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.

Dynamic multimedia, streamed audio and video, simulations, rich databases, and interactive web sites now make it possible to bring powerful tools, resources, and data to the classroom. Connections to museums, art galleries, scientific institutions, government agencies, statistical databases, and other organizations can help to create an active environment where learners can solve and pose problems using the artifacts that are available to real scientists, historians, mathematicians. These powerful interactive technologies present learning opportunities that have not been previously available and now make it possible to create learning environments *in which students can learn by doing, receive feedback, continually refine their understanding and build new knowledge* (Brown, Bransford et al. 1999)

Many technologies, including calculators, probes, handhelds, databases, spreadsheets, word processors, multimedia and web authoring, concept mapping, and programming software can serve as scaffolds and tools to assist student understanding and learning. Papert's use of LOGO (1980; 1992) and Jonassen's (1996; 2000) ideas about computers a *Mindtools*, or the use of Inspiration (Helfgott and Westhaver 2003) for concept mapping would be examples of using software applications to scaffold student learning.

Many software applications also offer enhanced opportunities for feedback, reflection, and revision. The discussion about how people learn stresses the importance of summative

assessment procedures and the need for teachers to provide learners with opportunities to develop their metacognitive skills. New assessment software, the clever use of word processors, spreadsheets and databases, and network technologies such email and threaded discussion groups makes available to teachers and learners tools to enhance and expedite feedback. Email, threaded discussion groups, and online journals can provide environments for reflection and authoring tools such as word processors, multimedia slide shows and web page creation software provide opportunities for learners to revise and reedit their work and build a richer understanding.

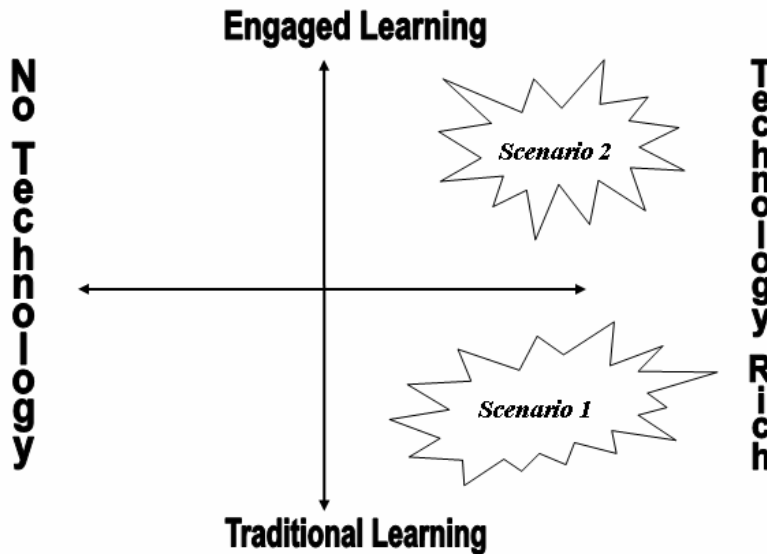
Network technologies can also be used to build local and global learning communities. Theory informs teachers that they need to create learning environments where the learner's preexisting knowledge is recognized and developed, opportunities for discussion and the shared construction of knowledge are provided, and the social and cultural background of the learner is considered. The communication technologies that are now available via the Internet including chat, email, threaded discussion groups and the many emerging database driven web applications that allow learners to respond to situations and share the responses (Edwards and Romeo 2003), present unique opportunities to build learning communities.

Teachers are also learners and the technology provides them with opportunities to be part of their own local and global learning communities, to use web technologies and various applications to scaffold their learning, as well as opportunities to revise, reflect and receive feedback (Brown, Bransford et al. 1999).

This discussion about how people learn, what constitutes effective learning environments, and the role of technology in education provides a strong theoretical framework for thinking about the possible synergies between technology and learning. However, to effectively restate and revitalize the message about *computers in education*, theory must be woven into reality. Scenario planning, a procedure borrowed from business, is a powerful way of doing this because it helps us to organize, comprehend, and connect knowledge about the issues, in a coherent and systematic way.

### ***Realising the Potential: Using scenario planning to reflect on the Potential of ICT in Education***

Scenario planning is a technique used by business to develop possible responses to threats and opportunities, to develop insight and understanding, and to help businesses build a shared vision of the future. It is not an attempt to predict the future; it highlights perceptual limitations and allows trends, issues, and developments to be identified that may otherwise go unnoticed. For educators it is an opportunity to explore the issues related to technology in schools and organize the information into a manageable format. For the purposes of this paper I have used scenario planning to develop the following matrix. [For more information on Scenario Planning see (Romeo 2004)]



**Figure 1: Scenario Planning Matrix**

The matrix intersects two themes. The first theme, not surprisingly, is the technology itself. In the future society may choose to saturate teaching and learning with technology or not. The second theme is teaching and learning theory. At one end of the scale is engaged learning at the other is traditional learning. From the matrix two scenarios have been extracted and presented them as vignettes.

The purpose of the first scenario is to draw attention to a teaching and learning model that is often advocated by technologist and politicians but is not in tune with current thinking about the nature of learning. The second scenario attempts to show that the technology matters and can be used to support learning in many ways but it is the skill of the teacher that matters more. The teacher is able to use her pedagogic skills, her understanding of her disciplines and her understanding of how technology can support learning to create a very powerful learning environment that is sensitive to current learning theory (Romeo 2003).

**Scenario 1 – If I see another piece of multimedia I think I will puke**

Highville Grammar School (HGS) is an expensive private school in Melbourne, Australia . It has a traditional curriculum - this school has character building rigour. It prides itself on its exceptionally high ENTER scores (university entrance scores) and its superior information and communication technologies. In fact, the school boasts the best information and communication technologies in the country - ultra-fast workstations, high-speed connection to the Internet, a virtual campus, wireless technologies, video conferencing between campuses, and its crowning glory – *AchieveHigh2* – a machine based *intelligent* tutor system.

*AchieveHigh2*, manages content for all curriculum areas, it assesses students, and provides sophisticated feedback to teachers and parents about student progress - including a clever system of intelligent *web cams* that allow parents to monitor students from homes and offices. *AchieveHigh2* even personalizes instruction by catering for multiple intelligences and remedial students. This is achieved by manipulating content, creating ability groups, and utilizing virtual tutors – computer agents that provide learners with a virtual critical friend to assist in the construction of knowledge and scaffold the learning experience. *AchieveHigh2* cost millions to develop and Highville pays an exorbitant *per student* licensing fee to LernTek

for updates, service packs and access to lightning fast servers located in the US. Version 2.1.4 is due out next year.

The licensing fees are passed on to the clients of course, but Highville Grammar is able to keep costs down and remain competitive because they have their own *content development* department. The *content department* has an international reputation for developing quality *learning objects*. Content and learning objects are now tradable commodities and content developed for *AchieveHigh2* by Highville Grammar is sold back to LernTek who then on-sell it to other schools. Highville Grammar also saves money by manipulating student-teacher ratios. *AchieveHigh2* is not only capable of monitoring student learning but it can also monitor and manage student behaviour. Virtual behaviour monitoring agents patrol the virtual and physical space making a simple trip to the bathroom a worrying ordeal for those who do not take the direct route. Now only one human teacher is needed for 150 pupils and five classrooms (Dede 2002).

A typical day at Highville Grammar for Year 9 students, Jessica and Kimberley, starts with *Homeroom* at 8.30am where they are required to register their attendance at school by via the swipe of a smartcard. This is not your usual student card. It contains a vast amount of data about each individual student including medical alerts, dietary requirements, and academic progress. It is Jessica and Kimberley's passport to school life. They need it to log on to the computer network, to enter rooms, and to borrow a book from the library; not that they borrow too many books these days. Outside of school they use their card on public transport, to buy a can of coke at the local 7-11 store, even to rent a DVD. Parents can download data from the card each evening and get a *digital footprint* of their child's activities for the day. Jess and Kim are not too keen on this aspect and have all sorts of tricks they use to thwart the intrusiveness of the cards. In fact, there is a flourishing underground community that willingly shares what has become known as *hscworkarounds* (Highville Smartcard workarounds).

After *Homeroom*, lessons begin. A typical *AchieveHigh2* lesson consists of logging on to the network and beginning work from where you left off the last time. Any tardiness is monitored by the computer, reported to the school administration and of course to parents via the smart card. *AchieveHigh2* uses state of the art interactive multimedia to support learning; much of the material could be classified as edutainment. Initially it is quite engaging and at times very challenging, but students can become distracted easily. *AchieveHigh2* is also very competitive; the focus is on achieving elite test scores that are compared with test scores from other *AchieveHigh2* schools across the globe. Highville is right up there with the best of them.

This morning Jessica and Kimberly have arrived at school to be told that the test scores for Year 9 Mathematics are below standard and as a consequence the workload for Year 9 is to be increased by five percent. This message has been delivered by Peedy, a virtual agent. Having Peedy, a likeable cartoon character, deliver the bad news is somehow supposed to make it more palatable. This decision would have been made by *AchieveHigh2* and based on student output over the last three weeks.

“This isn't fair,” complains Jessica, “this stuff is so boring.”

“Shh!” cautions Kimberley, “The cameras will pick up your whining and you will get me into trouble – again!”

Peedy pops up on Jessica's monitor and asks her if she needs assistance as her workstation has been inactive for a few minutes.

“God I hate Peedy” complains Jessica, “and if I see another piece of multimedia I'll puke!”

Suddenly all the monitors go black and pandemonium erupts. *AchieveHigh2* has crashed for the third time this week. For Jessica, Kimberley and the other Year 9 students it doesn't get much better than this, it will take about half an hour to reboot the system, time to chat – both girls reach for their mobile phones (Romeo 2003).

## Discussion

The focus at Highville is on attainment and competition rather than learning, and on economics rather than education. There are some that may argue that this is what the real world is like and some schools are in need of a reality check. They may argue further that the cost savings, and revenue potential, of *AchieveHigh2* is to be welcomed in a society where the cost of education is skyrocketing. However if the instructional environment at Highville is compared to current ideas about effective learning then some dissonance is obvious.

At Highville little attention is paid to the knowledge, skills, attitudes, and beliefs that Jess and Kim bring to the educational setting. The content of the curriculum is determined by the producers of *AchieveHigh2* and there is little time is for Jess and Kim to use their current knowledge to construct new knowledge. Most of the knowledge construction that does happen is associated with *hscworkarounds*. Jess and Kim are not encouraged to take charge of their own learning and there is little opportunity for reflection and self-regulation; regulation is Peedy's job. Self esteem, motivation and commitment to learning, taking responsibility for one's learning are not nurtured. In fact learning and behaviour are strictly monitored; technologies are used to track and police. Activities within *AchieveHigh2* are designed to stimulate learners intellectually and creatively but, even with the glitz and glamour of interactive multimedia, they somehow fall short, with learners quickly becoming bored and disengaged. At Highville Jess and Kim are not viewed as explorers, cognitive apprentices or producers of knowledge; they are seen as empty vessels ripe for knowledge transfer. They are not excited about learning and it is doubtful whether they will develop a passion for learning and or be the slightest bit interested in life-long learning unless perhaps it is connected to earning.

Perhaps the strength of Highville lies in its claim to help students acquire the knowledge and skills necessary to function effectively in society. After all *AchieveHigh2*, through its interactive content, developed in partnership with some of the world's best mathematicians, historians and scientists, claims to be serious about making students knowledgeable, and it contains some serious content. But Jess and Kim have difficulty in developing meaningful patterns, making connections, organising and contextualising their knowledge, and fluently retrieving and adapting that knowledge. This is even more problematic when the content of the curriculum focuses on the *Three Rs* and *Back to the Basics* rather than contemporary skills for the 21<sup>st</sup> century.

Assessment at Highville is mostly formative, it is not authentic, nor relevant; there is little opportunity for quality feedback and revision. Jess and Kim are not, encouraged to take risks, to learn from errors, to self evaluate or take responsibility. Assessment is not about helping the learners to learn, it is about attainment, competition and economic reward; he who has the best ENTER score (university entrance score) wins! Jess and Kim are not encouraged learn to from one another; chatting is frowned upon and an idle computer screen is seen as a call for help. There is no sense of community in classrooms at Highville - students, teachers and the outside community don't connect; they compete. There is no shared ownership of the curriculum or a sense of collaboration; learning is a competition where individual difference is about attaining the best test scores and homogeneous, inflexible groupings is a way of ranking learners.

The role of the teacher at Highville is not as facilitator, guide, co-learner and co-investigator; it is as supervisor, custodian, and gatekeeper. The magic is not in being able to weave the concepts and enquiry methods of disciplines into clever instructional designs that make it easy for learners to understand complex ideas, but in getting the server up and running after it crashes for the third time in a week. Technical skills, technological innovation and the ability to author learning objects is what will get you a job at Highville.

Scenario one is meant to be extreme, harsh and unsympathetic so as to highlight the inconsistencies between recent learning theory and some of the things done in schools in the name of good teaching and learning, especially some of the things that are done with technology. For many teachers it is absurd to think that Highville, or any school, would operate in this way, but on the other hand, with a little bit political interference, and a good dose of economic rationalism, it could happen.

## **Scenario 2 – e-engage, e-mpower, e-able**

Jessica and Kimberley have arrived early. They know Ms Mancuso will be in her room and will allow them to come in and do some work. They want to work on their project. Jess and Kim are in Year 9 at Plainville High School and their home teacher is Michelle Mancuso. Ms Mancuso is also their English and Social Studies teacher. The girls love Ms Mancuso and they love coming to school. At Plainville High they have some cool technology – super-fast computers, with super-fast network and Internet connections in every room, and students have easy access to digital cameras, handheld computers, laptop machines, scanners and other peripherals. The girls are very adept at pushing data around the Internet and the network and they also have their personal digital communicators and assistants (PDCA). In the old days people carried a palm pilot, a mobile phone *and* a laptop computer– Jess and Kim giggle at the thought and think how clumsy all of that must have been. These days high speed wireless networks make the handling of data and communications through a PDCA so seamless that even Jess’s little brother can do it and he’s an idiot.

“You buy a PCDA like you used to buy a mobile phone,” Jess tells Kim. “At least that’s what my Dad says, but what would he know?”

But the cool technology is not why Jess and Kim love coming to school. School is a social event - chatting to Ms Mancuso, the canteen, watching the Year 12 boys play football at lunch time, the debating club, the house athletics, swimming, netball, writing a story for the school magazine, deciding what to do on the weekend, art classes, learning to speak Chinese, school excursions, the debutante ball in year 11, wood working, community service.

“You know what is the coolest thing about this school?” Jess says to Kim.

“The Year 12 boys?” ventures Kim. “The new eighty centimetre plasma screens?”

“The coolest thing is that we get to have a say about what it is we want to learn and how we learn. You know how Ms Mancuso does all that brainstorming with us how what we do in Maths, Science and other subjects is all connected to the topic we are studying and how we get a chance to select the topic and the sort of activities we want to do and all that stuff - that’s cool,” says Jess.

As the girls approach the room their PCDAs vibrate and they read the message. Ms Mancuso has gone to the staff room to get a cup of tea she will be back in five minutes. The message was not specifically sent to the girls by Ms Mancuso, she did not know they were coming, but the smart technology incorporated into the building allows messages like this to be received as people approach the door. This sort of technology is now available in many buildings

throughout the city, last week the girls went to the new museum, as they passed exhibits they could access, download, send and store information via their PCDAs, as well as interact with the many exhibits. The girls also use their PCDAs to pay for movie tickets, public transport; they can even use them to buy a can of coke from a vending machine.

Ms Mancuso returns, she greets the girls and they all enter the classroom. A student from the 1990s would find difficulty in calling this a classroom, some things are familiar but others are straight out of Star Trek. There are pods of several small flat LCD screens as well as two large plasma screens, projectors, cameras, printers, and all sorts of other devices. There are some very comfortable looking sofas, office type chairs, an area for formal instruction, tables arranged for small group work, whiteboards, and displays of students' work. A closer examination of the whiteboards and the notice boards and it is easy to determine that the students are investigating the topic *Australian Discovery and Exploration*. There are lots of concept maps, questions and ideas displayed all over the place. On one noticeboard several sub topics and focus questions have been written, and projects assigned.

Some other students enter the room and pleasantries are exchanged. Without direction from Michelle screens flicker and digital images illuminate the room. Matthew and Kate want to show the others what they have been working on. They are investigating the expeditions of Matthew Flinders and Nicholas Baudin. Through their PCDAs and the wireless network they have downloaded their latest work onto the school network and have it displayed on one of the large plasma screens. Using some very clever programming they have created a very interactive piece of multimedia that helps to answer several questions that the class has about the rivalry between Flinders and Baudin and the significance of their expeditions. It starts by tracing the voyages of the explorers on a map of the world and as the ships reach certain points on the map the user is invited to explore what happened at these locations. Kim, Jessica and Michelle watch fascinated. The pair has used primary historical documents available online at French and British museums to build their project. The paintings done by artists and scientists on the Baudin exhibition are stunning and the sea charts of the Australian coast made by Baudin are exquisite.

The love letters written by Flinders to the new bride he left behind for 10 years are interesting. Michelle thinks about how she can use them to help the students understand the notions of *duty, honour, and glory for queen and country* and whether these things are still relevant today. It seems that Matthew has become very curious about the French and is talking about doing some research on some guy called Napoleon. Other teachers might reflect on the power of the technology and its impact on Matthew but Sue reflects on the power of *curiosity*. It drove Baudin, Flinders, generations of historians and scientists and academics and now it is driving Matthew. Curiosity may have killed the cat but the lust for *wanting to know* is probably one of the greatest gifts a teacher can nurture in her students. Michelle thinks about how she can weave this thought into the students' learning.

Jessica and Kim have been investigating the First Fleet and are ready to show what they have done. Through the brainstorming done at the beginning of the topic they became very interested in what it was like to be a teenager on the First Fleet and as part of the First Settlement. They have decided to do this by presenting a series of two narratives – a female convict and a male convict. Their research has led them to primary documents available online, to several databases about the First Fleet, to an old Alan Ladd movie, which they were able to download from the net, and hundreds of web sites about the topic. They have decided that they will present the narratives to the class as a multimedia slideshow, similar to the television show they watched last year about the American civil war.

The writing of the narratives will need to be spot on – crisp, accurate and entertaining. Michelle is pleased with their choice as it gives her an opportunity to talk to the class about

writing genres and writing for an audience. Their choice of graphics and images for the slideshow, and how these are matched to the narrative will also be important. Kim and Jessica have the first narrative displayed on the screen. Kim gets Peedy, a virtual agent, to read the narrative and looks to the others for some feedback.

“That’s horrible,” states Matthew. “I would have just jumped overboard.”

“Why don’t you use some images from the movie to show how awful it was” suggests Kate.

“You will need to be careful about copyright,” cautions Michelle.

Michelle makes a few suggestions; Peedy makes some suggestions about spelling and grammar in the 18<sup>th</sup> century. Jessica dictates the changes and the computer obliges. Jessica and Kim begin discussing the second narrative.

As the rest of the class start to arrive Michelle takes a couple of minutes to reflect on the impact technology has made to the teaching and learning environment. If she chooses she can access a range of virtual learning objects on every topic and concept under the sun. She sometimes uses them to fill gaps in her own knowledge and sometimes to help her explain specific concepts to groups of children. She rarely uses them to assemble a *course* because she wants the students to have some control and ownership of the curriculum. Other teachers tell Michelle that all the brainstorming, integration of subjects and a multidisciplinary approach to the investigation of topics is messy.

She looks across at Jess, Kim, Matthew, Kate, and the others entering the room and thinks about the commitment these kids make to their own learning – yes it is messy but it is worth it. With the technology Michelle can bring the outside world to the classroom and take the classroom to the outside world. Recent breakthroughs in wireless networks, data compression and bandwidth make synchronous video communication cheap and real. Later today the class will link to the British Museum to look at Captain Cook’s journal and when John comes in later for a Maths class they will link to the maritime museum at Plymouth in the United Kingdom to analyse the mathematics of ship building in the 18<sup>th</sup> century (Romeo 2003).

## Discussion

The Plainville High scenario is also extreme in that it is idealistic, romantic, perhaps even naïve; after all everybody knows that getting Year 9 students to work in this manner is virtually impossible. However the learning environment portrayed in this scenario is cognisant with what we know about good teaching and learning (see Table 2).

At Plainville careful attention is paid to the knowledge, skills, attitudes, and beliefs that learners bring to the educational setting. Jess and Kim use their current knowledge to construct new knowledge. They are encouraged to take charge of their own learning and are provided with opportunities for reflection and self-regulation. Motivation and commitment to learning are promoted and nurtured. Learners are intellectually and creatively challenged, and are viewed as cognitive apprentices and knowledge explorers who are excited and passionate about learning.

Learners are also encouraged to be knowledgeable. For Ms Mancuso, being knowledgeable, *is* knowing about the voyages of Flinders and Baudin and about the First Fleet and the First Settlement. But it is also about knowing how a historian analyses a primary document, about how mathematicians develops a theory or how a scientist collects evidence. At Plainville, Jess and Kim and Matthew and Kate construct knowledge so they can solve problems and are assisted in developing meaningful patterns, to make connections, to organise and

contextualise their knowledge, and to retrieve and adapt that knowledge. High level thinking skills and problem solving strategies are developed, and there is a focus on developing, tolerance, persistence, determination, excellence and inquiry.

Assessment at Plainville is mostly summative, generative and authentic. Jess and Kim are encouraged to take risks, learn from their mistakes, to self evaluate and take responsibility. There is plenty of opportunity for collaboration, cooperation, reflection and revision. There is a sense of community at Plainville; students, teachers and the outside world connect. Shared ownership of the curriculum is encouraged and scholarship is seen as a social event where there is much to learn and much to learn from each other. Ms Mancuso's role at Plainville is as co learner, co investigator, facilitator, and guide. But not always, sometimes, when the occasion warrants, she is tutor, lecturer and instructor. Her ability to weave her understanding of pedagogy and her in-depth knowledge of her disciplines into an effective learning environment is astonishing. Equally astonishing is how she employs technology to bring exciting, real-world problems into the classroom, to provide scaffolds and tools to enhance learning, to connect to global communities, and to expand her own learning Plainville is idealistic and romantic. It is also messy, probably expensive and requires the most able to be employed as teachers but maybe it is worth it.

## **Conclusion**

The purpose of this presentation has been to get you thinking about how we can go about restating and revitalising our message about teaching, learning and technology. It could be argued that the process employed to do so, with its focus on educational technology futures where clever web cams, smart cards and virtual agents exist, is a little strange considering the message was about teaching and learning rather than technology. But, if all you can see in the vignettes is clever, futuristic, technologies then the point has been missed, as we have seen at this conference, technology can make a significant difference and having learners engage critically with the technology is important. However what matters most is good teaching and good teachers. Imagine yourself as a Year 9 student in Ms Mancuso's class; I think it would be exciting, exhilarating a memory you would likely keep for the rest of your life, not because of the technology, but because of Ms Mancuso and the magic she was able to weave.

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